The Dutch (clinical) dental technician and denturist in the future

or

From plaster monkey to dental professional

Dirk Annaars

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Dedicated to my father, Dirk Annaars (1930 - 1978), who learned me to dream

Foreword

The reason behind this study is a number of conversations with people from the dental technique and dentistry world. Initially, these conversations had been planned as preparation for an article in a professional journal.
Many of those people came from the education institutes, like universities and schools for dental technicians and denturists in the Netherlands, Belgium, Denmark en the U.S., but also leading people from “the field”.

The important differences in conceptions concerning the future of the dental technique and the dentistry, and how to arrange it in the education and in practice, were remarkable.
When I came further in the literature, I was absorbed in researches and studies on the dental care in the Netherlands, the picture became more complicated.

The conceptions are changing rapidly, whereas many different professional are taking care of the quality, effectiveness and capacity of the mouth care in the Netherlands.

All those things were the reason to go into thousands of pages of texts during the 6 year and speaking with a lot people from the field and from the education. From “Opinion Leaders” to first year dental technique students, from professors to assistants.

All those information added to the enclosed study, conclusions and recommendations.

Dirk Annaars

P.O. Box 154
4600 AD, Bergen op Zoom, the Netherlands
dirk@annaars.nl

Chapter 1

INTRODUCTION

Since 40 years I am involved with dentistry. The first eighteen years directly and the last twenty-one in the branch. Dentistry has always been a constant factor in my life. I have started as “plaster monkey” in a dental laboratory in 1970, then I was active as a crown and bridge technician, denture technician, laboratory owner, technician/denturist in a dentist practice and as a teacher. (IVT). At this moment I am active for two companies: one in The Netherlands and the other one in Turkey. Further, I am frequently invited to be a visiting lecturer, in The Netherlands, as well as in other countries.

Besides my interest for dentistry in general, I have also developed a special interest for the applications of the removable denture, and the position of denture in the dentistry and dental technique. For some caregivers and technicians, it’s a specialism, for others: “a stepchild”.

In 1983/84, I wrote the following in the introduction of my thesis “Codex van de tandtechniek” (Codex of the dental technique)

Since the brochure called: “Vak of geen vak” (profession or no profession) was published in 1911 there have been big changes in dentistry. Before, dental technique was subordinated to the dentistry, but it rapidly moved to another direction. The development became more and more fast, a development wherein the dentistry is still to be discovered. Does it want to fix its course for the future, then the dental technique will analyze its present position’s accurate services. In other words: what is today’s place of the dental technique among the present dentistry care and what will be its place tomorrow? One of the factors which stipulate the answer to this question is the relation dental technician-dentist. Especially in the last years, the relation underwent a tumultuous development. The assistant has more and more become a modern entrepreneur. The present Dental training excellently prepares for it. The dental technique’s instruction was gradually placed at a higher demand from the technique. This revaluation, combined with the fact that the dental technique is less important in the dentist education during the study of dentists, in the practice means that, the relation between dental technique and dentists in increasing size will be characterized by mutual recognition and collaboration. The stronger the development of the dental technique and its education, the more independent the position of the dental technician in its relation with the dentists, it makes the need for the dental technique stronger to give the necessity on which compass he navigates. End of quote.

Meanwhile, the codex of the dental technique has, in great numbers, found its way amongst the dental technique and sold out. But what about the rest of the introduction concerning the direction mentioned above?

Chapter 2

PROVISIONAL QUESTION, PLANNING AND LITERATURE REVIEW

Under the influence of the economy, politics, health's technique and social developments, the field is changing. Aspects are changing because of digitalizing and automation, dental tourism, importation of work pieces from low cost countries, and also, co-operations and responsibilities.

One thing is sure, a better co-operation and installation, both during the training and in practice is indispensable. It's amazing to see that there are such different ideas in such a little field.

For the collaboration, it needs more parties, and the question is if they have to be lined up. The arrival of new professionals for some people leads to an apprehension of the fact that knowledge and skills will be divided.
In the future, the dentist cannot command this subject in its full breadth as we are expecting now. Nearest to a number of proceedings, the interprofessional teams shall co-ordinate or lead, it can have these followers with keeping up with the skills. *Generalize versus specialization.*

It seems to be the only solution for a changed field, a shortage of dentists, a growth in the shortage of cadres in the dentistry training in The Netherlands, the widening (of the patients' groups) and deepening of the field can bid for the top. The dental technique can play a very important role there!

During the last years, the collaboration between dentists and other disciplines was very spoken and published. Lots of Scientifics' publications are a drift, dentists' explicit desire to be executive in the collaboration oral care branch. A less attention exists for this, and the ideas' meaning is collaborations' partners. Do they want to collaborate and which role do they want to play in it? Which goal do they want to achieve?

The following proposition will describe how the research can lead to obtain a better interprofessional collaboration and therefore a better oral care.

As key questions, it will be used:

- Which role can and will the dental technician/denturist play in the future of dentistry?
- Which expectations, goals, ambitions do exist concerning interprofessional collaboration?
- How is this outside the Netherlands?

Literature review

The aim of this literature review is to establish that relevant work has already been completed in the field. In particular I am keen to demonstrate in this appendix that this thesis is based upon a thorough understanding of the field, and I am keen to establish where this study stands in relation to this previously published work.

Chapter 3

A HISTORICAL OVERVIEW OF DENTISTRY AND DENTAL TECHNIQUE

Introduction

Although this chapter is not really necessary for this study, it shows history and can certainly help to estimable understand the present.

Consecutively, first a part about Dutch dentistry history and secondly, dental technique will be described. After, there are several important developments of the professions (dentists, dentists of the 19th century, and dental technician and denturist) during the last 100 years in The Netherlands.

Finally, a chronology of the more important events in the dentistry during the past 5000 years. The subjects of this chapter have been chosen as background for the rest of the research.

It is interesting to go 9000 years back, to see how the handcraft of tooth replacement has advanced, and how it's outgrown, the first primitive equipment's until today, with more much more complicated techniques.

In the Babylonian and Assyrian period, people were given tablets; if they were drawn with a pen on the blackboard the contents of the formulas and the composition of remedies which were administrated to treat tooth pain would be very interesting
Sometimes they tried to treat cavities by, for instance, exorcisms they attempted to exorcise it.

Both the early and also the late civilization periods of the Old Egyptian people did not track suggestions about the fact that, the dentistry indicates one or other forms.
People of the upper circles who have received mouth care were probably respected; however, it shall be maintained here.
In case of eventual new dig, people are not expecting to find something about dentistry any more

Tooth replacements that are dated from the Phoenicians have been found, who existed centuries Before Christ.
There is an illustration of a tooth replacement which is dated from the Phoenician period. It is the earliest example of a dental prosthetic which has been found, but not really the oldest.
In Greece tooth replacement art has also been studied.
Hippocrates, Father of the Medicine, has also studied dentistry. He was not really engaged in tooth replacement, but he gave the instructions, teaching on jaw bone fractures, and how to keep either half jaw in position using linen and gold wire.

Later, according to the suchlike principle of use, people made gold wire and linen materials in order to repair detached teeth.

The Romans have continued the experiences of the Etruscans and they attained a degree in the tooth replacement art, (after a long time of abandoned and lost studies). That has been estimated in Western Europe around the end of the 18th century. Lost elements have been made of gold and ivory and they were placed in the mouth by the means of completely or not removable gold bandages.

The esthetic and phonetic factors have also played a more important role here.
In the medical literature of those days, there apparently wasn't any consequence attached to this manner of tooth replacement.

First, the Renaissance brought the new development. Even somebody like Leonardo da Vinci did important discoveries on the skull and tooth anatomy areas, and he also created charts of his findings. Furthermore, people learned more. After that, this part of his work had no value for his contemporaries. With the invention of printing, it was well possible to diffuse acquired knowledge.

History focused its attention more on North- Western Europe.
in France, it was a Parisian practitioner, Ambroise Paré (1520-1590), who installed replacement made of ivory on his patients, the replacement was supported by the other teeth by means of gold or silver wire In Germany, a professor wrote a book about a boy who was born with a gold tooth, the book is not more then 156 pages. Later they discovered that it wasn't true, but the real fact was that around 1593, an ingenious goldsmith has made the first golden crown.

Outside our country, there is also another virtuous story.
The doctor Pieter Foreest (from Alkmaar, The Netherlands 1522-1597) told about one of his medical works, which was about a very old man who was engaged with a young woman, and his missing teeth were replaced by teeth of ivory, and they were supported by all the rest of his teeth with gold wire. But the goldsmith did his work so perfectly that "the denture" was absolutely immobile, and was fixed. The man had painful inflammations and he had to remove his "denture", it was impossible and his acquaintances were mocking him.
We don't know if later he was married the young woman, because history didn't mention it.

The lack of scientific knowledge was delaying dentistry developments.
When there wasn't any amelioration, there also wasn't any opportunity for this becoming technique.

Our compatriot Anthonie van Leeuwenhoek (1632-1723) executed important works in the scientific area. He wasn't just ready to finish the making of a perfectly precise microscope, he also knew too much about its use.
In this time, he had a paradoxical declaration: "In a mouth there are more bacteria than people living in The Netherlands", everywhere, the predominant superstition was that, worms were the cause of the tooth pain. The invention of the microscope served to establish the presence of worms.

In the 17th century, doctor Purman took wax impressions of the jaw and upon this cut a denture made of ivory. He did not practice any extractions, he was sending his patients to the dental surgeon (dental "master").

Fauchard.
In 1728, the world famous bipartite book "le Chirurgien Dentiste", from the Parisian dentist Pierre Fauchard was published.
The second more important book for the dental technique is partially dedicated to the technique. Those books are specials, and have an historical significance. Because of their large completeness, with the contents of this period, this work will be examined with the elements of the contemporary technique.

Fauchard carved the denture teeth from hippopotamus, because he found the ivory less durable. Upper and lower were attached to each other by means of spreaders. Those spreaders were pushing the denture to the upper and lower jaw. They made themselves as heavy as possible in order to place the denture as well as possible.
In the illustration 13, prosthesis look rather primitive; people really have to consider that, in the past, this product signified a brilliant progress, which asked the agility of the manufacturer.
When people missed quoted elements, the lower denture was replaced by a brace, for the people who had the denture put on their lower teeth. Later, the upper denture was placed in order to be pushed in the direction of the upper jaw.
Partial dentures, as well as removable, irremovable, pin tooth and crowns, obturators, regulation and enamel techniques have been described only in Fauchard's book that shows the versatility of this Frenchman.

There is another strange characteristic concerning this time, this ingenious dentist advised his patients to rinse out their mouth with some spoonfuls of their own urine twice a day!

The authors of the first Dutch medicine and dentistry writings and documents were not dentists, but physicians, doctors, who were interested in dental surgery.
The dental practice found place in the market where "barber surgeons", also called "master of the dental", encircled by curious and anxious looks, were demonstrating their knowledge and their art to the people.
The education for master of the dental has a character/disposition of a companion relationship/proportion: "practice makes perfect", whereas just a little part of the present knowledge had been documented.

Besides there are also Doctors of Medicine with the qualification/authority to maintain the dentistry although, they were not attracted by his low position of the "master" of the dental sciences. In 1876, Dr. Th. Dentz double qualified and he is coming from an old dentals' masters graduated family, in Utrecht he was nominated to be lector in dentistry.

During centuries people tried to repair/restore missed teeth, our country have had/known a "tooth master" in the 19th century. This "tooth master" was like a dental technician, he was repairing dentures. In this period people did a distinction/difference between technique-mechanic affairs and surgery aspects of the practical profession, by which, the making of

denture is not included in the practice of the dental surgery. In 1871, was decided that the insertion of artificial teeth and dentures was not a part of the medicine and everybody was free to practice, with the consideration that he is deprived (himself) of the execution of surgery proceedings (Law on practice/exercise of medicine).
With the law of June 24th 1876, the rules/principles for the practice of dental surgery have been determined. The appellation "tooth master" was still maintained. None of this rules explained if technique-mechanic division also has to be included as a proceeding of the dental surgery. Between 1876 and 1913, the application of the denture was considered as a component/part of the medical profession/dentistry.

Dentist

The title of "dentist" in the Netherlands was been used for the first time in 1913, after the opposition of the doctors, they were facing dentists referred to their academic studies, then the dentists did not have enjoyed this training. In the same year, the use of denture has been added to the dentist' qualification(s). For that reason, a number of dental technicians have practiced their professions stealthy.

Denturists

In 1968, the Central council of Health investigated for the (Ministerie van Volksgezondheid) on the basis of the Law on paramedical professions, the attribution of the authorization to work independently "in the mouth" and to make impressions have been placed in dental technique. According to the Court, there was not necessity for this because "dental technicians received absolutely missed trainings". The Chamber of Representatives did not take a position about it, and placed it in a legal regulation of the profession of denturist. This results finally in the Law on the denturists, which became effective on May 25th 1989, whereby an individual legal basis was written about prosthodontics care for edentulous patients.

With the introduction of the Law BIG in December 1st in 1997, wherein the profession of denturist is also regulated.

History of the dentistry and technique in a chronological order

25000 B.C.
It was during - the middle Stone Age - with its refinement in the manufacture of tools, differentiation between populations, and burial of the dead, that modern man probably emerged in Zambia.
We may imagine family groups of small-statured people living near water and sustaining themselves by hunting the abundant game as well as gathering fruits, tubers and honey from their surroundings. Some skulls show serious tooth decay caused by honey? From different researches on old skulls (in Europe) otherwise, it appears that the real increasing of caries is dated from middle Ages.

7000 - 5500 B.C.
In a Neolithic cemetery/graveyard in Pakistan (Merhgarh, Balluchistan) there have been found the oldest proves of dental works: 7500 to 9000 years old.
In eleven molars (posteriors), of a total of 9 persons, small holes have been found, from1 to 3 mm for the diameter and from 0.5 to 3.5 mm for the depth. In one of the holes there was also proves of amelioration work of the hole which have been found, with a kind of grinding instrument.

5000 B.C.
A Sumerian text of this date describes “tooth worms” as the cause of dental decay.

3000 - 2750 B.C.
Admission of the fact that dentistry is a specialty in the medicine in Egypt. An under jaw have been found, it shows that in this period, there was alveolar abscess operation. (Mandible showing evidence of having had a surgical operation to relieve an alveolar abscess).

2600 BC
Death of Hesy-Re, an Egyptian scribe, often called the first “dentist.” An inscription on his tomb includes the title “the greatest of those who deal with teeth, and of physicians.” This is the earliest known reference to a person identified as a dental practitioner.

2500 B.C.
Egypt. The earliest evidence of simple, dental prosthesis. It has been found in Tomb 984 at Gizeh. It is a dental prosthesis, wherein a connection between elements has been made by means of gold wire.

1700 B.C.
The Edwin Smith Surgical Papyrus transcribed from an earlier manuscript around 2700 B.C. It contains: first stages of science and methods for reducing fractures of the mandible.

The Edwin Smith Surgical Papyrus

Ebers papyrus

1550 B.C.
The Ebers papyrus refers to diseases of the teeth and various toothache remedies is one of the most important ancient Egyptian medical papyri. The Ebers papyrus was purchased at Luxor (Thebes) in the winter of 1873–74 by Georg Ebers

700 - 50 B.C.
Etruscan period of dentistry. Today, this region is situated in Italy. There are different examples of their fixed or removable dental prosthesis in various museums.

669 - 626 B.C.
The King Ashurbanipal of Assyria, patron of arts and science. Tooth worm theory. There are proves that in this period there was dental practice in India.

490 - 425 B.C.
Herodotus, the Greek historian and traveler, describes Egypt as being the home of medical science.

480 B.C.
Roman period begins.

460 - 370 B.C.
Hippocrates as the important founder of the medical science, made a separation between in the one hand philosophy, prejudices, superstition and the other hand the medical science. He described the process of development of tooth and pathology. He described also in his

“De Carnibus” the use of gold wire for fractures, and made instructions on how to handle instruments and how to cure a dislocated jaw.

450 B.C.
Roman Laws, wherein is described, who can practice dentistry.

300 - 400 B.C.
Evidence of Roman dentistry, and use of gold shell crowns.

384 - 322 B.C.
Aristotle, pupil of Plato. He discovered the theory of chemical combination, and he is the first to make a study of comparative anatomy of the denture. He described also teeth extractions with forceps/pincers.

100 B.C.
Celsus, a Roman medical writer, writes extensively in his important compendium of medicine on oral hygiene, stabilization of loose teeth, and treatments for toothache, teething pain, and jaw fractures. He wrote his “De Medicina”. The manuscript have been discovered in Milan in 1443 and published in 1478. He was the first to mention the filling of teeth with lead. Later, he gave suggestions about the binding of teeth and fractures of the jaw and orthodontic treatment.

48 - 117
Archigenes of Apameia (Syria), a roman physician/doctor encouraged the use of drill in the dentistry.

130 - 201
Galen, the Prince of Physicians. His treatise was a standard textbook. He was the earliest to mention denture’s elements.

166
The Etruscans practice dental prosthetics using gold crowns and fixed bridgework.

249
St. Apollonia, the Patron Saint of Dentistry (on February 9th her saint day) had her teeth extracted in Alexandria.

500 - 1000
During the Early Middle Ages in Europe medicine, surgeries, and dentistry, were generally practiced by monks, the most educated people of the period

700
A medical text in China mentions the use of "silver paste," a type of amalgam.

800 - 1050
In this period called Scandinavian period, north men of Europe exposed their teeth, from Iceland to Mesopotamia, from Ireland to Russia, they are plundered and trading and colonies are provoked. In Sweden, between 1970 and 2005, four big cemeteries dated from the Scandinavian period have been found. From the 557 skeletons of this cemetery, 22 had horizontal holes in their incisors of the upper jaw, and the teeth have received reparation by means of iron.

Some transformations are also diagnosed in old Eskimo's skeletons. They pasted animals' bony substance along their teeth, when it was soft enough; they used it to make clothes or footwear. It caused grooves on the cutting surface but not in the exterior of the anterior teeth.

On purpose, people outside of Europe know the denture replacement.
Mayas were skilled in the fabrication and placement of carved stone inlays in precisely prepared cavities in the front teeth (these inlays were made of gold or precious stones).
The Iban people of Borneo were filling their teeth to points. The Mimikan people of the South-New-Guinea did the same act; westerners explained it as a sign/act/kind of cannibalism.

936 - 1013
Albucasis (Abul-Qasim), a Spanish-Arabian physician was one of the most learned doctors and surgeons. His "Dechirurgia", one of the best surgical treatises, contains illustrations of both surgical and dental instruments with description of the use of them. He describes also dental transplantations and the use of gold wire.

1130 - 1163
A series of Papal edicts prohibit monks from performing any type of surgery, bloodletting or tooth extraction. Barbers often assisted monks in their surgical ministry because they visited monasteries to shave the heads of monks and the tools of the barber trade—sharp knives and razors—were useful for surgery. After the edicts, barbers assume the monks' surgical duties: bloodletting, lancing abscesses, extracting teeth, etc.

1308 - 1745
Guild of Barber-Surgeons remained active until 1745. In two manuscripts in the Vatican-Library, we can see the earliest use of the term “dentist”.
Guy de Chauliac achieves his famous work on surgery (published in 1478).

1452 - 1519
Leonardo Da Vinci was among others, anatomist, he described and signed the Human body very precisely. His illustrations are the earliest accurate drawings of the skull, teeth, associated structures and maxillary sinus.

1460
Earliest English medical manuscript. Guy de Chauliac’s surgery.

1468
England. Barber-Surgeons obtained charter from King Edward IV.

1498
Invention of the modern toothbrush in China.

1514
Publication of Giovanni’s da Vigo’s work on surgery. That passed trough innumerable editions. He described how to make a filling of teeth with gold foil, after first excavating and shaping the cavity.

1530
The Little Medicinal Book for All Kinds of Diseases and Infirmities of the Teeth (Artzney Buchlein), the first book devoted entirely to dentistry, is published in Germany. Written for barbers and surgeons who treat the mouth, it covers practical topics such as oral hygiene, tooth extraction, drilling teeth, and placement of gold fillings.

1575
In France Ambrose Pare, known as the Father of Surgery, publishes his Complete Works. This includes practical information about dentistry such as tooth extraction and the treatment of tooth decay and jaw fractures.

1650
G. Purman of Breslau - known for wax impressions.

1673
Antonie van Leeuwenhoek discovered the use of the microscope.

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contours & jets de fil passé & repassé sur ces ressorts & dans chaque trou que j'ai dit être près de l'endroit où se terminent ces entailles. Ayant exécuté tout cela, je plaçai cette machine dans la bouche de la Dame, où elle se trouva en état de faire toutes les fonctions qu'on en avoit espéré.

Explication de la planche XLII qui représente toutes les pieces qui composent un dentier supérieur & une partie d'un dentier inférieur, le tout artificiel. On donne ici ces pieces separées & ensuite rassemblées.

La figure 1 représente deux demi-cercles, qui embrassent par leurs extrémités & à droite & à gauche une partie de trois dents molaires artificielles, qui y sont arrêtées par deux clous rivés.

A. Le demi-cercle extérieur.

B. Le demi-cercle intérieur.

C. Les trois dents molaires artificielles.

DD. Deux trous qui les traversent, afin d'y attacher avec deux clous rivés un porte-ressort, dont les deux lames,

1728

First edition of Pierre Fauchard : « Le chirurgien dentiste ». Fauchard is designed as the founder of the modern dentistry.

1746

Claude Mouton describes a gold crown and post to be retained in the root canal. He also recommends white enamelling for gold crowns for a more aesthetic appearance. Mouton described the fabrication of golden crowns for posteriors and anterior teeth. He denoted also the first clamp consolidation used inside of thread junctions/liaisons in artificial teeth

1756

Philip Pfaff developed the use of plaster models and developed a form of taking a bite. Wax impression, cast models and determination of the relation between the upper and lower jaw. Philip Pfaff (Germany/Deutschland) developed in 1756 the use of cast models and also the first determination between the upper and lower jaw. Important publications of Pfaff , dentist of Frederik de Grote, made the more famous pouring out of wax impression in casts, and the determination of the relation between the upper and the lower jaw.

1757

The French dentist Bourdet wrote a book called The Dentist's Art. It had a chapter on tooth alignment and on using appliances in the mouth. These were the first important references to the new dental science.

1769

Title of "Doctor" (Latin for teacher) began to be used.

1771
John Hunter, anatomist and surgeon, described the anatomy of the denture. In transplanting teeth, he demanded first the removal of the pulp.

1775
Denture basis cut out of ivory, for which, people have painted with different colours, were not exceptional. Those colours were preserving the colour of a piece of ivory, which was what people liked. The surplus of the painted cover of the ivory was put away by means of a chisel. According to the same proceeding people obtained: equal “tooth lines”, corresponding to each other in the mouth. After the invention of the cast (model), the development of the complete denture has been accelerated. 1775: the first gold-plate has been created by Bordet. Human teeth were riveted on this plate that was stimulated trade in human teeth.

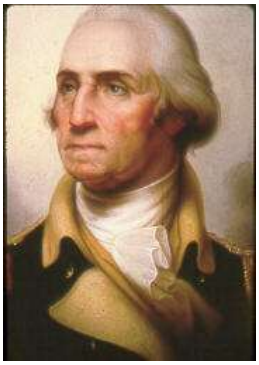
1776
The French pharmacist Duchâteau and the dental technician Guerhard have developed the artificial teeth and dentures, using porcelain. The Italian dentist Fonzi brought an ameliorated model with platinum connections. The perfection of the artificial teeth to the product, just like people knows its present form, found place in another continent: America (U.S.A.). In 1825, Samuel W. Stockton (S.S. White) started the beginning of the industry of the manufacture of artificial teeth.

1789
Frenchman Nicolas Dubois de Chemant receives the first patent for porcelain teeth - New developments and improvements of porcelain dentures.

1790
John Greenwood, son of Isaac Greenwood and one of George Washington’s dentists, constructs the first known dental foot engine. He adapts his mother’s foot treadle spinning wheel to rotate a drill.

1790
Josiah Flagg, an American dentist, constructs the first chair made specifically for dental patients. To a wooden Windsor chair, Flagg attaches an adjustable headrest, plus an arm extension to hold instruments.

1794
First use of mineral paste teeth in America by Le Breton. John Greenwood began to swage gold bases for dentures in the U.S.A.



1798
Famous set of dentures made for George Washington by John Greenwood.

1806
Individual porcelain teeth with baked-in metal pins, invented by G.A. Fonzi.

1819
Mixing of coin silver powder and mercury into a silver paste, by Tavenu in France, Bell in England.

1825
Samuel Stockton begins commercial manufacture of porcelain teeth. His S.S. White Dental Manufacturing Company establishes and dominates the dental supply market throughout the 19th century.

1833 – 1850
The Crawcours (two brothers from France) introduce amalgam filling material in the United States under the name Royal Mineral Succedaneum. The brothers are charlatans whose unscrupulous methods spark the “amalgam wars,” a bitter controversy within the dental profession over the use of amalgam fillings.

1836
Spooner introduced Arsenic for the killing of pulps.

1839
The American Journal of Dental Science, the world’s first dental journal, begins publication.

1839
Charles Goodyear invents the vulcanization process for hardening rubber. The resulting Vulcanite, an inexpensive material easily moulded to the mouth, makes an excellent base for false teeth, and is soon adopted for use by dentists. In 1864 the moulding process for vulcanite dentures is patented, but the dental profession fights the onerous licensing fees for the next twenty-five years.

1840
The American Society of Dental Surgeons, the world's first national dental organization, is founded. (The organization dissolves in 1856.)

1842
Crawford W. Long discovers anesthetic, but does not publicize it.

1844
Beginning of large scale manufacture of porcelain teeth by S.S. White.
Use of plaster for impressions.

1844
Horace Wells, a Connecticut dentist, discovers that nitrous oxide can be used as anaesthesia and successfully uses it to conduct several extractions in his private practice.

1851
Patent for hard rubber (vulcanite) granted to Nelson Goodyear.

1855
Robert Arthur originates the cohesive gold foil method allowing dentists to insert gold into a cavity with minimal pressure. The foil is fabricated by annealing, a process of passing gold through a flame making it soft and malleable.

1864
Sanford C. Barnum, develops the rubber dam, a simple device made of a piece of elastic rubber fitted over a tooth by means of weights, which solves the problem of isolating a tooth from the oral cavity.

1868
Combination of nitrous oxide and oxygen for prolonged anesthesia, by Edmund Andrews.

1871
James B. Morrison patents the first commercially manufactured foot-treadle dental engine. Morrison's inexpensive, mechanized tool supplies dental burs with enough speed to cut enamel and dentin smoothly and quickly, revolutionizing the practice of dentistry.

1871
The American George F. Green receives a patent for the first electric dental engine, a self-contained motor and hand piece.

1877
The Wilkerson chair, the first pump-type hydraulic dental chair, is introduced.

1880
The collapsible metal tube revolutionizes toothpaste manufacturing and marketing. Dentifrice had been available only in liquid or powder form, usually made by individual dentists, and sold in bottles, porcelain pots, or paper boxes. Tube toothpaste, in contrast, is mass-produced in factories, mass-marketed, and sold nation-wide. In twenty years, it becomes the norm.

1887
Stowe & Eddy Dental Laboratory, the first successful industrial-type laboratory in the U.S., opens in Boston, marking the ascendancy of the modern commercial dental laboratory. The earliest known dental laboratory in the U.S. was Sutton & Raynor which opened in New York City around 1854.

1887
Gutta percha root canal points.

1890
Willoughby Miller an American dentist in Germany notes the microbial basis of dental decay in his book Micro-Organisms of the Human Mouth. This generates an unprecedented interest in oral hygiene and starts a world-wide movement to promote regular tooth brushing and flossing.

1895
Wilhelm Roentgen, a German physicist, discovers the x-ray. In 1896 prominent New Orleans dentist C. Edmond Kells takes the first dental x-ray of a living person in the U.S.

1899
Edward Hartley Angle classifies the various forms of malocclusion. Credited with making orthodontics a dental specialty, Angle also establishes the first school of orthodontics (Angle

School of Orthodontia in St. Louis, 1900), the first orthodontic society (American Society of Orthodontia, 1901), and the first dental specialty journal (American Orthodontist, 1907).

1900
Federation Dentaire Internationale (FDI) is formed.

1903
Charles Land developed the porcelain jacket crown. With the use of porcelain jacket-crowns, metallic crowns and bridges with buccal facings and inlays, people saw the constant advancing popularity to the disadvantage of synthetic resin and later of the composite. Now, with the advanced, ameliorated techniques and materials, we see an advance/increasing of the ceramic. Using all or not of the entire or partial milled through scan of the preparations and also press and casting techniques are possible.
The combination of the milled substructures of a very hard ceramic, on which there is the traditional porcelain way of baking, is currently/actually very popular.

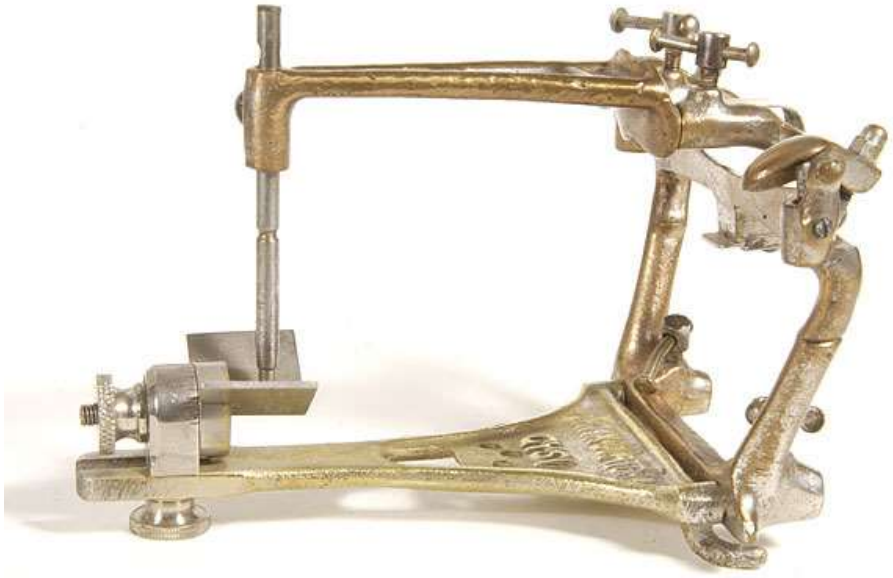
1905
Alfred Einhorn, a German chemist, formulates the local anaesthetic procaine, later marketed under the trade name Novocain.

1906
Einhorn recommends novacaïne and adrenalin combination for local anesthesia.

1907
William Taggart invents a “lost wax” casting machine, allowing dentists to make precision cast inlay’s. Taggart caused a revolution in the fabrication of crowns and bridge works with which the casting technique made its entrance. For this reason, the development of the inlay-technique became possible. Proportions of crowns or bridges, people could do all desirable moulds using wax, afterwards, by means of fireproof cast (heat resisting materials), a negative of the wax model has been made in a metallic muffle, wherein, one or more cast canals have been installed. Furthermore, people met in the same time ameliorated cobalt-chromium (casted partial dentures) and allows of palladium-gold-silver. Also non precious metals as nickel made their entrance. Today, the day shows that the metal is going to lose the conflict with full ceramics. Ceramic materials and techniques to use are ameliorated, and full ceramic is almost always possible.

1910
Dr. Alfred Gysi (1865-1957), a Swiss dentist involved in researching the development of artificial posterior teeth that fit comfortably in the mouth. He and Dr. James Leon Williams developed tooth size and placement standards that continue to form the fundamentals of dental teaching worldwide. Today Gysi is considered as on of the most significant pioneers of the dentistry. It was him who developed the articulator system in general. Many of his inventions and statements have continuance till this day. On the base of values ascertained by him, he constructed about 1910 the first average value articulator, the GYSI "Simplex".

It is an "Average Value" instrument, that is, the rotation centres, condylar guides, the incisal guide are fixed to "average" settings.



The "Simplex" articulator was the average value version of the GYSI "adaptable", a highly adjustable instrument produced in 1912. Gysi felt compelled to produce this instrument because of competition in the market place and dentist's demands for simplicity. Gysi believed that with the "Simplex" the dentist could provide efficient denture service without the need for "scientific equipment". The "Simplex" would suffice in 80% of the cases.
Gysi suggested that the "protrusive" angle of the "Simplex" incisal guide table could be modified by the use of modelling compound and sheet metal. Apparently, an industrious person modified the lower cast holder to accept a Wadsworth adjustable incisal guide table. It had a horizontal protrusive guide with adjustable lateral wings. This also illustrates the diverse concepts that dentists had regarding the function of the incisal pin and guide.

1913
The title and profession of “Dentist” is recognized in the Netherlands.

1914
J. Leon Williams develops typical tooth forms (typology)

1915
McKay and Black publish results of investigation fluoride in drinking water.

1927
Occludator and articulator. Until the beginning of the 20th century, practically, people worked with an occludator. Exactly, it was not any more the hinge (flexible joint) which was making possible the opening and closing movements.
In 1927, Ir. Rudolf Hanau came personally to introduce his articulator in the Netherlands. In the same period, the Netherlands met also the Gysi and the Trubite articulator.

1927 - 1932
Before the 1st World War, the research of tooth replacement means was stimulated.

As a first plastic, people used first celluloid; it appeared really not durable, not enough to change/replace the rubber. Thanks to the quick developments of the chemistry, people appeared very sonly to be in position to introduce better materials.
Before the beginning of the 2nd World War, the materials appeared to catch in a short time, a new place in the dental technique. 1927, Walkerite, 1932, S.S. White-Resovin and in 1938, Kallodent). Because of the war, quickly, a lot of materials have been developed and used (like synthetic resin as methyl methacrylate).

1930 - 1943
Frederick S. McKay, a Colorado dentist, is convinced that brown stains (mottling) on his patients' teeth are related to their water supply. McKay's research verifies that drinking water with high levels of naturally occurring fluoride is associated with low dental caries and a high degree of mottled enamel. By the early 1940s, H. Trendley Dean determines the ideal level of fluoride in drinking water to substantially reduce decay without mottling.

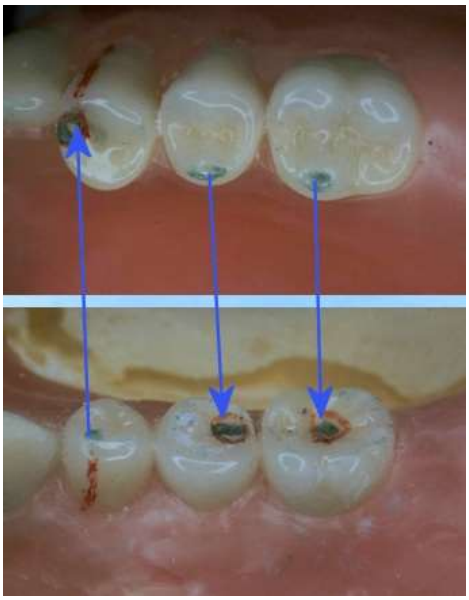
1933
Lactona Toothbrushes starts production.

1937
Alvin Strock inserts the first Vitallium dental screw implant. Vitallium, the first successful biocompatible implant metal, had been developed a year earlier by Charles Venable, an orthopaedic surgeon.

1938
The nylon toothbrush, the first made with synthetic bristles, appears on the market.

1940
Synthetic (material) and composite. Since 40's synthetic material is used as full material for dental fillings. This was risky because of the leakage. In 1962, Bowen added silicium and produced the first composite combined with etching technique. UV hardening composites were developed from 1970.Due to the technique's position of the business in this moment/instant, later more synthetic elements have been used for crowns and bridge works. Porcelain facings, tubes, pontopins, etc.… have been more and more replaced by synthetic material. Today, it's the day of the composite, an important material in the dentistry. As full material, for crown and bridge works, but also in the construction of occlusion surfaces and of complete elements directly in the mouth. It's possible.

1941



Lingualized occlusion concept. Many prominent prosthodontists are advocating the lingualized occlusion concept, especially whenever severe resorption takes place in posterior edentulous ridges and in case of overdentures. Prof. Dr. A. Gerber (University of Zurich, Switzerland) improved this concept in many ways and made it popular in Europe. The basic concepts of lingualized occlusion were first suggested by S. H. Payne, Dent. Dig. 47:20-22 (1941). E. Pound discussed a similar concept and introduced the term "lingualized" occlusion. J. Prosthet. Dent. 24:586-600 (1970)). Pound placed the lingual cusp of the mandibular posterior teeth between lines drawn from the canine to each side of the retromolar pad. The buccal maxillary cusps were ground off by Payne, while the buccal cusps of the mandibular teeth were removed by Pound. Consistent in their philosophy was the belief that the lingual cusp was the only area of maxillary tooth contact. These occlusal schemes were designed to narrow the occlusal table and improve mastication, reduce forces to the underlying bone, and help stabilize a lower denture. The techniques of Payne and Pound may be modified further to a medial positioned lingualized occlusion. ENTA B.V. (The Netherlands), developed the special lingualized occlusion teeth in cooperation with N. Postema (dentist, University of Nijmegen), Th.F.Z. Brand and R.E. de Visser (Dental technicians). In a later stage, in close cooperation with Prof. Dr. W. Kalk, present head of the Department of Prosthetic Dentistry (Groningen), a new series of teeth for the use of lingualized occlusion have been developed, named Optiform®

1947

Foundation of ENTA BV. Eerste Nederlandse Tandenfabriek (The first Dutch artificial teeth factory).

1949

Oskar Hagger, a Swiss chemist, develops the first system of bonding acrylic resin to dentin.

1950

The first fluoride toothpastes are marketed.

1952

In the University of Lund in Sweden, a research team headed by Per-Ingvar Brånemark (an orthopedic-surgeon) found a break on implants.

1953
Nelson's turbo-jet drill, 60.000 RPM.

1955
Michael Buonocore describes the acid etch technique, a simple method of increasing the adhesion of acrylic fillings to enamel.

1956
Air-rotor drill, 250.000 RPM, Robert Borden.

1957
Permador introduces porcelain which can be baked on metal.

1958
The first adjustable dentist's chair. As well as for the patient as for the dentist and for the assistant, it is a big progress (procession)

1960
Lasers are developed and approved for soft tissue procedures.

1960
The first commercial electric toothbrush, developed in Switzerland, is introduced in the United States.

1962
Rafael Bowen develops Bis-GMA, the thermoset resin complex used in most modern composite resin restorative materials.

1980
Per-Ingvar Branemark describes techniques for the Osseo integration of dental implants.

1985
Digitalizing, scanning/milling and colour measurement/registration. Those techniques are an important step. Those techniques did their entrance (from ± 1985) and these changes are very rapid. Now, 2007 it is not possible to imagine that those techniques are not available. More strongly, this will bring about/provoke big changes. Once again, this chapter is an historical view and is not complete, but in the scheme/plan of the research with a chronology, it gives in the end of this chapter, a representation of the important developments over the countries.

1988
ENTA B.V. (The Netherlands), introduced a special lingualized occlusion teeth Optiform® (see 1941).

1989
The first commercial home tooth bleaching product is marketed.

1989
The title and profession of “Denturist” (tandprotheticus) is recognized in the Netherlands.

1990
New tooth-coloured restorative materials plus increased usage of bleaching, veneers, and implants inaugurate an era of aesthetic dentistry.

1997
The BIG law. The profession of denturist is regulated in the Law on the dental Prosthodontics. The denturist and dentist will be the only qualified professions concerning complete removable dentures

1997
FDA approves the first laser, the first for use on dentin, to treat tooth decay.
Certainly a big number of ameliorations and improvements have been introduced since 1997. The more attractive ameliorations were on implantologie and the use of cad/cam, the laser and computers.

2002
SVGB-IVT (School for dental technicians) and the University of Nijmegen St. Radboud starting together the training of Clinical Dental Technician. The course “clinical dental technician according to the protocol of the complete denture dentist/dental technician, It is for students who desire to exercise in the treatment of patients with complete denture.

Chapter 4

A BIRD'S EYE VIEW OF THE DENTAL TECHNIC IN THE NETHERLANDS

Actual situation of dental technicians and laboratory

Introduction
In this chapter, the dental technique will be described in brief:

- What does the branch structure look like?
- The advance of this branch in quantitative terms (turnover and employment)
- What is the general opinion of the entrepreneurs in this branch about their position in the market?

Branch structure
In this branch, the following five types of companies will be described:

- Companies which concentrate more on crown and bridge works.
- Companies with marked concentration on the denture works, including framework
- Companies without marked concentration: all-round dental technique laboratories
- Dental prosthesist companies with laboratory
- "Other companies": that have specialized parts in orthodontistic proceedings or in other areas, under which there is selling of materials.

All these companies will be further argued in this study, under the term of "dental technique companies". One of the individual groups will be argued, than there will be an explicit argument in this study.
The numerical division of the enterprises (2003) about the types of companies will be presented in table 1.

Table 1

Type of Company	Number in 2003	%
Dental technique laboratories crown and bridgework	260	27
Dental technique laboratories removable dentures	340	36
All-round dental technique Laboratories	150	16
Other companies	60	6
TOTAAL	950	100

Source: EIM 2003

The branch includes almost one thousand companies, wherein 5.000 persons are working. The greater part is composed of small companies: in 69% of the enterprises less than 5 persons are working. The branch made 370 million euros turnover in 2005.

Quantitative development

Favourable profit and employment expansion
In 2003 and 2004, compared to the preceding years, the profit of the dental technique companies has increased by 4 percent. In 2002, the increase was inferior, 3%. For 2005, it there is small growth: 0.5%.
Notably, the growth seems to be going very slowly. It's still unknown where this trend is going.

Table 2

Year	Turnover in millions	Grow in % compare previous year
2001	333	
2002	342	3
2003	357	4
2004	372	4
2005	373	0,5

Source: EIM, 2006

Between the periods of 2002-2005, the employment expansion looks positive, in all these years it is a question of a little/short increase in the area of employment.

Table 3

Employment dental technicians 2002, 2003, 2004 and 2005				
Type of Company	Active persons 2002	Active persons 2003	Active persons 2004	Active persons 2005
Crown & bridge	1.090	1090	1110	1110
Removable dentures	860	910	960	930
All-round	1600	1640	1510	1540
Denturist practices	560	560	620	660
Other	920	930	990	1050
Total	5030	5130	5190	5290

Source: EIM, 2006

The school for dental technician in the Netherlands
The official history of the dental technician training in the Netherlands is not very old. In 1911, a brochure about dental technique called "Vak of geen Vak" (Profession or no Profession) has been published. In the brochure, a confirmed answer is given about the title, because all the dental technicians are active/employee since may years, there is now not any official training and there is not a good teaching and there is also not any exams.
First exams have been given in Rotterdam in 1916 and 1919. The results were bad, because there was not a good teaching (instruction) system. Rotterdam department/division of the Dutch dental technicians association (Nederlandse Tandtechnici Vereniging) organized a

course for practical and theoretical teaching. The course ran 6 month, and continued 1 evening per week. It is a real success.
In 1931, VLHT (Vereniging van Laboratoriumhoudende Tandtechnici = Association of Dental Laboratory Owners) appears. This organization attempted to encourage having a better contact and meeting with dentists.
Between 1933 and 1940, the field made big changes in this area but with the occupation everything stopped. Everything was made concerning an official teaching to the dental technique, but it was not successful. Until 1948 there were assemblies, plans have been made, excepted for the first effort with in the framework of the Military Dentistry Department.
The dental technicians were learning their work in the laboratory and apparently this seemed enough to start the technical trainings. In 1948, a training with a written exam (examination) was started, it was put out by the syndicated of dental technicians.
In student centres in eight cities of the country, the students received a supervision of practical training
Unfortunately, this variance was perished and because of that the, achievability of the training became very bad. Rapidly collaboration with other trade unions was started up; it resulted in the foundation of the "Stichting Vakopleiding Tandtechniek" (Organization of Dental TechniqueTraining). In 1952 after the declaration of the Constitution's conclusion/ about the dental technique laboratory works, the professional training Exams and Information Dental Technique (SVEVT = Stichting Vakopleiding Examens en Voorlichting Tandtechnici) appeared. Proportionally dentists as well as agents of the federal government, employers and integrated workers have participated to the organization. The "Leerboek" (manual) for dental technique appeared in 1950, a supplement to the written training which appeared in 1948. With the appeal of the Institute for the Individual Development (IVIO = Instituut voor Individuele Ontwikkeling) the written course was placed into a wider perspective and the lessons were corrected. The course is still limited to the training of dental technique I and II. Just after 1966, course I and II were divided in 1st, 2nd, 3rd and 4th study years, containing: basic year, denture year, crown and inlay year, and regulation year. The results due to the exclusive written course are clearly noted. The possibility of practical training came in 1967, when the training of the SVEVT (Stichting Vakopleiding Examens en Voorlichting Tandtechnici) was subsided by the federal government. On April 15th, 1968, in Amersfoort, a temporal accommodation was started with the Institute of Professional Training of Dental Technique. A final residence has been found in 1970 in Utrecht. Because of the lack of space, students were forced to find a larger residence. In 1976, it looked as if the Institute would be established outside of Utrecht. The plan constructed on this training, concerned the expansion of the period between secondary school and distributive education. This could be possible with the creation of the 5th study year, with the extension of a compartment in order to have good qualification in management and direction.

In 1972, the first final exam took place. The more extended diploma which was given to the dental technician. In 1974, it was considered as the Professional Skills Certificate (Bewijs van Vakbekwaanheid).
The number of students in 1975, (375) under the instruction of six teachers clearly showed the growth of the training in this area. The students came to the school one day a week, 40 weeks per year and received 3 hours of theoretical lessons and 4 hours of practical lessons.

It is certain that with the Institute of Professional Training of Dental Technique, an adequate education was achieved.
A question about the technician's laboratory skills was still on the structure of the education, the question if those skills had enough possibilities to be extended on adequate dental technique's developments. There was a problem, it was true that the school has a central location (Nieuwegein), but you had to live in Maastricht or Groningen.
Further a question rose about the fact that the actual plan of the education with a wider view in the street wasn't in the street.
Certainly 2007 the question was if a daytime course is not a better connection to the actual vision which is concerning the objective of the dental technique training.

In the new knowledge profile of the profession of the dental technique and the concluded qualification profiles it not only focuses on the product, but also on the procedure. It depends on the development of your knowledge. In the knowledge profile of the profession, we can see the conditions which have been determined, which will be expected for the practice of the technical assistant/colleague and the dental technician.
In the qualification dossiers, which contain the concluded profiles, the measures which have to be satisfied by the beginner technical assistant and the dental technician after long studies are described.
When you have obtained your diploma in the IVT (Instituut Vakopleiding Tandtechniek = Institute of Technical and Vocational Training of the dental technique) you will have all the skills which will be practiced by a beginner technical assistant or dental technician.

The directional competence is given during the instruction. That means that the teaching situations are indistinguishable, every student has to trace his own way. In the Institute of Professional Training of Dental Technique, you can actually attempt 2 trainings on dental technique, and every training has 2 orientations:

- dental technique assistant on level 3, with 2 choices BOL/BBL
- Dental technician on level 4, with 2 choices BOL/BBL.

Within both of the trainings you can also choose between 2 orientation courses: denture (partial and complete) and crown and bridgework. There is also a possibility to choose for the BOL of the orientation BBL. If you choose the BOL training, you have to go to school 2 days a week and the rest of the week you have to attempt a stage in a recognized company (in this case a dental technique laboratory). If you choose the BBL orientation, you have to go to school for one day per week and you can work 4 days or attempt 4 days stage in a recognized company. As well as for the BOL as the BBL you will be trained for the practice by a recognized practice instructor.
The recognized instructor/instructress is a dental technician trained worker (professional man or woman) who has attempted a complete didactic training to the accompaniment of the participants in the company. The professions: dental technique assistant and dental technician have differences concerning the amount of responsibility of the tasks, the extensiveness, the complexity and the number of key tasks.

The admission for both these trainings is minimum VMBO KL. For the BBL you have to be employed in a dental technique laboratory.

Orientation courses:
Denture:
The replacement of teeth with a denture is made in a closed cooperation between dentistry dental assistants and dental technician. The complete denture (artificial teeth) is the more famous restoration of the Dentistry. For edentulous patients, it is extremely important and an (dental) appliance for eating, speaking but also for good looking, encourages self-assurance and social contacts. The complete denture is not an easy work-piece to change, it demands too much steps to be achieved before it is finished.

Crown and bridgework:
In contrast to the denture, crown and bridgeworks are not removable. For the replacement of crown or bridgework a real experience and modelling skills are indispensable. You must be able to reproduce teeth moulds (forms) by means of wax, metal or ceramic.

IVT is the Dutch expertise centre for Training and Education in Dental Technology. IVT is the result of an initiative by the social partners in this field of work. The Dutch Ministry of Education, science and Culture accredits our Dental Education. The institute exists since 1968. Since 1985 it has a building if its own that is situated in Nieuwegein, The Netherlands. This school is designed for the needs of the training and education of Dental Technicians.

Theory and practice:
On the basis of professional competence profiles for Dental Technicians, IVT defines training programmes for youngsters and adults. Based on the principle “Learn when you work”, these training programmes comprise both a theoretical and a practical part. The theoretical part serves to provide an understanding of the subject whereas the practical part gives the student hands-on experience!

IVT is responsible for the training programs and exams in the Netherlands, but part of the practical training is left to the companies themselves. Of course IVT gives those training laboratories a lot of support in training their employees. An official Dental Training Laboratory needs a certified trainer; otherwise it’s not possible to become an official training company.

Assistant Dental Technician
As an assistant Dental Technician you carry out preparatory activities in order to manufacture dental pieces of work. , under the supervision of an experienced colleaque.The dentist makes casts of the patient’s mouth. These casts are poured in gypsum by the Assistant Dental Technician. The Assistant Dental technician creates common pieces of work onto these gypsum models. Sometimes an Assistant Dental Technician is allowed to be present when a patient comes in to determine what colour teeth he or she likes best.

Dental Technician
As a Dental Technician you manufacture full and Partial Dentures, Crown and Bridgework or Orthodontic pieces of work (braces for children). One carries out all activities independently in a dental laboratory. A Dental Technician receives assignments from dentists or directly from patients who visit the dental laboratory. Occasionally one manufactures an entire dental piece of work. In other cases ones works on a piece of work together with other

Dental Technicians. 'Contact with clients' and 'Industrial Maintenance' are important subjects in the 'Dental Technician' course.

Specialization Full Denture
The specialization Full Denture covers the replacement of lost natural dental elements and their supporting tissue. A Full Denture aims at aesthetics and the chew-, speak-, and swallow function in order to reinstate the chewing system. Traditionally, this specialization is very important in both the Dental Education and in dental laboratories because Full Denture is one of the oldest and one of the most used dental renovation techniques. Making a denture doesn't require just technical skills. Knowledge of anatomy, physiology and pathology of the chewing system is necessary because toothless jaws are liable to constant changes due to shrinking of the jawbone. That is why a denture is not a once-only replacement. The fit has to be adjusted to the jaw periodically or a new denture has to be made. The specialization Full Denture has interfaces with the specializations Crown and Bridgework and Partial Denture.

Specialization Partial Denture
A part of frame technician's activities consist of the manufacturing of pieces of work where different techniques are combined. All round knowledge and manual skills are required in this field of dental technique. The pieces of work are the result of cooperation and efforts made by the dentist and the dental technician. Proper communication between the dentist and the dental technician are essential for the result of the patient's treatment that needs a Partial Denture or in case combined with Crown and Bridgework or Full Denture.

Specialization Crown and Bridgework
In order to manufacture Crown and Bridgework one need excellent manual skills. One has to be able to shape wax, metal and ceramic materials. Manufacturing Crown and Bridgework also requires knowledge of the surrounding supporting tissue (paradontology) and the chewing system. In this course the student often has to deal with issues in the field of problems regarding Crown and Bridgework on implants. The specialist dental technician has his own input in the dental team of a dental laboratory. Consultation and meeting strategies are important subjects in the 'Crown and Bridgework' course. The specialization Crown and Bridgework has interfaces with the specializations Full Denture, Partial Denture and Orthodontics.

Specialization Orthodontics
The field of Orthodontics has reference to the study of the ordinary and inordinate growth and development of the teeth and the head and how to influence this growth and development. The last mentioned has also reference to the treatment of orthodontic deviations. The Orthodontics specialist has got to have the disposal of sufficient knowledge of orthodontic treatment methods. Furthermore one has to be skilled in the manufacturing of orthodontic equipment.

International activities:
Over the last 5 years there have been giving several training courses with patients in China. Together with Chinese Dental Technician students there are also made superstructures on implants for the benefit of this group of patients. There is also participated in a project in

which developed educational materials in order to set up techniques for full dentures in cooperation with dental schools in Germany.

Chapter 4.1

The Dutch denturist

The denturist profession is adapted for the replacement of perished teeth or missed (denture elements) teeth. With the treatment of removable dentures, the denturist is in position to restore, repair, and make a "natural" denture. He considers the grinding/chewing of the food but also the power of speech and appearance. The replacement of denture's elements by artificial teeth is not new. During centuries people tried to repair missed teeth, our country has known a "tooth master" in the 19th century. This "tooth master" was like a dental technician, he was repairing dentures. In this period people made a difference between technique-mechanic affairs and surgery aspects of the practical profession, by which, the making of denture is not included in the practice of the dental surgery. In 1871, it was decided that the insertion of artificial teeth and dentures was not a part of the medicine and everybody was free to practice, with the consideration that he has deprived himself of the execution of surgery proceedings (Law on practice/exercise of medicine).
With the law of June 24th 1876, the rules for the practice of dental surgery have been determined. The appellation "tooth master" was still maintained. None of these rules explained if technique-mechanic division also had to be included as a proceeding of the dental surgery.
Between 1876 and 1913, the application of the denture was considered part of the dentistry.

The title of "dentist" has been used for the first time in 1913, after the opposition of the doctors, they were facing dentists referred to their academic studies, and then the dentists did not have enjoyed this training. In the same year, the use of denture has been added to the dentist' qualification(s). For that reason, a number of dental technicians felt self-disadvantaged. They have practiced their professions stealthy.
In 1968, the Central raad investigated for the Volkgezondheid (people's health) on the basis of the Law on paramedical professions, the attribution of the authorization to work independently "in the mouth" and to make impressions have been placed in dental technique.
According to the Court, there was not necessity for this because "dental technicians received absolutely missed trainings". It was supposed that making impressions was not an independent affair and also that it was not concerned by the elementary technique.
The prosthetic dentistry is not a handicraft, but an inseparable part of the dentistry, wherefore, a medical-biological academic training is necessary, and consequently this cannot be left to people who have received bad training(s) education, and to the people who have practiced it as a handicraft.
The Chamber of Representatives/Lower Chamber did not take a position about it, and placed it in a legal regulation of the profession of denturist (Denturists Profession Regulation)
The dental technician was seen as someone who has no direct relation with the patient and "he does not work in the mouth" and is in contrast with the denturist.
This finally resulted in the Law on the dental technique which became effective on May 25th 1989, whereby an individual legal basis was written about Prosthodontics care for

edentulous patients. Since this date, the following happened: accommodation and installation of the complete denture is not part of the dentistry anymore and the legislator has qualified 2 profession groups in the basis of the education: denturist and dentist.

With the introduction of the Law BIG in December 1st in 1997, wherein the profession of denturist is also arranged, the Law on the dental Prosthodontics is expiring, but it's a fact that denturist and dentist will be the only 2 qualified professions in the area of the taking of measure for removable dentures

Admission level
Before the admission to the next training, the student must to be in possession of the diploma of dental technique with these qualifications: complete denture-2 and partial prosthetic-2 and as a specialty: complete denture delivered by the Professional Institute of the dentistry (IVT), or an equivalent certificate.

Complementary
Before the beginning of the course, the student can demonstrate that he is able to run a company because he has the basic skills and knowledge to practice.

Chapter 4.2

Clinical Dental Technician

Clinical dental technicians are part of the multi disciplinary dental team who specialise in the manufacture and fitting of removable dental appliances directly to patients.

The main type of work they undertake is in the provision of dentures. However, through continuing professional development they can enhance their skills, knowledge and competence in other areas of removable dental appliances such as sports mouth guards and anti-snoring devices.

Equipped with solid technical training as a Dental Technician – plus post-technician training in sciences, clinical skills, and interpersonal skills – Clinical Dental Technicians are able to provide complete dentures to edentulous patients independently of other members of the dental team. Currently, they can provide partial dentures as long as the patient has been seen by a dentist who has issued a certificate of oral health and a treatment plan.

However the underlying principles set by ethical guidance include 4 main points. All Dental Care Professionals who work clinically must ensure:

1) They have received consent from the patient.
2) They are indemnified for the procedures they undertake.
3) The treatment they provide is in the best interest of the patient.
4) They work to the limitations of their competence as set by their curriculum.

Any Dental Care Professional, including a Clinical Dental Technician, will be required to prove the above in case of a complaint and they are placed before Fitness to Practise Panel under the General Dental Council.

Starting 2002, the SVGB-IVT and the Radboud University Nijmegen
orgenies the training of Clinical Dental Technician together. The course “clinical dental technician” means experienced denturist, according to the protocol of the complete denture dental technician; it’s for students who want to exercise in the treatment of patients with complete denture.

Legal cadre:
The actual legislation has decided that the treatment with complete denture is not only reserved for dentists, but that others can also exercise this treatment, if they can demonstrate that they are able to be in service for it. During the training, dental technique, clinical and communicative skills are studied. There’s also attention for the infection prevention” (course). The length of the training is 5 months; the total study takes 240 hours (of which are 10 full day’s of contract education and 160 hours of self-education).

The patient treatment:

- the reading, interpretation and eventually research on the origins of the illness
- the communication with the patient
- psychology behind the treatment of the patient
- hygiene and disinfection
- the impression (provisional and definitive)
- registration of the relation between the upper and the lower jaw
- trying of the “trial” complete denture of wax
- installation of the complete denture in synthetic
- the follow-up/after-care including an after-registration

The dental technical part:

- provisional and definitive pouring out of the plaster impression
- the replacement of the individual impression tray
- the replacement of the registration plate
- the mounting of the definitive cast in the articulator
- the adjustment of the complete denture of wax
- the commutation of the denture of wax to the synthetic
- the grinding of the elements of the denture
- the elaboration and polishing of the occlusion after an after-registration

The course will be given by the workers of the SVGB-IVT in Nieuwegein and the faculty of Dentistry of the Catholic University of Nijmegen.

- an introduction afternoon
- proceedings in the laboratory
- course days divided on a longer time period

The preclinical part takes place in Nieuwegein
Five course days are dedicated to refresh the old knowledge and the instruction (learning) of the necessary missed knowledge. This part is concluded with a theoretical (multiple choice) exam. During the practice, L.O.C. denture is practiced.

The clinical part in Nijmegen
During seven course days every participant has to treat 2 patients’ wearers of complete denture. For these patients, a denture following the Anatomical concept and a denture following Lingualized occlusion concept will be placed. The participant has to document the treatment of the patient in a logbook which will be signed by the instructors. A judgment will be made on the treatment of the patient.

The certificate
When these 2 parts are sufficiently concluded, these 2 institutes give a united certificate of “clinical technician”.

After a training
Before the end of the course of clinical dental technician, an annual obligatory training day is organized.

Admission level
To be accepted to these courses, the student has to be in possession of the IVT diploma “dental technician” completed with the diploma “specialization complete denture” and the recommendation of the exam commission of clinical dental technician.

Clinical technician Crown and Bridge work
In 2009 the first, new traning will start. Possible items:

- Make and remove temporary restorations;
- adjust colours
- check / fit restorations

Chapter 4.3

Dentist (mondarts)

Actually, there are 3 training centers in the Netherlands (Amsterdam, Nijmegen, and Groningen).

The academic dentist's studies became very difficult. Not only for the lesson plans which became more complicated, but also starting September 1st of the year 2007, the duration of the studies became one year longer. Dentists must have studied a minimum of 6 years. It was the decision of the council of the Minister of education Maria van der Hoeven, in 2006. Thanks to the long duration of the studies the comer dentist (oral surgeon) has to know the complicated aspects of the profession more profoundly.

The ministry announced that the number of students that are attempting dentist trainings will be decreased to 240.

Minister van der Hoeven made this decision about burding this training with the advices of the Commission of the Innovation Mouth Care. With this advice, the tasks in the dentistry care have been newly categorized. In the future, higher education graduate students can very easily practice almost all of the treatments. This way, dentists can have more time to resolve difficult problems. That is the reason why the training has become more thoroughly and harder.

In the bachelor phase of the program, the knowledge and qualification has become enlarged and more advanced. Practice will take an important part of the program, (at the same time); more time will be spending on the dental treatment of the patient. The 3rd year will be finished with a bachelor degree.

During the master phase, in principal, patients are treated and a specialty is chosen. The 6th year is achieved with a mater degree, and the new graduate student can practice as a dentist.

Possible professions/occupations :

- general diagnostic and proposition of indication
- endodontology
- crown and bridgework
- partial prosthetic
- gnathology
- esthetic dentistry

Preparation

VWO (Voorbereidend Wetenschappelijk Onderwijs = Preparatory School Education) or appropriate HBO (Hoger Beroepsonderwijs = Higher Vocational Education) / WO (Wetenschappelijk Onderwijs = Scientific Education) course.
Students must have chemistry and physique in their package.
Biology and English language are recommended.

Chapter 4.4

Oral hygienist (Mondzorgkundige)

Training takes 4 years, and it's a full-time HBO (Higher Education) training. In the Netherlands, you can study oral hygiene in Groningen, Nijmegen, Utrecht and Amsterdam.

Propaedeutic studies
In the first study year the student learns a number of basic mouth hygienic skills. Apprehension of the mechanism of the Human body, notably the head, neck region and making acquaintance with the psychology.

Preclinical
The mouth hygienic basic skills are practiced on a phantom head during the first and second year in the proclinic.

Clinic
During the 2nd, 3rd and 4th year of the study, a specialization is chosen, for example: orthodontics, parondontology or information and prevention. The specialization of the trainings and the thesis.

Possible professions/occupations:

- prevention
- Caries (dental caries), tooth decays and paro-diagnostic and proposition of indications.
- 1, 2 and 3 surface reparations with full materials made of plastic.
- Paradontology treatments
- Prosthetic

Preparation

Level 4 diploma in VWO, HAVO (Hoger Algemeen Voortgezet Onderwis = Higher General Secondary Education) or MBO (Middelbaar Beroepsonderwijs = Secondary education Technical/Vocational Training).
A good knowledge of chemistry, biology and English language are also desired.

Chapter 4.5

Dental assistant

There is a large choice of different trainings. From independent working in practice, to (written) theoretical studies or full MBO (Secondary Education) studies. The dental assistant leads the proceedings on behalf of the preparation, execution and completion of the patient care in the dentistry area. He is responsible for the good organization in the dentist practice.
Which proceedings are going to be executed?
That is depending on the kind of practice, the number of other assistants (colleagues), the procedure of the dentist(s), competency of the dental assistant.

Legal cadre of the dental assistant:
There is not an individual allowance for the dental assisting profession. The general regulation of the Law (BIG: Professions in Individual Health Care, December 1993) is consequently applied. The dental assistant (just like everyone else) with the exception of the law BIG can independently execute all the proceedings.

When the dental assistant practices his/her profession, he/she has to satisfy the following conditions:

- an order of the dentist
- demonstrable knowledge in order to execute burdened proceedings
- surveillance and possible intervention of the dentist

In the dentistry, there are different proceedings as follows: the drill, grind, polish and resume of the elements of the denture, surgical intervention, method of anesthetizing by means of injection and taking X-rays.

Preparatory training:
Lower and middle secondary education.

Chapter 5

Present inter professional co-operations and communication

Effective communication and cooperation between dentists and dental technicians are essential in providing quality services. There has been a lack of information regarding dentist-dental technician communications and current methods and materials used for the fabrication of dental products. Materials and procedures are changing extremely fast... At the same time, the knowledge and demands of the patient continue to rise. In order to navigate through these challenging waters, the relationship between dental office and laboratory must become one of corroboration and partnership. The relationship between dentists and laboratories should be seen as an interactive system. With full participation, better education, and wise management of information, this partnership can grow to the benefit of everyone concerned.

The professions of dentistry and technicians - Improving the interface
Dentistry's mission to provide rehabilitation services to patients who experienced dental disease is being jeopardized through the continual reduction of critical to quality skills and knowledge in dental laboratory technology being offered in dental and dental laboratory technician education. These reductions are creating a shortage of knowledgeable dentists and dental laboratory technicians who will be needed to address the projected public demand for laboratory-fabricated tooth replacements and restorations.
Methods.

Demographic trend analysis supports a hypothesis that without immediate action by dentistry, substantial patient needs will not be met owing to inadequate levels of dental laboratory support for general dentists.

Results. The sophistication of laboratory-based rehabilitative and elective therapies demands closer cooperation between dentists and dental laboratory technologists.

Conclusions. Dentistry must not abdicate its responsibilities in dental technology as it pursues a path away from rehabilitation services toward a projected future of prevention services.

With decreasing educational exposure and training in dental laboratory procedures, dentists will have difficulty participating with dental laboratory technologists to fabricate laboratory-based rehabilitative and elective therapies. Without significant guidance from dental professionals in establishing laboratory standards in both education and practice, proprietary interests and commercial biases may set the laboratory and clinical standards of the future.
Clinical Implications. Dentists will have limited experience or background to evaluate the dental laboratory technology offered in the marketplace and will be subject to the marketing of the industry. A shortage of educationally trained dental laboratory technologists will create a clinical and an economic burden on both dentists and patients.

Dentistry has begun a slow journey away from its roots as a primarily rehabilitative health care profession by reducing—both in education and practice—its involvement in dental laboratory technology. Perhaps an even more ominous trend is the practical abandonment of the profession's relationships with dental laboratory technologists and the laboratory technology industry. These trends were noted in several studies (SVGB/IVT – ADA – Branch organisations and expert panels.

Dentistry needs to rededicate itself to its responsibility of supporting all aspects of dental laboratory technology. According some people, the dentist must remain the repository of laboratory skill and knowledge. Others believe in more independency and authority for technicians and denturists on laboratory procedures.

Current environment
Historically, dentists have interacted with dental laboratory technicians through multiple interfaces:

– Dental technology schools;
– Knowledge of dental laboratory techniques and technology;
– State board–regulated rules regarding laboratory work authorizations;
– Undergraduate dental education and in-school dental laboratories and technicians;
– Use of laboratories in close physical proximity to dentists;
– In-practice dental laboratories and technicians.

Most of these interfaces created an intimacy between dental laboratory technicians and dentists that started in dental school and continued throughout dentists' careers. Unfortunately, most of these interactions placed dental laboratory technicians in a subservient role because of educational and economic disadvantages. Regardless of the benevolence of dental professionals, the stature afforded dental laboratory technicians has been insufficient to create a sustainable professional career model. To cope with the demands of practicing dentists and new dental technologies, dental laboratory technicians and the laboratory industry are searching for new relationships with dental professionals.

The educational and economic imbalances of the past now are being reversed with dental technologists being the most knowledgeable members of the dentist/dental laboratory technician partnership in the area of laboratory techniques, instrumentation and materials. We need to ask ourselves how this role reversal will affect the structure of the dentist/dental laboratory technician interface in the future. Will dental technologists become manufacturers or allied health professionals or will the dental technology industry become a direct-to-the-consumer business?

New professionals
Today, in clinical practice, we see a lot of changes. The denturist, the clinical dental technician (denture or crown & bridge specialized) but also the assistances and the new oral hygienist both wit with extensive powers, will change dentistry.

Apart from that, the changed education program of the dentist (from 5 to 6 years, less students, upgraded to oral surgeon (mondarts) and the introduction of a new clinical dental technician, specialized on crown and bridge work, will change even more.

Dental implants
Another large segment of laboratory-based dental procedure education is the dental implant manufacturing industry. This manufacturer-sponsored education is extensive and concentrates on clinical procedures requiring laboratory-based restorations. Implant prosthodontics require extensive cooperation between dentists and dental laboratory technicians. It is expected that this phase of dentistry will enjoy continued growth for many years. With the minimal amount of implant prosthodontic training in undergraduate dental education, the burden of education in this field has fallen on the dental implant manufacturers and the dental laboratory industry.
The dental laboratory industry has taken a leading role in providing both clinical and laboratory education to dentists, as well as providing the most sophisticated dental restorations.

Aesthetic dentistry
In the area of elective aesthetic dentistry, making laboratory-fabricated restorations demands the utmost in communication and partnership between dentists and dental laboratory technologists. New materials and technologies will increase the need for dental laboratory technicians to be highly educated to provide support to dentists. This is especially true for procedures such as the newest computer-aided design/computer-aided manufacturing technologies, which will demand greater cooperation between dentists and dental laboratory technicians. With dental students having little or no experience with many of the newest materials and techniques, dental laboratory technologists will be the source of information for general dentists.

The need for laboratory-based restorations will be increased further by the increase in life expectancy. Since all dental restorations have a finite service life, people's additional years of life will increase the demand for retreatment of existing restorations and new restorations.

All disciplines of dentistry need to rededicate her to its responsibility of supporting all aspects of the other players. Dentistry and dental laboratory technology today is so extended and complicated; it’s not the exclusive responsibility of one of the disciplines.

Cooperation and communication

So, it’s important that dentists and dental laboratory technicians needs to create a climate of cooperation between dentists and their colleagues in dental laboratory technology to provide the public with the quality dental services they deserve. Future dental technology demands a vibrant dental technology industry to partner with the dental profession. It is important that a dentist and a dental technician share information about form and function of the restoration to be provided for the patient. The purpose of this paper is to discuss the methods and the contents of communication that a dentist establishes with a dental technician in treatment for fixed prosthesis. The communication is not one-way in which a dentist directs some work content to a dental technician; rather, it is a two-way communication of exchange that includes dental technician's knowledge and skill toward the dentist. A dentist must communicate with a dental technician to express four factors of biocompatibility, function, aesthetics and biomechanics in the fixed prosthesis. Provisional restorations are used for embodiment as early as possible, and each other's communication enables smooth sharing of the image of the final prosthesis. It is necessary to inform the dental technician of the contents that are required for fabrication of fixed prosthesis and that cannot be obtained from the model. The fixed prosthesis satisfactory for the patient can be made through cooperation between dentist and dental technician. Furthermore, the strong relationship of mutual trust can realize more reliable fixed prosthesis.

The information provided by a study (Centre of special dentistry, University Nijmegen) indicates areas of weakness in communication between dentists and dental technicians, along with areas where both parties should use greater care during clinical and laboratory procedures. In prosthetic dentistry the final result is mainly determined by the co-operation within the team: the dentist, the implantologist, the dental technician and the patient. The technician is more and more involved in the composition and colouring of the dental restorations. In many laboratories a dental unit is available to maximise the co-operation and to involve the patient if necessary. A plea is made to develop protocols to improve the co-operation between dentist and dental technician. At the same time new communication techniques can be used such as digital photography. As the costs are often high a treatment plan and an estimate of expenditure are necessary. It is advised that the dentist asks the

technician to submit an offer. The dentist should realise that patients, because of the high costs, often have great expectations of the final result, which not always can be fulfilled.

Chapter 6

THE DUTCH HEALTH CARE INSURANCE SYSTEM

The Netherlands has a unique health care insurance system. Until 31 December 2005, it is composed of a mix of public and private insurance.
As of 1 January 2006 the two-tier public-private healthcare system was replaced by a base level health insurance, for everyone (Zorgverzekeringswet). It is obligatory for all residents of the Netherlands to have one of the basic health insurance plans (if you are unsure whether you are a resident, see the IND definition on their website below). All resident children under the age of 18 are insured for free as part of their parent insurance policies. People are free to choose one of many health insurers (zorgverzeraars) who all offer a basic coverage package, as well as a dizzying array of extras, like supplementary coverage for: dental, after-pregnancy care, extra physiotherapy, etc.

The government has opted to have private insurance companies provide the coverage to use market forces to cut healthcare costs. In addition, the insurers are not permitted to refuse anyone the basic package regardless of age, employment status or general health, but may refuse anyone for supplementary insurance (*aanvullende verzekering*).

The standard or basic health insurance
The standard health insurance was introduced in 2006. In this section you can find some background information about the main principles, the position of the insured and about the role of health care insurers and of the government.

Main principles
Objective is to introduce a standard insurance against the costs of curative care and to enlarge the freedom of choice for the insured. This Standard or Basic healthcare Insurance puts an end to the former dual scheme of statutory health insurance funds (Ziekenfondsen) and voluntary private health insurance.

Open enrollment
All Dutch inhabitants are obliged to take out a health care insurance and all Dutch health care insurers have to accept every inhabitant. Risk selection by health care insurers is not allowed. This guarantees a 100% cover of all Dutch inhabitants

Standard or basic cover
The Minister of Health determines by law what care has to be covered by the Dutch health care insurers. This basic package is minimum – health care insurers may cover more. The basic cover consists of GP care, hospital care, pharmaceuticals and medical devices.

Fixed premiums
Differentiation of premiums for the same policy is not allowed. Dutch health care insurers may offer different policies, but the same policy should cost the same for everybody who chooses that policy.

Risk equalisation
To enable open enrolment and the obligation to take out a policy, the health care insurers will take part in a system of risk equalisation. This national fund redistributes money from health care insurers with a 'healthy' portfolio to health care insurers with an 'expensive' population of insured. The redistribution will take place along a refined risk adjustment system and enables the latter to stay in business. Of course, health care insurers are always accountable for mismanagement and only the health and socio-economic status of the insured is taken into account by the risk adjustment system.

Dentists
The insurance company will provide a list of dentists to her customers. Dental services are expensive and over the last 10 years many dental procedures have disappeared from the basic insurance package. Adults (18 plus) are not automatically 100% covered (see changes above) for annual checks, x-rays, dentures and tooth extractions. Therefore people take an extra, supplementary insurance.

Abstract
It shows that the Dutch population was very price sensitive after a major health care reform and found an exceptionally high premium elasticity of -6,7 for the year 2006 and -1,7 for the year 2007, while comparable figures for the years 1997-2005, in the Dutch social health insurance without large reforms, were around -0,6. In the Dutch social health insurance 10 million Dutch consumers gained in the past ten years only about 20 millions euro by switching from health insurer. This result, however, was in sharp contrast with the year 2006 were 16 million Dutch consumers gained in the year 2006 about 130 million Euros by switching. This number declined to 32 million Euros in 2007.

Through the reforms, combined with massive media coverage of premium differences, the population seemed to have become much more aware about their possibilities to switch health plans. One important difference with previous years was that consumers with an individual contract could opt for a lower priced group contract (sometimes with the same insurer). Many consumers, probably those that were most prices sensitive, used this opportunity and the share of group contracts in the Dutch population increased from 38% in 2005 to 53% in 2006 and 56% in 2007.

Zorgverzekeraars nederland
Organisation Zorgverzekeraars Nederland is an association. Nearly all Dutch healthcare insurers are a member of ZN.

Insurance Department
The Insurance Department focuses on affairs concerning the relationship between the insurer and the insured, and matters which involve the insurers, supervisory bodies and the government. Emphasis is on anything related to insurance, implementation and finance. Other activities include translating changes in legislation and analyzing them, and updating the budgeting model for the statutory health insurance funds. In addition, the department administers a number of files, such as 'reserves of the statutory health insurance funds', 'supervision of modernization activities' and 'the code of conduct concerning good insurance behavior'.

Care & Cure Department
The Care & Cure Department is responsible for the general tasks which ensue from the representative functions of ZN. These are focused on, for example, the preparation and implementation of policy, compiling knowledge and skills, establishing and maintaining networks and providing service to individual members. In particular, communication with the members is an essential task. In part, these tasks are organised according to categories of care providers, but certain tasks go beyond these categories.

Communication and Documentation Department
The Communication and Documentation (C&D) Department is responsible for an active communication policy and the provision of up-to-date information. C&D is responsible for issuing the daily collection of newspaper cuttings and for publishing the ZN Journal. The department also manages the website and the ZN library and has the task of providing information to the press, maintaining contact with the political an regulatory stakeholders, issuing press releases and making statements on behalf of the Directors.

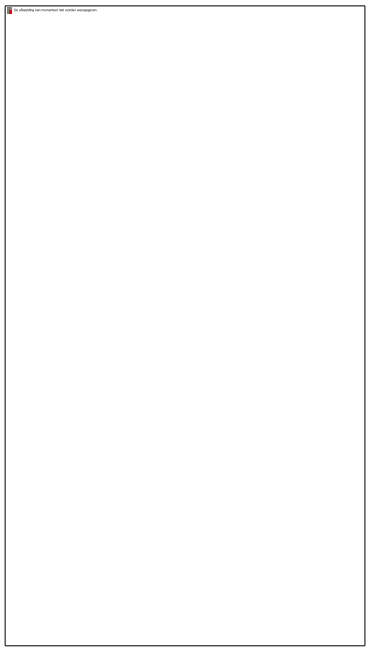
International Affairs Unit
The International Affairs Unit is concerned with informing members on international developments. In addition, ZN participates in a large number of European committees, working groups and joint activities and is a member of several international umbrella organizations, including the Association International de la Mutualité (AIM), and the Comité Européen des Assurances (CEA).

Chapter 7

DENTAL TOURISM AND IMPORT FROM COUNTRIES WITH LOW LABOR COSTS

Google the term Dental Tourism and the vaunted Internet search engine serves millions listings, most of them links to other websites that offer a dizzying array of options for dental patients willing to cross borders or even oceans in pursuit of cut-rate dental care.

Dental health providers in foreign countries advertise prices at one-third to one-tenth of European or U.S. prices. What's more, even insured patients may benefit from travelling for dental tourism care trip.



Within hours of landing in Vienna, Istanbul or Budapest is easy from Amsterdam. In a few hours you are laying in a dental chair, mouth wide open.

The idea is a trip to the dentist for a quart of the costs at home. Dutchmen, Austrians, Germans and other Europeans for decades have been crossing the former Iron Curtain to get their teeth fixed, often at jaw-droopingly low prices. Now, a growing number of Europeans, prompted by soaring medical costs and dwindling insurance benefits at home, are following suit. They're contributing to the rising popularity of "dental or tooth tourism," a relatively young trend here, but part of a fast-growing global phenomenon in which travellers, typically from wealthier countries, visit less-developed nations for medical care mixed with vacation — all at cut-rate prices. Dental treatment, eye lasering, cosmetic surgery and general medical tourism.

Want a nose job? Combine it with a safari in South Africa. Face lift? Go to Mexico and lollygag at the pool while you recover. Or, get bigger breasts in Bangkok and tummy tucks in Argentina. Although its buyer bewares, most Web-based medical tourism companies boast state-of-the-art facilities and highly trained medical staff.

In Hungary and other Eastern European countries, but also Turkey, dental tourism is putting a twist into the trend. Some clinics take up a full block; smaller practices are tucked inside hotels, above gift shops or beside casinos.

How can they keep their costs down? One reason is the low labour costs.

But also the locations. Dentistry combined with a vacation, including visiting other countries, it's very attractive. Especially if the total sum is less than only the dentist at home.

An example written by Julie Snider in an article for USA TODAY.

By the time Nancy Carothers met Frank Kannmann, the two had discussed by e-mail an overview of her treatment (based on a hometown dentist's exam) and his cost estimate. After he examined Carothers, Kannmann quoted a fixed price of $2,900 in cash, even though individual charges exceeded that. Here, his sample charges, compared with what she might have paid in the Washington, D.C.

Procedure	Dr. Kannmann's charges – 1*	Estimated U.S. costs (insurance reimbursement)
Exam	$0	$59 ($9)
Panoramic X-ray	$44	$96 ($23)
Pin retention	$88 – 2*	$41 ($8)
Root canal treatment	$88	$546 ($0) – 3*
Teeth cleaning	$44	$73 ($16)
Eight Crowns – 4*	$2,931	$10,336 ($0)
Total -6*	$3,195	$11,151 ($56 – 5*)

1* - based on May 20, 2005 euro-dollar exchange rate
2* - handmade; Kannmann said a factory-made pin costs about $19
3* - based on survey of Washington area dentists by Washington Consumer's Check book
4* - including temporary crowns and other preparatory procedures
5* - according to Washington Consumer's Checkbook fall 2004/winter 2005 edition
6* - excl. travel and accommodation costs

Some insurance providers permit patients to seek care outside of there own country. This is not only in case of dental, but in general.

Promising low cost and high quality, medical / dental tourism service outlets in Mexico, Hungary, Bulgaria, Austria, India, Australia, the Philippines, Turkey an post Soviet countries.

They are pitching their dental health activities and services to relatively affluent, yet cost-conscious health care consumers in Western Europe and the United States.

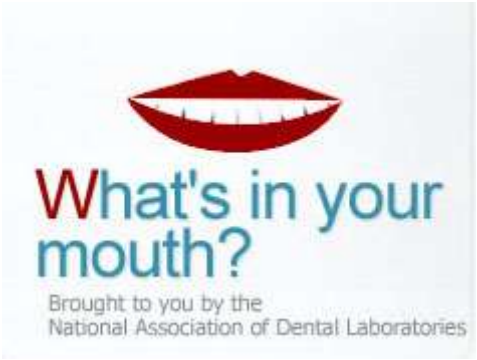
Made in China?
Some dentists and lab technicians are asking consumers to add a new product to the list of frightening exports from China, and the latest warning goes beyond regular, off-the-shelf consumer goods.
Actually, thousands of Europeans and Americans may have unknowingly allowed someone to cement this product directly into their mouths. Dental crowns are the issue and experts say European and U.S. laboratories, including some in Holland, are reaching out to China to get them faster and less expensive.

The overseas dental market is largely unregulated, some said, with no enforcement of the materials from which the crowns can be made.

According to different people from the dental field and branch organisations.
"Some patients are allergic to nickel or they're allergic to silver, and nobody is checking to see what metal China is using,"

USA
The National Association of Dental Laboratories estimates that between 10 percent and 15 percent of U.S. dental restorations, mostly crowns, are produced overseas. It's big business, with 12,000 dental labs in the United States generating about $5 billion a year in sales,

according to the NADL. The savings is not worth it, said Bennett Napier, co-executive director of the NADL, who said some dental labs are importing products from Pakistan, Turkey, Thailand, China, the Philippines and India.



"Unfortunately, some of the countries where dental crowns and other similar devices are being manufactured do not have the same material compliance requirements as in the U.S.," Napier said. "Materials as beryllium, a metal alloy, are commonly used around the world."

Beryllium in very small amounts is allowed in dental crowns made in the U.S., but the metal is toxic in larger doses, Napier said.

"It is not possible for any federal agency to 100 percent monitor the safety of dental materials (from overseas)," Napier said. "FDA, or another agency, could randomly test shipments coming in from foreign dental laboratories ... much like other products coming in; there would be a large amount of crowns in one shipment, so it is somewhat like a needle in a haystack."
What can patients do to stay safe? Experts say that patients in line for crowns have to be proactive and question their dentist about where they plan to have it made. To be absolutely certain of its provenance, they may want to call the lab the dentist uses and ask if their products are made in-house or bought overseas.

The possibility of infectious disease also enters into play when an industry is unregulated, said Napier, who questions whether crowns could transmit a virulent infection like SARS. Napier said the lifespan of SARS germs was thought to be about seven days. Many U.S. labs that import crowns from China use overnight shipping.

"If a dental restoration was not disinfected properly before it was placed in a shipping container, or disinfected before it was placed in a patient's mouth -- you can imagine the possibilities," Napier wrote in an e-mail.

Frichtel, co-owner of Jesse and Frichtel Dental Labs, in Pittsburgh, said that is nonsense, adding, "The chances of that happening are next to nothing -- and if it's going to be a situation like that it will be because a dentist here didn't disinfect something the right way." Frichtel has labs in Shenzhen, China. He turned to China for help because he needed at least 100 technicians to fill his 14,000-square-foot factory, and he couldn't find enough qualified staff in the United States.

He said his partners in China work 10 hours a day, six days a week on campuses devoted to producing dental products. They go home only on holidays. The factories are certified for safety by the FDA, which inspects the materials they use, Frichtel added.

"All they're doing is working, learning and talking about teeth ... I think the quality is better than 85 percent of those made here," Frichtel said.

THE NETHERLANDS
So far there are no exact figures about the situation. There are estimations about an import of 20 - 30%. This is including under structures.

DENMARK
In 2004 was unacceptable % of copper found in crowns from Thailand.

Chapter 8

DEVELOPMENT OF LASER, CAD/CAM AND RAPID PROTOTYPING APPLICATIONS IN DENTISTRY

Introduction

The term 'CAD/CAM' in dental technology is currently used as a synonym for prostheses produced by 'milling technology'. This is not entirely correct. CAD is the abbreviation for 'computer-aided design' and CAM stands for 'computer-aided manufacturing'. The term 'CAD/CAM' does not provide any information on the method of fabrication.
All CAD/CAM systems consist of three components:

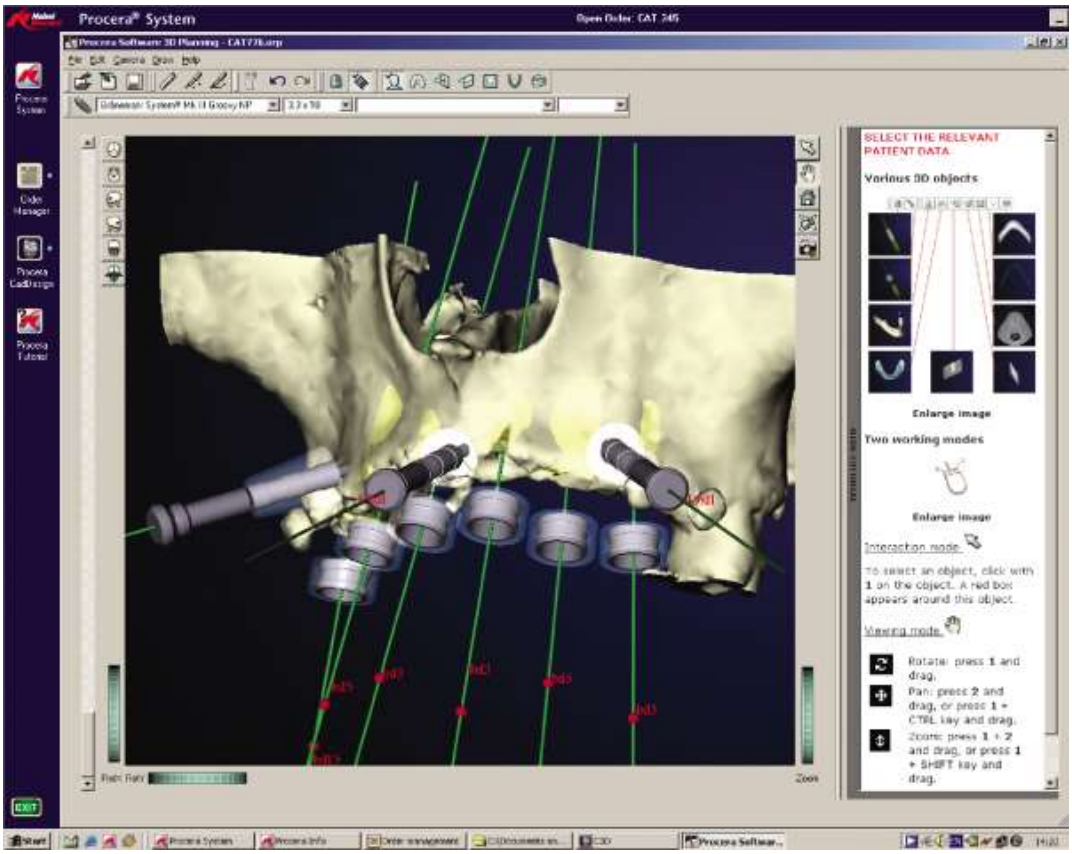
1) A digitalisation tool/scanner that transforms geometry into digital data that can be processed by the computer
2) Software that processes data and, depending on the application, produces a data set for the product to be fabricated
3) A production technology that transforms the data set into the desired product.

A lot of companies and opinion leaders believe that the future of dentistry is digital and based on knowledge. Dental medicine will be interactive and driven by technology. Above all, it will focus on patient access to better oral health services. Patients are better informed and always demanding more in terms of quality and aesthetic for their dental prostheses. They will expect that the materials used will be biocompatible with a proven safety track record. They will want their dental prostheses to be cost-effective, delivered fast and both aesthetically and clinically superior. The advent of information technology looks very promising for dental health. With digital dentistry, the clinical environment of tomorrow will have tools that will meet the patient's needs more affectively.
We will also be seeing an increasing number of interactive tools that can globally interface with other diagnostic, measurement and production tools.
The use of computers in dental education and practice dates back to the middle of 1960, when they were used for specific and limited tasks in the administration of dental schools and large dental practices. An early educational use was in the marking and collating of multiple choice examinations in some universities. The broad availability of both the Apple and PC computers in the early 1980's changed the emphasis and role of the computer and hence the relationship dentists had with them. The dentists became empowered at the expense of the so called computer expert. The hypothesis that dentists, in all disguises, are "gadget mad" and were a natural group to become computer enthusiasts will be explored. This has resulted in dentistry being in the forefront of the development of computer uses in universities and dental practice was ahead of medical practice in both administrative and in office/surgery functions. In recent years, however, the lead has been eroded and there is now very little innovation that is specifically dental and we are using and adapting existing techniques, hardware and software or sharing developments in order to reduce escalating costs.

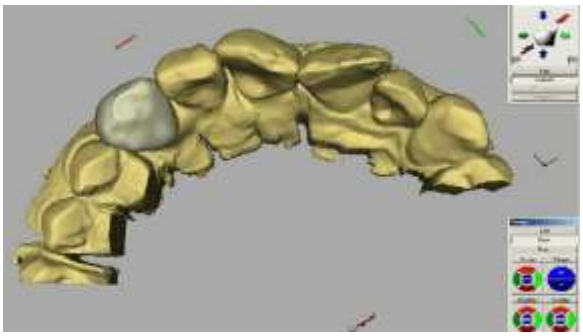
Dentistry in all its many facets is not considered either different enough or a big enough market to be separately developed.
Dental treatment in the 21st Century has advanced to a high level of predictability and in many ways become the “Golden Age of Dentistry.” New techniques not only repair dental disease but also create beautiful and pleasing smiles. Unfortunately, the challenge for any dentist is to be able to understand what is wrong and to determine the proper course of treatment. Advances in digital imaging, computer aided design, Internet communication, digital manufacturing and new materials have made an ideal opportunity to simplify the diagnostic process, improve outcomes and once again make the practicing general dentist, the leader of the restorative team.

A couple of dental digital CAD/CAM research subjects:

- Computer Aided Scanning (CAS), radiography, optical impression, MRI
- Computer Aided Design (CAD), virtual articulation, finite element analysis
- Computer Aided Manufacturing (CAM), CAD/CAM materials, clinical
- Computer Aided Implantology (CAI), computer guided implanting, surgical guides
- Computer Aided Dental Decision Making (CAD/DM), diagnosis, treatment planning.



The advent of CAD/CAM technology to dentistry is revolutionizing the practice of prosthodontics. Increasingly sophisticated software and automated fabrication will replace a lot of the current labour-intensive techniques.



Laser aplications

Everybody wants to have healthy teeth. But the thought of needles and drills makes the idea of visiting the dentist less appealing. With the advent of dental lasers patients can now receive a better quality of dental care, with fewer visits and without many of the discomforts of traditional dentistry.

Lasers have been used in other medical fields for a lot of years and have revolutionised many treatments, notably eye surgery and hair removal. This proven technology is now an established aspect of modern dentistry, and is widely used in Europe and the USA, and by an increasing number of dentists worldwide.

Laser dentistry has been practised for more than 12 years, and recent advances have enhanced the considerable benefits for patients.

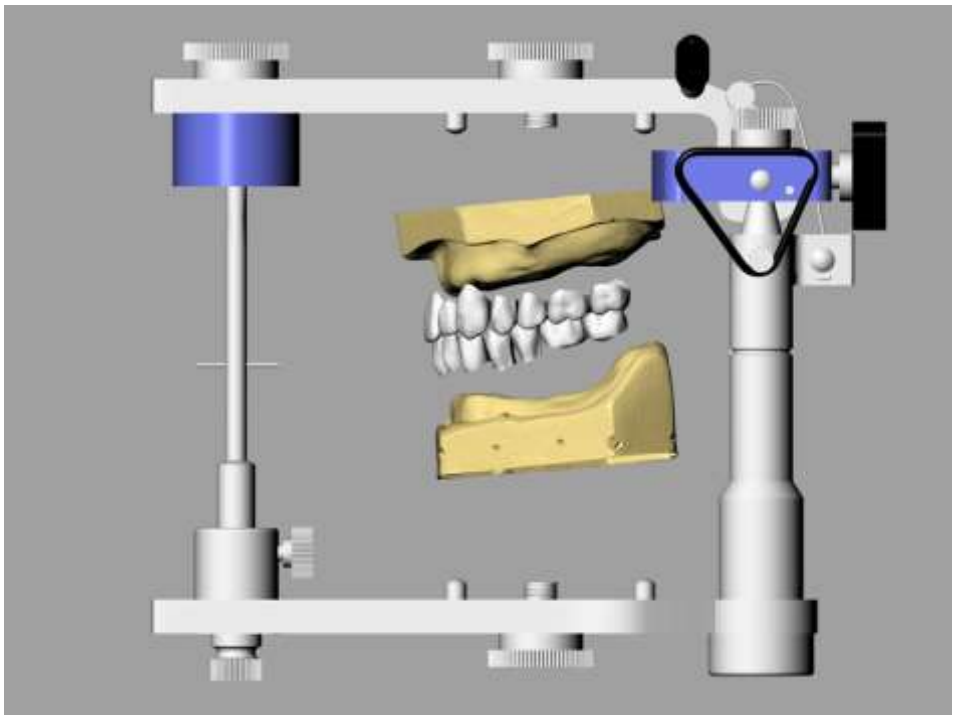
The benefits for patients include:

-Less discomfort during and after treatments
-Preservation of natural, healthy teeth whilst targeting decay
-Fewer visits
-Protects teeth against further decay
-Less need for needles and drills
-Reduced treatment time
-Needle and drill-free fillings in most cases
-One-hour superior teeth whitening with better results than conventional systems
-Effective treatments for sensitive teeth
-Root canal and gum disease treatments

Rapid prototyping

Computer-directed rapid prototyping techniques have been used for dental therapy including the fabrication of all-ceramic restorations and orthodontic tooth movement for several years. The application of these technologies to dental education is waiting to be exploited. Also replacement of plaster models.

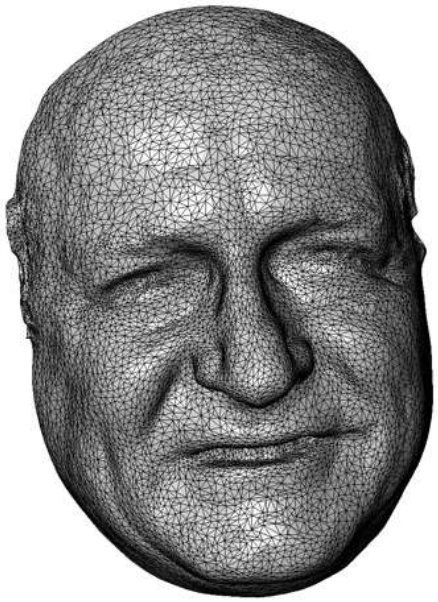
There is a potential use of a newly developed rapid prototyping system to train tomorrow's clinicians. The reason of mention this technique is to introduce these technologies to dental educators and encourage innovative ways to take advantage of them.



- Input unit in form of a scanner
- Modelling software, the core of a virtual articulator
- Output device, a "rapid prototyping system" with stereoscopic inkjet technology

With the continuing automation, more and more usable techniques appear. With CAD/CAM, it is possible to replace it with automated crowns, scanning/milling of computer data's. This really asks solid investments and high production. Small systems, just like milling or under structures, are sometimes more predominant in the branch. By means of CAD/CAM, it is possible to use other materials. More and more new technologies are usable. Automating by means of CAD/CAM (scanning, computer freezing) makes possible to capture definite labor proceedings and also to have more flexibility. Besides, a high size of exactness will be possible, just like the working on/up other materials. This really asks a force investment and a big sale. With this, the dental technique can offer a counterbalance to the tendencies of the outsourcing. In the other hand, CAD/CAM offers to the dentists the possibilities of practicing the tasks of the dental technician.

Important consequences en suggestions following this trend are:



- CAD/CAM can lead to (economies of scale) a reduction of production costs, by which the national concurrence position of the Dutch products with regard to the foreign countries will be purchased improved products (the payment of the labor costs must to be made, by which, the difference of costs between The Netherlands and low costs countries becomes smaller.
- There is a big possibility of flexibility in the fabrication of products
- With using computer is a question of constant high quality
- Other kind of materials can be used, which are impossible to use in the “traditional” proceedings
- With automating of the production, a division of the tasks must be brought : programmer and dental technician
- High investments are required to buy CAD/CAM, to make big investments like this, you need a higher turnover (more customs) to make this economical (compensation of the spent money in the investment)
- Dentists also can determine the automation systems and also accept the division of the tasks of the dental technician.
- With new techniques, it is possible to preserve (maintain) an artificial denture longer (it is negative for the artificial teeth market).
- Development of the vision and of the strategy with regard to /concerning CAD/CAM: giving to the necessity the administration of new techniques and how this can be inserted.
- Making of collaboration with colleagues who are able to use and follow new developments.
- Arranging programs for investment and stimulation.

- Learning as dental technician the use of CAD/CAM, or in anyway, learning all the relative possibilities.
- In anyway to be able to offer CAD/CAM – technology, self or in/with collaboration with colleagues.
- Working with CAD/CAM- technology gives/brings big chances/opportunities of vertical integration (chains).
- Scaling-up, as well as vertical as horizontal, is necessary to invest and making use of this invests.
- Education: timely new official / functionary (a kind of operator) trainings.
- Education: adaptation of training programs with consideration (of) the working with the most important CAD/CAM systems, with this, the new workers are ready to work with new techniques which make possible the production of efficient products and the concurrency with foreign countries can be passed.
- Enlightment of the patient/consumer concerning the esthetical possibilities.

An overview of recent developments for CAD/CAM and Rapid Prototyping in dentistry

As in many other industries, production stages are increasingly becoming automated in dental technology. As the price of dental laboratory work has become a major factor in treatment planning and therapy, automation could enable more competitive production in high-wage areas like Western Europe and the USA. Advances in computer technology now enable cost-effective production of individual pieces. Dental restorations produced with computer assistance have become more common in recent years. Most dental companies have access to CAD/CAM procedures, either in the dental practice, the dental laboratory or in the form of production centres. The many benefits associated with CAD/CAM generated dental restorations include: the access to new, almost defect-free, industrially prefabricated and controlled materials; an increase in quality and reproducibility and also data storage commensurate with a standardized chain of production; an improvement in precision and planning, as well as an increase in efficiency. As a result of continual developments in computer hardware and software, new methods of production and new treatment concepts are to be expected, which will enable an additional reduction in costs. Dentists, who will be confronted with these techniques in the future, require certain basic knowledge if they are to benefit from these new procedures. This article gives an overview of CAD/CAM-technologies and systems available for dentistry today.

CAD/CAM production concepts in dentistry
Depending on the location of the components of the CAD/CAM systems, in dentistry three different production concepts are available:

Chair side production
All components of the CAD/CAM system are located in the dental surgery. Fabrication of dental restorations can thus take place at chair side without a laboratory procedure. The digitalization instrument is an intra-oral camera, which replaces a conventional impression in most clinical situations. This saves time and offers the patient indirectly fabricated restorations at one appointment. At present, only the Cerec® System (Sirona) offers this possibility. Other producers also plan to introduce chair side CAD/CAM systems to the market. Since the Cerec® system functions with water-cooling, a variety of materials can be processed, from glass-ceramic to high performance oxide ceramic. Clinical observations on ceramic inlays are available over a period of 21 years. Scientific literature reported success rates for CAD/CAM produced inlays of 90% after ten years and 85% after 12 and 16 years.1, 2, 3 Historically, this system was the first CAD/CAM system in dentistry and is currently available in its third product generation. One of the benefits of this very mature system is the software that has been supplemented by a very exact three-dimensional reconstruction of the occlusal surface.

Laboratory production
This variant of production is the equivalent to the traditional working sequence between the dentist and the laboratory. The dentist sends the impression to the laboratory where a master cast is fabricated first. The remaining CAD/CAM production steps are carried out completely in the laboratory. With the assistance of a scanner, three-dimensional data are produced on the basis of the master die. These data are processed by means of dental

design software. After the CAD-process the data will be sent to a special milling device that produces the real geometry in the dental laboratory. Finally the exact fit of the framework can be evaluated and, if necessary, corrected on the basis of the master cast. The ceramist carries out the veneering of the frameworks in a powder layering or overpressing technique.

Centralized production

The third option of computer-assisted production of dental prostheses is centralised production in a milling centre. In this variation, it is possible for 'satellite scanners' in the dental laboratory to be connected with a production centre via the Internet. Data sets produced in the dental laboratory are sent to the production centre for the restorations to be produced with a CAD/CAM device. Finally, the production centre sends the prosthesis to the responsible laboratory. Thus, production steps 1 and 2 take place in the dental laboratory, while the third step takes place in the centre. As a result, the configuration of the prosthesis remains in the hands of the dental technician. The benefit of outsourcing CAM production is to be found in the small investment requirement, since only the digitalisation tool and software have to be purchased, still having access to a high quality production process. In addition, this procedure results in greater independence, since there is no relation to a particular production technology (such as, eg milling technology). It must, however, be noted that presently almost all CAD/CAM systems are only available as closed systems. In other words, if one acquires a scanner from one manufacturer, this implies, in the case of a closed system, that there is only access to that manufacturer's processes and line of products. In addition, the dental laboratory loses the income from producing the framework, since it is fabricated in the production centre.

Many production centers also offer laboratories without a scanner the possibility of sending the master cast to the centre for scanning, designing and fabrication. The additional veneering of the frameworks for prosthetic restorations is carried out in the dental laboratory.

Recently, dentist's have been offered the possibility of sending the impression directly to the production centre (Biodentis). This application is presently limited to ceramic inlays only.

An additional simplification in CAD/CAM production consists of intraoral data collection (optical impression). This means a digitalization of what is now only an 'analogue' step in the production process. This could lead to additional improvement in quality and cost reduction. New software developments will make it possible to directly judge the quality of the preparation intraorally, before data are finally sent to the dental laboratory or production centre.

CAD/CAM components

Scanner

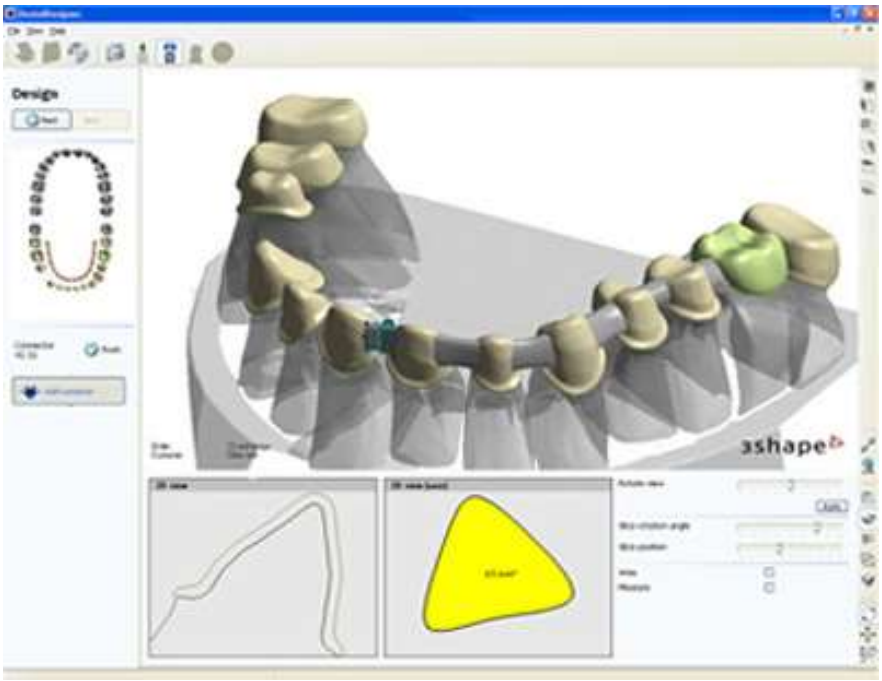
Under the term 'scanner' one understands, in the area of dentistry, data collection tools that measure three-dimensional jaw and tooth structures and transform them into digital data sets. Basically there are two different scanning possibilities:

Optical scanners
The basis of this type of scanner is the collection of three-dimensional structures in a so-called 'triangulation procedure'. Here, the source of light (eg laser) and the receptor unit are in a definite angle in their relationship to one another. Through this angle the computer can calculate a three-dimensional data set from the image on the receptor unit.9 Either white light projections or a laser beam can serve as a source of illumination (Fig. 1). The following can be named as examples of optical scanners on the dental market: Lava Scan ST (3M ESPE, white light projections), Everest Scan (KaVo, white light projections), es1 (Etkon, laser beam). and 3SHAPE.

Mechanical scanner
In this scanner variant, the master cast is read mechanically line-by-line by means of a ruby ball and the three-dimensional structure measured. This type of scanner is distinguished by a high scanning accuracy, whereby the diameter of the ruby ball is set to the smallest grinder in the milling system, with the result that all data collected by the system can also be milled. The drawbacks of this data measurement technique are to be seen in the inordinately complicated mechanics, which make the apparatus very expensive with long processing times compared to optical systems.

Design software
Special software is provided by the manufacturers for the design of various kinds of dental restorations. With such software, crown and fixed partial dentures (FPD) frameworks can be constructed on the one hand. On the other hand, some systems also offer the opportunity to design full anatomical crowns, partial crowns, inlays, inlay retained FPDs, as well as adhesive FPDs and telescopic primary crowns. The software of CAD/CAM systems presently available on the market is being continuously improved. The latest construction possibilities are continuously available to the user by means of updates. The data of the construction can be stored in various data formats. The basis therefore is often standard transformation language (STL) data. Many manufacturers, however, use their own data formats, specific to that particular manufacturer, with the result that data of the construction programs are not compatible with each other. The systems available on the market are differentiated mostly in their construction software. While many systems emphasise an indication spectrum that is as broad as possible, other manufacturers place emphasis on intuitive use and user-friendliness.

Processing devices
The construction data produced with the CAD software are converted into milling strips for the CAM-processing and finally loaded into the milling device. Processing devices are distinguished by means of the number of milling axes:



3-axis milling devices
This type of milling device has degrees of movement in the three spatial directions. Thus, the mill path points are uniquely defined by the X -, Y -, and Z – values (Fig. 3). The calculation investment is therefore minimal. A milling of subsections, axis divergences and convergences, however, is not possible. This demands a virtual blocking in such areas. All 3-axis devices used in the dental area can also turn the component by 180° in the course of processing the inside and the outside. The advantages of these milling devices are short milling times and simplified control by means of the three axes. As a result, such milling devices are usually less costly than those with a higher number of axes.
Examples of 3-axis devices: inLab (Sirona), Lava (3M ESPE), Cercon brain (DeguDent).

4-axis milling devices
In addition to the three spatial axes, the tension bridge for the component can also be turned infinitely variably. As a result it is possible to adjust bridge constructions with a large vertical height displacement into the usual mould dimensions and thus save material and milling time. Example: Zeno (Wieland-Imes).

5-axis milling devices
With a 5-axis milling device there is also, in addition to the three spatial dimensions and the rotatable tension bridge (4th axis), the possibility of rotating the milling spindle (5th axis). This enables the milling of complex geometries with subsections, as for example, lower jaw FPDs on converging abutment teeth (end molar tipped towards the medial plane), or also crown and FPD substructures that, as a result of anatomically reduced formation,

demonstrate converging areas in the exterior of the frame. At least a 4 milling axis is required for the milling unit to fabricate a substructure for this situation.Example in the Laboratory Area: Everest Engine (KaVo). Example in the Production Centre: HSC Milling Device (etkon).

The quality of the restoration does not necessarily increase with the number of processing axes. The quality results much more from the result of the digitalisation, data processing and production process.

Milling variants

Dry processing

is applied mainly with respect to zirconium oxide blanks with a low degree of pre-sintering. This offers several benefits:

Minimal investment costs for the milling device and no moisture absorption by the die ZrO2 mould, as a result of which there are no initial drying times for the ZrO2 frame prior to sintering.

Disadvantages: The lower degree of pre-sintering results in higher shrinkage values for the frameworks.

Some manufacturers also offer the option of milling resin material in a dry milling process [Zeno 4030 (Wieland-Imes), Lava Form and Cercon brain].

Wet milling.

In this process the milling diamond or carbide cutter is protected by a spray of cool liquid against overheating of the milled material. This kind of processing is necessary for all metals and glass ceramic material in order to avoid damage through heat development. 'Wet' processing is recommended, if zirconium oxide ceramic with a higher degree of pre-sintering is employed for the milling process. A higher degree of pre-sintering results in a reduction of shrinkage factor and enables less sinter distortion. Examples: Everest (KaVo), Zeno 8060 (Wieland-Imes), inLab (Sirona).

Materials for CAD/CAM processing

The list of various materials for processing by CAD/CAM devices depends on the respective production system. Some milling devices are specifically designed for the production ZrO2 frames, others cover the complete palette of materials from resins to glass ceramics and high performance ceramics. The following materials can normally be processed on dental CAD/CAM devices:

Metals

At present, titanium, titanium alloys and chrome cobalt alloys are processed using dental milling devices. The milling of precious metal alloys has been shown to be of no economic interest, due to the high metal attrition and the high material costs.

Examples: coron (etkon: non-precious metal alloy), Everest Bio T-Blank (KaVo, pure titanium).

Resin materials
On the one hand, resin materials can be used for the milling of lost wax frames for casting technology; on the other hand, it is possible to use resin materials directly as crown and FPD frameworks for long-term provisional or for full anatomical long-term temporary prostheses. Prefabricated semi-individual polymer blanks (semi-finished) with a dentine enamel layer are provided by one manufacturer (artegral imCrown, Merz Dental). The exterior contour conforms to an anatomically complete anterior tooth crown, while the internal aspect of the crown is milled out of the internal volume of the blank.

Silica based ceramics
Grindable silica based ceramic blocks are offered by several CAD/CAM systems for the production of inlays, onlays, veneers, partial crowns and full crowns (fully anatomical, anatomically partially reduced)). In addition to monochromatic blocks, various manufacturers now offer blanks with multi-coloured layers [Vitablocs TriLuxe (Vita), IPS Empress CAD Multi (IvoclarVivadent)], for the purpose of full anatomical crowns. Due to their higher stability values, lithium disilicate ceramic blocks are particularly important in this group; they can be used for full anatomical anterior and posterior crowns, for copings in the anterior and posterior region and for three-unit FPD frameworks in the anterior region due to their high mechanical stability of 360 MPa. Glass ceramics are particularly well suited to chair side application as a result of their translucent characteristics, similar to that of natural tooth structure; they provide aesthetically pleasing results even without veneering. As a result of their relatively high portion of glass, these ceramics are, in contrast to oxide ceramics, etchable with hydrofluoric acid and thus can be inserted very well using adhesive systems.

Infiltration ceramics
Grindable blocks of infiltration ceramics are processed in porous, chalky condition and then infiltrated with lanthanum glass. All blanks for infiltration ceramics originate from the Vita In-Ceram system (Vita) and are offered in three variations:
Vita In-Ceram Alumina (Al_2O_3): suitable for crown copings in the anterior and posterior region, three-unit FPD frameworks in the anterior region.
Vita In-Ceram Zirconia (70% Al_2O_3, 30% ZrO_2): suitable for crown copings in the anterior and posterior region, three-unit FPD frameworks in the anterior and posterior region. Thanks to its superior masking ability this ceramic is suitable for discolored abutment teeth19, 20
VITA In-Ceram Spinell ($MgAl_2O_4$): has the highest translucency of all oxide ceramics and is thus recommended for the production of highly aesthetic anterior crown copings, in particular on vital abutment teeth and in the case of young patients.

Oxide high performance ceramics
At present, aluminum oxide and zirconium oxide are offered as blocks for CAD/CAM technology.

Aluminum Oxide (Al_2O_3)
This oxide high performance ceramic is ground in a pre-sintered phase and is then sintered at a temperature of 1520°C in the sintering furnace. Aluminium oxide is indicated in the case of crown copings in the anterior and posterior area, primary crowns and three-unit anterior FPD frameworks. The ground frames can be individually stained in several colours with Vita

In-Ceram AL Examples of grindable aluminum oxide blocks: In-Ceram AL Block (Vita), inCoris Al (Sirona) available in an ivory-like colour.

Yttrium stabilised zirconium oxide (ZrO2, Y-TZP)

Zirconium dioxide is a high-performance oxide ceramic with excellent mechanical characteristics. Its high flexural strength and fracture toughness compared with other dental ceramics offer the possibility of using this material as framework material for crowns and FPDs, and, in appropriate indications, for individual implant abutments. The addition of three molecules of Y2O3 results in a stabilising tetragonal phase at room temperature, which, as a result of a transition to a monoclinic phase can prevent the progression of cracks in the ceramic (Transformation strengthening).24, 25, 26, 27 Examples of Zirconium oxide blocks: Lava Frame (3M ESPE), Cercon Smart Ceramics (DeguDent), Everest ZS und ZH (KaVo), inCoris Zr (Sirona), In-Ceram YZ (Vita), zerion (etkon) and Zeno Zr (Wieland-Imes)

Processing can take place in different density stages

Green stage: blank without heat treatment, ie an object pressed from ceramic powder and binding agents. Since there was no pre-sintering, the object is as soft as chalk. This permits very easy processing, but results, due to the low degree of stability, in great problems in transport and application. Processing is by means of carbide metal grinders without liquid cooling. The green stage has an open porosity, and in firing a 25% linear shrinkage is to be expected. At present, zirconium oxide is not processed as a green stage in any of the CAD/CAM systems on the market.

*White stage: pre-sintered blanks.*As a result of the thermal pre-treatment the organic compressing additives have vanished and the blank has an adequate stability. As a result of pre-sintering, the white body has already had shrinkage of approximately 5%. In the case of CAD/CAM production of objects from white bodies, the subsequent shrinkage of some 20% (linear) must be taken into consideration. Processing of white stage can be either with carbide metal grinders without water cooling or with diamond grinders with liquid cooling

Processing in hot isostatic pressing condition. Some systems also process zirconium oxide in HIP (hot isostatic pressed) condition with diamond tools and water cooling. The advantages and disadvantages are as follows.

Future technologies

Generative production methods are special CAD/CAM methods, which, in contrast to grinding technology, do not work by subtracting, but rather by adding material. In the dental area there are some areas of application for which this technology is already applied. In some production centres, so-called 'laser sintering devices' are used to produce crown and bridge frames from chrome cobalt alloys. Since the productivity of such devices is very high, dental restorations can be produced very cost-effectively. Basically, geometries are conceivable with this technology that cannot be realized with grinding technology.

Rapid Prototyping in Dentistry

Only a limited number of articles have been published regarding application of rapid prototyping in dentistry. The majority of them are on surgical techniques, Invisalign ™ clear braces, and the use of CAD/CAM in restorative dentistry. Rapid prototyping is a technique for the production of solid objects from computer models. By definition, the utilization of lab-based CAD/CAM technology for metal-free ceramic restorations falls into this category. CAD/CAM technology using nonmetallic esthetic materials is increasingly gaining importance in restorative dentistry. One of the chair side all ceramic CAD/CAM restorative systems has been in use for over ten years. In a ten-year prospective clinical study of Cerec ™ CAD/CAM inlays and onlays, the authors reported very high patient satisfaction after a decade of clinical service. They concluded that CAD/CAM restorations made of Vita™ MK II feldspathic ceramic appear to be acceptable in private practice. Another five-year clinical study reported two fractures among forty-three crowns placed. The clinical quality of CAD/CAM-generated In-Ceram™ Alumina and In-Ceram™ Spinell posterior crowns was excellent. Within the limitations of this study, both types of crowns appeared to be feasible. Recent improvements provide a sufficiently user-friendly handling of all components to accommodate operators with ordinary technical skills.

Orthodontics. Using state-of-the-art CAD/ CAM technology, the two normally separate processes of bracket production and bracket positioning are fused into one unit. In this process, the de-mand for maximum individuality with simultaneously minimized space requirements is put consistently into practice. Another innovative use of the CAD/CAM technology was to create an overcrown able to open the bite through clinical crown lengthening of the mandibular second premolars.

Align Technology (Santa Clara, California) provides clear plastic orthodontic treatment devices (www.aligntech.com). Every one to two weeks, the patient receives a new set of splint-like aligners that are intended to continue moving their teeth. As a re-sult, each aligner has a different shape than previous aligners. To produce aligners that are customized to each patient's treatment regimen, Align Technology utilizes several SL machines to fabricate models upon which plastic sheets are molded. After trimming the molded sheets, the aligners are shipped to the patient's orthodontist for fitting. Data sets are obtained by digitizing an impression taken of the patient's teeth. The resulting point sets are separated into individual tooth geometries, which are then positioned according to the orthodontist's treatment plan.

Anatomic medical models built with Rapid Prototyping (RP) technologies represent a new approach for surgical planning and simulation. These techniques allow one to reproduce anatomical objects such as 3D physical models of the skull or other structures, which give the surgeon a realistic impression of complex structures before surgical intervention. The shift from the visual to the visual-tactile representation of anatomical objects introduces a new kind of interaction called "touch to comprehend. Clinical data indicate that computer-aided rapid prototyping may be of value in minimizing the extra-oral time and possible in-jury to transplanted teeth during the process of auto transplantation.

Significance for the dentist.

In recent years, the use of CAD/CAM technology has above all strongly influenced dental-technical production procedures. If one ignores chair side prostheses, the significance of this technology for the dentist is not immediately clear. In recent years, CAD/CAM production has clearly expanded the palette of materials for dental prostheses by providing access to

new ceramic materials with high dependability. The stability values of zirconium oxide ceramics permit, in many areas of indication, the use of this material as an alternative to metal frames for permanent prostheses.
The production of long-term temporary prostheses has, as a result of the use of a virtual wax up on the computer, become faster, more convenient and more predictable. This method has already been implemented by computer-generated long-term temporary restorations, since it can be modified, by changing the form, to the functional and aesthetic satisfaction of the patient during a clinical test phase. The production of the definitive prosthesis should also be carried out by CAD/CAM technology and represents merely a copying process of the temporary prosthesis into the definitive prosthesis by a different material.
In spite of all the benefits of these new methods, the dentists working procedures will have to be adapted to the methods of CAD/CAM and milling technology. These include appropriate tooth preparations with the creation of a continuous preparation margin, which is clearly recognizable to the scanner, for example in the form of a chamfer preparation. Shoulder less preparations and parallel walls should be avoided. On the basis of present knowledge, a tapered angle of between 4° to 10° is recommended. Subsections and irregularities on the surface of the prepared tooth as well as the 'creation of troughs' with a reverse bevel preparation margin can be inadequately recognised by many scanners. In addition, sharp incisor and occlusal edges are to be rounded. Sharp and thinly extending edges as well as 90° shoulders in a ceramic restoration can result in a concentration of tension; in addition sharp edges cannot be milled exactly using rounded grinders in the milling device. The diameter of the smallest grinder is 1 mm in most systems, so structures smaller than 1 mm cannot be milled precisely. The result is an inaccurate fit.
A 360 degree shoulder or chamfer preparation is considered to be the appropriate marginal preparation geometries for CAD/CAM produced all-ceramic restorations. In the case of FPDs, the abutment teeth cannot show any divergence.
The precision of fit that can be achieved with the assistance of CAD/CAM systems is reported to be 10-50 µm in the marginal area. Thus, the demands of the literature concerning marginal adaptation of dental restorations can be reached with this technology; in addition, this production process achieves an industrial standard that does not have to deal with the variations of manually produced prostheses.

Significance for the laboratory
Apart from the previous mentioned possibilities, the Dutch company PRITIDENTA B.V. provides a new generation of manufacturing. Pritidenta is a new company in the dental industry. It's a daughter company of ENTA B.V., worldwide active since 1947, specialized in

producing ceramic artificial teeth. The major core is a revolution in innovative 3-D-Imaging-CAD/CAM - the new generation of dental restorations, Complete digitally produced. With a innovative 3-D-Imaging-CAD/CAM-Process can be any type of prosthesis will be fully automated manufacturing. The manufacturing process is completely digitalized: Imaging is a 3-D image of the face, combined with the scanned data of the mouth status. Apart from the technical aspects, the big advance is that the patient can see the end result in advance.

Conclusion

CAD/CAM became one of the important developments for every discipline. CAD/CAM offers to the companies, especially the possibility to enlarge the efficacy and quality of the fabrication (industry/manufacture) from the plan to the factual (real) production.
It is an innovation of first importance which can be important, distinguished, for the conservation of the force/power of the competition and a head start to the Dutch dental technicians. “Innovations” is the answer to the quality concerning the menacing tendencies/trends.
CAD/CAM technologies have started a new age in dentistry. The quality of dental prostheses has improved significantly by means of standardized production processes. This makes very efficient quality management possible. On the one hand it increased the productivity tremendously and changed dental laboratories from manufacturers to modern computerized production centers. On the other hand this increase in productivity leads to a competitive capability to produce dental prostheses independent of the manufacturing site, which might be a major factor for the high wage countries to keep business volume in the country. Last but not least CAD/CAM technology has made it possible to machine interesting new materials like the high performance ceramics and titanium with high accuracy.

Computer-directed rapid prototyping techniques have been used for dental therapy including the fabrication of all-ceramic restorations and orthodontic tooth movement for several years. The application of these technologies to dental education is waiting to be exploited. The teaching cube for operative dentistry instruction described in this article is one example of the potential use of a newly developed rapid prototyping system to train tomorrow’s clinicians. Our purpose was to introduce these technologies to dental educators and encourage innovative ways to take advantage of them.

However, some drawbacks of this fabrication technology have to be mentioned. The high investment for machines might overextend the budget of smaller laboratories. Some applications are limited due to software and production procedures.
CAD/CAM technology has already changed dentistry drastically and will replace more and more of the traditional techniques in fabricating dental restorations.

Chapter 9

DISCUSSION

In several countries removable dentures can be supplied either by dentists or denturists (MacEntee, 1974). The rights of denturists are usually limited to complete denture services, but in most of Canada and New Zealand they also had the right to supply removable partial dentures (RPD) directly to the public (MacEntee, 1974; MacEntee, 1981; Devlin, 1994). Denturists in many countries were licensed to practice directly with the public as part of an attempt to decrease the cost of denture care (Rosenstein et al., 1985), by increasing accessibility and availability of denture services (Tuominen, 1984). However, Friedrichsen, Hertzog and Christie (1992) found that denturists and dentists in the USA serve patient groups from similar socioeconomic backgrounds and that denturist services were not improving the accessibility of denture services to individuals with low-incomes. Similarly, denturist services in Finland were available mostly in larger cities where dentists were readily available (Tuominen, 1984) and two-tier delivery system had not improved the availability of denture services in more remote areas. MacEntee, Pierce and Williamson (1980) showed that the presence of denturists in British Columbia limit the increase in denture fees introduced by dentists. Similarly, Rosenstein et al. (1985) found that denture care costs had not increased at the same rate as other dental services after denturist legislation was passed in Oregon, USA. A controversial finding was reported by Abrams (1997), stating that no substantial change in price level of denture services by the two professions could be observed after the denturist law was passed in Canada.

In Finland denturists have been legalized since 1964 to provide, reline and repair of complete dentures (CD) for persons aged 20 years and over with an already edentulous jaw free of pathological or congenital anomalies. Dental laboratory technicians are licensed only to construct dentures on the prescription of a dentist and they are not permitted to supply dentures directly to patients. Supply of RPD is the right of dentists alone. Since 1992, Finnish social insurance has covered the fixed fees of denture services for World War II veterans. The fees set by the Social Insurance Institution to subsidize complete denture services are 8–17% higher for the services of dentists than denturists. There is anecdotal evidence that dental laboratory technicians in Finland are making dentures directly for the public, although the extent of this service is unknown. In addition, there is little information available on the opinions of denture-wearers about the services – legal or illegal – offered by dentists, denturists or dental laboratory technicians. This study investigates the provision of denture services by dentists, denturists and dental laboratory technicians for elderly Finnish men and it explores the opinions of the denture wearers about the dentures they received.

According to MacEntee (1994), there is little clinical evidence that complete dentures provided by denturists pose a risk to older people. In a Canadian study amongst 48 denture wearers, complete dentures which had been provided by denturists showed better aesthetics and phonetics than the ones provided by dentists. However, the dentures

provided by dentists were significantly older than the ones provided by the denturists, which explained the variation in clinical evaluation (Knazan & McCarthy, 1987).

Again, in Finland, denturists have been licensed for the provision, relining and repair of complete dentures for persons aged 20 years and older with an already edentulous jaw free of pathological or congenital anomalies. Laboratory technicians, however, are only permitted to prepare dentures for dentists who, in turn, provide them to individuals. The supply of partial dentures is the right of dentists alone. The aim of this study was to evaluate the oral health of elderly Finnish men who wore removable dentures, which had been supplied either by dentists, denturists or laboratory technicians. Although the present study sample was relatively big, the numbers of certain types of removable dentures provided by different professional groups were in some cases too small to allow a statistically valid comparison. The participation rate can be considered good and as only 32 interviewed subjects were not clinically examined, the probability of selection bias could be expected to be small. The selection of the subjects occurred in taking yeast cultures. This is probably why the present study showed higher proportions of yeast counts than that which could be expected in the whole sample. Orthopantomogram radiographs were taken only when the subject's oral health diagnosis and possible later treatment was expected to Benet from it. However, this had probably a minor effect on the occurrence of radiolucent periapical lesions, and did not affect the differences between the studied groups. The age and general health status of the subjects determined the extent of the data collection, and no re-examinations were carried out. By estimating the inter-and intraexaminer reproducibility of the recordings, the reliability of the findings of this study would have increased. Although it has been expected that this effect is only minor (Mojon et al., 1995), an attempt to increase the reliability of the recordings was made by using well-defined clinical criteria and calibrated interviewer and examiner. If more than one interviewer and clinical examiner had been used, the reliability of the recordings may have been reduced. Wearing a removable denture seemed to be a strong determinant of any oral mucous membrane lesion, which corroborates with the findings of earlier studies (MacEntee & Scully, 1988; Budtz-Jørgensen et al., 1996). Subjects with dentures supplied by dentists had fewer mucous membrane lesions than the other denture wearers. In general, dentists had prepared partial mandible dentures, whereas the other two groups had provided mostly complete mandible dentures (Tuominen, 2003b). This may explain the observed difference among subjects wearing mandible dentures.

High level of mucosal yeast growth is related to the wearing of removable dentures (Budtz-Jørgensen et al., 1996). Subjects wearing dentures provided by dentists exhibited high level of yeast growth more frequently than others. However, dentists had provided proportionally more RPD than complete dentures. It could have been expected that high level of mucosal yeast growth is less commonly associated with RPD than in subjects with complete dentures as they cover a smaller area of mucous membrane (Budtz-Jørgensen, 1990; Budtz-Jørgensen et al., 1996).

Patients without removable (partial) dentures had significantly more natural teeth remaining than denture wearers, which explained a lot of the observed differences in dental health parameters. In general, subjects without removable dentures had better oral health than denture wearers.

In previous studies the wearing of RPD has been strongly associated with the odds and severity of periodontal disease (Tuominen et al., 1989; Yusof & Isa, 1994; Wright & Hellyer, 1995). In the present study subjects with all types of removable dentures were analysed together, which may explain why no differences between denture wearers and non-wearers could be observed. The antagonist teeth opposing complete dentures are probably not as susceptible to periodontal diseases as those in close connection with RPD.
Tooth wear in mandible dentition was more common among those who had obtained their maxillary complete dentures from providers other than dentists. The few remaining teeth carry a heavier mastication load than a more complete dental arch and may thus exhibit more tooth wear. If excessively hard artificial denture teeth are chosen for a complete maxillary denture, it may cause excessive tooth wear in antagonist natural dentition. It has been shown in an earlier study that no differences in occlusion were observed between the respective dentures providing

Dentures provided by dentists, denturists and technicians*
Summary: In some countries removable dentures can be supplied by either dentists or denturists. Dental laboratory technicians, on the other hand, are licensed only to construct dentures on the prescription of a dentist and do not supply dentures directly to patients. This study investigates provision of dentures by dentists, denturists and laboratory technicians to 264 elderly Finnish World War II veterans. The veterans were wearing 454 removable dentures, of which 272 were complete dentures (CD) and 177 were removable partial dentures (RPD). Dentists had supplied one-quarter of the CD and three-quarters of the RPD, denturists had supplied two-thirds of the CD and one-fifth of the RPD, whereas the dental laboratory technicians had supplied the remaining seven per cent of the CD and four per cent of the RPD. Denturists had provided mainly mandible partial dentures. A high proportion of the RPD provided illegally by denturists were made to oppose CD. The subjects reported that maxillary CD were good or very good more often than mandible CD and considered more often CD by dentists or denturists good or very good than CD by dental laboratory technicians.

Cooperation and competition between dentists and denturists*
The aim of this study was to investigate cooperation between dentists and denturists in Finland, particularly in relation to perceived competition between the two professions. From a representative sample of 350 private dentists and 253 denturists, 68% returned acceptably filled-in questionnaires dealing with competition and cooperation with other healthcare professionals. Dentists referred their patients significantly ($P < 0.001$) less often to denturists (26.2%) than denturists did to dentists (94.1%). Those who referred their patients to members of the other profession also received patients from the other profession significantly ($P< 0.001$) more often than those who did not (60.7% vs. 16.7% among dentists; 90.0% vs. 44.4% among denturists). Denturists saw themselves as competing with dentists (56.0%) significantly ($P< 0.001$) more often than dentists did with denturists (29.2%). Dentists practicing in small towns or rural areas cooperated more often with denturists than did those practicing in more urban areas. Among denturists, the likelihood of referring patients to dentists was associated with younger age and fewer clinical working hours. It was concluded that cooperation between dentists and denturists was common. Oral healthcare professionals who referred their patients to the other profession also benefited by receiving

more patients on referral from them. Dental services provided by denturists are limited, which may explain their greater willingness to cooperate with dentists.
**Both studies are done by R.Tuominen, Helsinki, Finland in 2002 - 2003.*

Canada
Denturists and oral health in the aged Macentee, 1994. Abstract: The activities of denturists have been the source of annoyance and alarm to dentists. The dental profession has been unsuccessful in curtailing the prosthodontic service provided by denturists directly to the public despite frequent warnings about the risk to oral health. In many countries denturists have become a legitimate part of the health service in competition with dentists. This article explains the historic circumstances leading to the widespread acceptance of denturists in Canada in contrast to the rejection of these services in Great Britain. It demonstrates that dentists generally were not opposed to an alternative complete denture service and that there is little evidence of a serious threat to the oral health from the complete dentures made by denturists.

New Zealand
The New Zealand Dental Act of 1988 allowed clinical dental technicians to deal directly with the public in fitting and supplying dentures. This study tested the hypothesis that dentists responded to competition from dental technicians by lowering their fees. The results indicate that there was no significant change in the fees charged by dentists for dentures. The apparent failure of deregulation to produce the expected outcome could be due to the competitive pressure imposed by dental technicians practicing illegally prior to 1988, to consumers' lack of information, or to barriers to "consumer search" imposed by the act itself.

Sweden
In Sweden is the situation different compared to most countries. The dental technician can study all levels of education. Even a Ph.D. program is possible.

The programme contains a good deal of practical work which is supervised by our dental technicians, alternating with theory, which to a large extent is provided by dentists from the dentistry and the dental technology programmes. The dental technology programme is a three-year university course alternating between theory and practice. As a dental technician you work in a creative manner with shape and colour to replace lost teeth, and for that reason much of your work is done in the laboratory under the supervision of teachers. The teachers first demonstrate some particular stage in the work in small groups, and then the students practice independently by themselves. During the first two terms basic medical subjects and dental anatomy are studied, alternating with practical laboratory work, while dental materials science is studied in terms 2–4. The fifth term and part of the sixth are filled entirely with extramural practice at commercial dental laboratories, and today many students do their 26-week practice abroad, for instance in England, Norway, Finland, Spain, the United States or Australia, such moves being very popular. Other students choose to do their extramural practice in, or near, their hometown.

During the sixth and final term the students write an independent dissertation, a 10-week research project paper on a subject of their own choice, and this, too, may be done abroad.

For some students, this project opens the door to a Swedish Master level degree (an official translation of the Swedish degree “magisterexamen”, or a doctorate.

The Netherlands
As described in chapter 4, in the Netherlands, the education of all disciplines *apparently* is quality wise well organized. Three universities with a dental department for dentists (oral surgeon), well trained oral hygienists (professional bachelor degree) and denturists (contract program in Hogeschool Utrecht, University of Applied Sciences.). Concerning technicians: The IVT (Instituut Vakopleiding Tandtechniek) for dental technicians. In cooperation with the University of Nijmegen there is a possibility to be trained as a clinical dental technician.

Jungle
In practice, especially when we talk about removable dentures the Netherlands is a jungle for the patient. The patient can make a choice between dentist, clinical technician, denturist and a “regular” dental technician. If the patient wants to claim the costs by the insurance, he is forced to go to the dentist, clinical technician (with a prescription of a dentist) or a denturist.
It’s strange and confusing for such a small country and a small branch.

Apart from this, the influence of insurance companies, the liberal view of the government, there will be a lot of pressure on pricing en quality. Together with the influence of digitalisation and CAD/CAM (see chapter 8), dental tourism and import from countries with a lower standard of living (chapter 7), will be the cause of big changes in the near future. Simple and labour intensive technical work will be reduced dramatically because of the influence from abroad, technical progression and better trained assistants in the dental practice.

The Dutch dental (clinical) technicians and denturists today
Under the influence of the economy, politics, health's technique and social developments, the field is changing.

Aspects are changing because of digitalizing and automation, improved possibilities with composite (more possibilities and bigger, direct restorations, in the mouth), dental tourism, importation of work pieces from low cost countries and also, co-operations and responsibilities.

One thing is certain, a better co-operation and installation, both during the training and in practice is indispensable. It's amazing to see that there are so many different ideas in such a little field.

It seems to be the only solution for a changed field, a shortage of dentists, a growth in the shortage of cadres in the dentistry training in The Netherlands, the widening (of the patients' groups) and deepening from the field can bid for the top. New professions entering the profession. The dental technique can play a very important role there!
More and more, partially under the influence of high work pressure and shortage of capacity, tasks are delegated to a lower professional level. For example, the tasks of a dentist are more and more done by a dental assistant or an oral hygienist. In 2002, a new HBO training oral hygiene has started. Then, part of the mouth care will be able to be done by these professionals, under supervision and responsibility of the dentist. The government policy is focussed on expanding the dental team (dentists / oral churgeon / dental assistants, prevention assistants. Oral hygienists, and dental prothetici) besides that, the influence of the health insurers will be larger (costs reduction)

View of entrepreneurs versus branch organisations
According to a branch report (2006) from "Hoofdbedrijfschap Ambachten" in 2004, in general a positive image was given, certainly where an opinion of the entrepreneurs themselves has been asked;

- Approximately 85% obtained a profit in 2003, and a company's result which was equal or higher than the year before.
- 3/4 was less or more satisfied of the profit; on the other hand, only 10% found the competition to be a real problem.

The maximal chokepoints which have been experienced were: the recruitment of qualified personnel (43%) and the administrative costs.

Commentary of the branch organizations
At first sight, it is a question of a gradual but favourable branch extension. This is really not equal to the image of his branch organizations. In this study, a positive image of the branch organization seems to have no reason for self-satisfaction complacency. Quit the opposite; First of all, a comparison with numbers of the preceding years, that the number of companies have decreased and a number of active persons does not augment clearly. Second, there are the developments of the dental technique area, which pressure the

branch into alertness. There are menaces, which have actually been manifested not long ago.

Among other things, they have noticed the following alarming developments:

- the possible movement of the dental technique /activity to the (low-budget) foreign countries;
- the pressure on prices for the dental technique department on the side of the health insurances;
- restricted possibilities of the dental technician to bring a balance to the pressure on prices;
- The possible recess of the custom-made goods in order to replace it with “standard confection”. (an other words, which have the same meaning : the possible fact that the (dental technique) “art” will move into factories);
- with that, the associated quality deficits (in knowledge and product) as a result of the pressure on prices;
- the non-optimal affiliation of the trainings with the needed deal of high educated members;
- The menace of an inferior mass of qualified personnel and a lack of new entrepreneurs.

The consequences will appear in their full dimension after long term. With an unchanged government, the branch organizations will be dangerous for the future before survival independent dental technique companies. It is not a care only for the branch itself, but also very much for the patient. They will be the victims if the dental technique laboratories/companies of The Netherlands disappear, the profit in short term will be the defeat of the costumers interest in verifiable quality and fast service in long term, as a consequence, dental technicians and denturists organizations appeared. In the present rapport, this and other trends from the influence on the dental technique branch.

Trends

In the chapter “trends”, developments or situations in the branch and direct entourage of the branch which are considered as direct influence on the future of the dental technique will be debated. First of all the important trends will be described by means of literature research and discussions with the experts who came ahead of the branch. Finally, in the following chapter, there will be a place for: the approach of important trends in order to determine which concrete actions do this trends need?

Transfer of the production into foreign countries/outsourcing

Dental technique’s work pieces will be fabricated in increasing size – every body/thing but not any Dutch intermediary – in foreign countries. This outsourcing has reference to the putting out to board of the crown and bridgework in low cost countries (example: South-East Asia). This phenomenon is not something new in its genre. The ambit of this is now bigger than ever. Besides, there is the initiative which is now detached of the dental technique branch itself, on one side by having an own company in a foreign country, and on the other side by cooperating in the purchase in big contracts in countries with low income level. This event is simulated by the insurance companies in order to have low prices. This trend is

essentially noticeable for the fabrication of dental technique products. The manufacture of denture will be less confronted here.

The important consequences following this trend are:

- Contrary in opposition to the contract in the past on the low cost countries, the quality of the products is always situated in high level
- low purchase/product prices would be realized
- payrolls would be really in delay each-other overgrowned
- outsourcing can lead to the big question of crown and bridgework, in the circumstance/condition of making the product “cheap product”, recognizable for the patient
- the acquired extra allowance will be directly transferred for an important proportion if the clients (dentists) and health’s insurances insist on sharpened prices of the dental technique’s products
- The prices of the dental technique work pieces have been based for a big proportion on average margin. The interesting work pieces (“cherry picking”), crown and bridgework, compensate less favourably priced labour intensive specialized in work pieces. With the stopping of the margin crown and bridgework, this can lead/provoke a declension of the operating result; for that reason, specialized proceedings are going to the compression /crushing.
- at the moment insurances (a part of them) have a little interest in taking acquired extra margins; it is expected that the insurances which are in delay would like to claim there part here the dental technique laboratory will be more a hand-crafted company, what with people will always less manufacture himself and will more purchase. For that reason, the necessity of qualified technical personnel could/can decrease.
- an evident separation/division will be formed between a low segment (more contracting out in foreign countries) and a high segment (specialized actions)
- the know-how will be (in first instance the simple products) partly lost
- In the course of time, problems will emerge with the finding of skilled personnel. Young people will less want to work in the dental technique branch, what with a part of the profession will be lost
- the education also has some problems because of the students do not have the possibility to learn the manufacture of these work pieces in practice
- education/instruction problems in the crown and bridgework areas will also appear in the course of time, also on the development of specialized knowledge will emerged
- However, for the moment the dentist chooses to be sure and convenience: the Dutch bridge and crown!!

Less applicable to the denture work
For the denture work this will be not realized. Materials' prices are relatively small. Before the termination of a denture, it needed too much communication between the patient and the dental technician.

Offshore dental laboratories owned by U.S. / European companies
A relative new item is that western companies owning laboratories in the Far East. Also laboratories establish and using laboratories in China, the Philippines, Mexico, Costa Rica and other countries.

The overseas competition debate heated up when the CAL-LAB Group were informed that DENTSPLY USA intends to open its own dental laboratory in China and then sell dental appliances direct to laboratories. Needless to say the US laboratories were (and still are) very unhappy about the impact this move will have on the marketplace. The general opinion was that DENTSPLY USA is making a subtle move from supplier to competitor, effectively forcing laboratories in the US down the route of becoming retailers for DENTSPLY USA products, rather than being manufacturers in their own right. DENTSPLY USA representatives insisted that this will not lead to DENTSPLY USA dealing direct; however only time and the commercial success of this project will tell for sure.

Conclusion
Outsourcing is a trend which became more and more clear. After all the consulted parties, this trend will be seen as an effective work and important for the branch (see 4.2). With a solid development of this trend, the consequences will be effective on the dental technique branch. Now, the branch has still the advantage that dentists choose for Dutch products. But to maintain this head start, dental technicians do not have to invest only in effective/successful methods of production, but have to invest also in the visibility of the high quality of their products and in/on the expansion of the services to the dentists and consumers/patients.

Changing professions and functions in the dental sector
More and more specialties appear in the mouth care and the dental technique, among others innovations, CAD/CAM and new materials. There are also developments which are assigning tasks to the dentists.
This is on one hand the consequence of the deficit of the dentists and on the other hand the dentists have less skills and knowledge to do the dental technique work by him.

Example of specialties is in the field of implantology, Paradontology, CAD/CAM, etc. The more important consequences following this trend are:

- With the specialization more collaborations will emerge; specialist acts will be expanded in specialized companies
- The distinct/respective power/capital of the company will be reinforced. A bigger surplus value will be required to the costumer/client in the field of the dental technique service

- The delegation of tasks as following of an under capacity of the dentists can be larger and completed because the dental technicians also can practice preparative and educational proceedings like support/accompaniment of/to the patient
- With the specialization a continued economy is possible.

Conclusion
More important is the fact that with the specialization, the dental technician can maintain his surplus value. By staying distinct he can detach himself of the not-specialized suppliers and thus, construct a "permanent competition advantage/profit". The condition is that he has to continue his work to the level of his specialism or to the development of new specialties.
In fact, "specialization" is the answer to the positioning of the trends which are putting the position of the dental technician in danger.

Collaboration and expansion in the sector (horizontal)
The sector is composed of a big number of small-scale companies. Several levels which are composed in the companies of the dental technique sector are collaborated in order to obtain/achieve the "large-scale" effects. This takes place in the area of purchasing (in the foreign countries) and production/specialism (complementary actions/operations).

The more important consequences following this trend are:
- If the group companies can be easily purchased, production can be put out to board (in foreign countries), etc…
- with a returns to scale an efficient structure of costs can be realized/made
- The collaboration with other companies can conduct to the use of more innovations (for example in the field of CAD/CAM) with this; they can benefit from the possibilities of the other companies or the presence of a bigger financial bearing surface to invest.
- By bigger scale, bigger chains contracts with insurances can be ended in better consequences.
- chain of companies for example if preferred suppliers are designated

Conclusion
Scaling-up and horizontal collaboration are apparent trends in this sector. A lot of new collaboration initiatives of the last years brought developments. The examples are: Dental Partner Group, Dental Digilab, Partners in Tandtechniek. This trend can be considered as *a cost-focus strategically answers* of a lot of companies of the sector on the trend of the low-priced products from low cost countries.

Scaling-up and vertical collaboration
There are collaborations in increasing size between different disciplines of the mouth care. There are more and more groupings between dentists, the mouth hygienists, dental prosthesis's (denturists), etc…
The efficacy and the presentation (submission) of complete mouth care. The patient can be taken in and helped quickly. The obstacles to the collaborations are represented by the

traditional distance between the different professions, and can give direction/leadership and communication. The rejuvenation slowly eliminates all those obstacles.

The necessity of the collaboration in the sector will be reinforced with the following factors:

- the offer(ing) of a complete service : complete mouth care,
- More dentists who are going to work part-time: for this group of dentists it is difficult to start their own practice regarding the financing; this will be reinforced by the fact that there are more women in training. Besides, young people are more likely to agree with the collaboration. There is also question of a less hierarchical dimension compared to the past.
- Collaboration bids also the possibility to resist to a union between dentists: with intensive collaboration, the dental technician can assume different tasks: there is a task delegation protocol.
- there are more possibilities to apply a vertical collaboration with the latest technology
- by working with a practice manager, specialists can find an efficient way to practice their own profession
- The sector is also an interesting object for (the) investors. Those are frequently placing in practices;
- More attention to the aesthetic: a dental technician in the circle of acquaintances of the dentist can help his client in difficulty to find for example: the exact choice of colour.

The important consequences following this trend are:

- high conditions will be determined on the attempt and the communication (also for the education)
- with a vertical collaboration it is possible to offer full service to the patient
- specialism and treatment can find their place very easily
- with the tasks delegation, the insufficient time of the dentist can be used efficiently
- the collaboration offers a large-scale advantage to small companies, thus the possibility of economy
- There is a bigger investment surface: this helps to introduce new techniques (cs) more easily.

Conclusion

From a vertical and lateral (integration with related services in (side) the mouth care) integration arise the mouth care centres which can bid an important surplus value to the costumers. This surplus value reinforces evidently the position of the dental technique company because it will now be an integrated part of the service.
The elimination of this service by means of outsourcing is not so logical. Contrary, in this situation, more assistance and contribution will be expected by the dental technique companies and will be given by these companies.
Vertical integration and included full service are a surplus value strategy as an answer to the trends which can lead to elimination.

Implementation of a new public's health system
The introduction of a new public's health system results in a more determined role of the insurer, concerning the insurance package, the compensation and where the act will take place. The elaboration will be different for the denture work and the dental technique. Dentures have been taken in the basis insurance, whereas for the dentists and dental techniques work pieces a supplementary insurance has to be signed (not necessary for children).

Especially in the area of denture work, contracts of compensation between denturists and insurers will be signed. In general, supplementary insurances are based on a maximal compensation. The contribution of the patient himself will be more important, and because the patient decides for himself if he wants to have a supplementary insurance. The role of the government concerning the elaboration of a compensation system is thus of first importance to the question of the dental technique work pieces: if something is or is not under the basis insurance (for example: dentures) and the patient's own compensation is arranged.

The more important consequences following this trend are:

- Insurers adjust the maximal compensation, also in the side of tariffs which are determined with the dentists; the elevation of the compensations has been fixed first without denturists, they have been ignored (denturists).
- it necessitates to stop all battles on all sorts of contracts with insurers
- the health insurer will attack the cheap possibility to buy and consequently, all kinds of removable pieces will be moved to the denturist instead of the dentist : positive effect to the question of denturist
- a larger personal contribution is an influence in the question
- the health insurer will attack the cheap possibility to buy and consequently, all kinds of removable things/objects will be moved to the denturist instead of the dentists; negative effect on the question of the dental technique laboratories
- supplementary insurances are principally arranged set up as maximal compensative insurances : towards, the alternative is to find a solution, this is especially an affair between dentists and patients : dentists make the decision
- Health insurances are going to interfere with supplementary insurances when the first competition will breathing down their neck.
- With a higher own contribution, the patient costs show that the denture has to be maintained for a long time before cheap solution of the complete denture.

Advancing determinants of health
Over the past 50 years, a growing understanding of the many factors that affect health has spawned various public health initiatives in the Netherlands. Underlying these initiatives is the premise that the biomedical approach to disease cannot solve all health problems. These initiatives spring from evolving models that spotlight factors affecting human health: lifestyle choices and personal skills, social and community influences, living and working conditions, the organization and provision of health care services, socioeconomic, cultural and environmental conditions.

Demographic trends
The world population increases by roughly a billion people each decade. At the same time that the Netherlands is seeing an aging of its population, it is also becoming more racially and ethnically diverse. Such demographic changes are expected to alter disease patterns as well as cultural attitudes and expectations about health care and lifestyle behaviours. As a corollary, health care delivery systems and the services they provide will also change.

Changing populations
While the rapidly changing demographics of the population are unquestioned, the effect of these changes on oral diseases and health is not well understood. The questions that need to be addressed include: How long patients will maintain their teeth? Will they experience more, less or different oral diseases? What are the interactions of oral diseases with other conditions? And what are the effects of these issues on dental service requirements? Predisposing factors and demographic trends known today can be used to predict the possible future incidence, prevalence and squeal of diseases and conditions and their impact on health care delivery, education and research.

The use of materials should be ensured.
It should be ensured that only materials for which manufacturers have completed a premarket notification (CE – ISO 9000 etc.) The industry, the dental profession and the laboratory industry should enforce the government requirement that offshore laboratories be registered. Further, encourage laboratories using prostheses made offshore, to require materials to be specified and identified.

Oral health partnerships
The success of the future of the dental profession relies on its ability to be responsive and proactive in meeting the public's oral and general health needs, to effectively incorporate new technologies and knowledge into practice, and to assume a leadership role in the globalization movement. National and international partnerships and alliances will be needed to address the many issues raised in each of the chapters. Clear and direct avenues of communication must be established. Achievable goals, and the necessary resources for their accomplishment, must be identified. These goals must embrace the objectives of each organization and group.

- Establish and support partnerships and alliances among dental, other health care professional, and public health organizations, as well as business and social service groups, in order to address common goals to improve oral health.
- Establish regular forums to meet with groups representing patients and families. By listening to the needs and experiences of these groups the profession will be better positioned to identify priorities and take action on activities that will make a difference to the public.
- Establish and expand mechanisms for ongoing interaction among dentists, allied dental personnel, educators, researchers, manufacturers, and others. These modalities should be used to strategically position and reposition all components of dentistry based on emerging trends and opportunities. This will align them with the common goal of improving oral health.

Dental workforce
Having a responsive, competent and "elastic" dental workforce is key to meeting the needs of the public. The rapidly changing environment and emerging science and technology base continually place new demands on the existing and developing workforce. The numbers and types of personnel needed to address oral health improvement and their ability to meet the needs of the public are but a few of the many issues. The issue of local problems being best addressed and solved with local solutions should be the mindset that tempers consideration of solutions.

International collaboration
As globalization advances rapidly in this new century, crosscutting issues emerge that demand a worldwide collaborative approach to solving health problems. The Dutch dental technician is one of the leaders in the world and is essential to establish and reinforce the importance and relevance of oral health to total health. Dentistry/technique must be fully involved in international organizations and activities for research, education and clinical practice. This involvement requires a commitment to learning from other countries and cultures and creates a mandate for leadership with sensitivity.

- The Dutch dental profession should be an active partner and leader in the global environment.
- The Dutch dental industry and dentistry will benefit from dentistry's global involvement. As the demographics of this country continue to change and reflect multiple cultures from around the world, answers to many of the disease management, disease prevention and health promotion questions will be found through collaborations with other countries.
- International collaborative networks should be established to facilitate funding and implementing of research, education and practice-related activities.
- The Dutch dental profession and industry should work to restore and perpetuate the presence and effectiveness of oral health programs at the WHO.

Promoting through information sharing
There is a unique opportunity to promote health on a global scale by addressing those risk factors that have a direct effect on oral as well as general health. When countries work together, each may be able to realize greater benefits for the health of their citizens.

- The dental profession should emphasize the importance of addressing global oral health and general health issues to its members and to other health professions.
- Technicians/dentistry must play an active role in promoting health through active participation in controlling the global spread of risk factors. This will require technician/dentistry to be part of multi-national initiatives and to be involved with the public and their representatives.
- National and global health policies, particularly those promoting primary preventive strategies, should be developed.
- The international dental profession, including technicians should work to establish and maintain a strong global data bank that would capture information which helps to prevent the spread of diseases and promote the best clinical practices.

- The international dental community should ensure that there are sufficient individuals trained in epidemiology, dental informatics, and health services research.
- The international dental community should foster the development of exchange programs and fellowships to ensure that basic principles of ethics, competencies, and sensitivity to cultural differences are maintained.
- The international dental community should foster research training for investigators from developing countries.
- International standards for dental products and equipment should be fostered.
- The international dental community should support the emerging development of standards for dental education and clinical practice.
- The global dental community should foster the expansion of international volunteer activities to include educational components for local practitioners and populations.

Free competition, mechanism of the market and the position of the dental technicians
Free competition and the mechanism of the market assume equivalent positions in the market; where in the prices of the demand and the offer are fixed after negotiations. It is not the case in the dental technique branch. Dental technicians can not be in competition with the prices, certainly not vis-à-vis the costumer. They make namely unique work pieces According to the specifications of the dentist (or dental prosthesis/denturist). The dental technician is mostly in a dependent position regarding the insurances, which are making price fixings with dentists, the principals dental technique companies. Practically, insurances pose the price level with the dentists, without /participation of the dental technicians. The market where in the dental technicians are moving, the insurances in the side of demand have a large control they purchase in large-scale, but in the offer side, the dental technicians should (notably the dental technicians) not be negotiated as a party. What does exist there is always a fraction of what they need in the basis of a transparent costs calculation and a healthy management. The fiction of “the market” forms a menace for the branch this way.

The consequence is that the position of the negotiation of the small-scale operating dental technique branch is delicate (especially the dental denturist) opposite to the big cares-insurances. Free competition presents – with the background of the present care legislation – the dental technician in disadvantaged position, in a position where he can not proceed as a full-fledged party. Individually, the entrepreneur can make a little difference in his surplus value by letting appear clear with different manners and with intensive forms of collaboration with a.o. dentists, acquire a fast place in the chain of the dental technique services. The branch organizations have to play a role of a special alarm on the negative consequence of the free competition and mechanism of the market on the position of the dental technicians in practice. It is their role to bring this to politics if the necessity for this purpose appears clearly from the facts.

Increasing globalization
All the trends described thus far point to one incontestable fact: health care is a global concern that breaks down national boundaries. Microbes can be transported around the world in a matter of hours. Health care information can be transmitted from one corner of the globe to another in seconds. New and useful scientific findings and technologies can arise anywhere in the world. Dentistry/technique is a resident of that global community and a vital participant on the world stage.

Public awareness of dental technology should be increased.
A public relations firm should be engaged to develop methods to promote dental technology as a viable vocational area. A public information Web site should be developed to allow patients to become educated about dental technology. Methods should be developed to inform patients about the benefits of quality dental technology, where restorations are made, what materials are used to make the restorations and how laboratory technicians are paid for their work.

The public must understand the importance of oral health in order to appreciate and take advantage of the services available. Education efforts must be made to ensure that every individual is aware of the necessity of visiting a dental practitioner on a regular basis. Optimal oral health care can be achieved only by a cooperative effort of all interested parties, including the public, the government, private industry, and health care providers. Alliances should be forged to structure and fund this effort.

- An alliance should be formed comprised of the dental profession, organized dentistry, government health agencies and dental industry to develop and fund a "National Health Awareness Campaign" focusing on increasing the awareness of the public and policymakers of the importance of oral health.
- Lobbying activities should be organized that include the participation of all levels of society to convince legislators that oral health is a major part of general health and that increased funding is necessary to support efforts to achieve the goal of optimum oral health for all.
- Low-income families and immigrants often suffer from dental neglect.
- The public should be educated about the importance of oral examinations by qualified health professionals and other pertinent information, which will heighten the awareness of the risks of developing oral or pharyngeal cancer as well as the benefits of regular screening.
- The dental profession should conduct intensive public service information and education efforts to reduce the death rate due to oral cancer through early diagnosis.
- A study should be undertaken to address the adequacy of the number of dental laboratory technicians and to develop a strategy for attracting qualified individuals into that profession.
- Utilizing the combined resources of the dental profession and dental industry, emphasis should be placed on the development of highly targeted, collaborative marketing and public relations initiatives.
- Develop a cooperative effort between various sectors of the dental profession and relevant business sectors to plan marketing and public relation initiatives. Cooperation such as this will leverage both funds and impact of these kinds of activities.

Development of the demand: changing costumer kind of products

The demand of the dental technique work pieces will be among other things determined by the following developments of the costumer (patient). The composition of the population is changing: ageing and more migrants. This has an influence on the way of the mouth care (more dentures or just maintaining of the denture). In general seniors have spent money. New techniques give the possibility of the preservation/maintaining of the denture. Besides, the development of the economical situation has an influence on the mouth care. There is also more attention to the "luxury" acts (esthetics) and for the health/welfare. It is a question of a progressive/gradual displacement of pure (medical) care assignment (=offer) to a mix of medical and esthetical mouth care (=demand). The following actions are mentioned, distinguished in type player in the market:

- change of the composition of the population: ageing, more migrants,
- improving denture conditions;
- development of the capacity to pay
- influence of the trends: attention to the esthetic and implants
- There is a demand in increasing to the dental technique as following to the ageing, the number of old people increases very rapidly: by this, there is more demand of dentures and maintenance of this.
- New techniques give the possibility to keep the denture for a longer time. (negative for the dentures market)
- Seniors are more and more exigent, and can also pay for the dental technique.
- The demand of the esthetical and implant treatment is going to increase.
- The dental technique laboratory attains the consumer very difficultly; there is a task for the branch organization.
- The dental technician has to enlighten the patient concerning all the possible cases, by means of the development of the product information and its administration.
- The dental technician does not have a direct relation with the patient, but can take care about the sending of information to the patients and the dentists.
- Fashionable products is a serious possibility in the dental technique branch; companies can specialize themselves in eminent esthetical products.
- Offering of dentists with more choices in the area of prices, quality and esthetic.
- Offering of financing possibilities of the products which are in the supplementary insurance.
- Dentists have to inform the costumer about the products and services, possibilities in the area of dental technique.

Conclusion

It is apparent that with the changes in the position of the costumer for the denture and mouth cares, the demand of high-qualify prevention care and denture regulation is going to increase. Besides, it is not unthinkable that more proceedings are going to (follow) ensue from the care and the esthetical perspective, than from a clear restoration perspective. This means that the dental technicians have more than ever to examine to what extend they can obtain a place in those services/in this service. Besides there is a problem with the fact that the dental technician can practice only with the permission/commission of the dentist.

Direct contact is possible with the consultation of the client, but it is not necessary to guide/conduct the consumer to bigger services/departments. Perhaps, interest groups can play a role on the present with the health insurances and the authority/government can argue/plead a bigger factual/real direct contribution of the dental technician.

Price & Margin under pressure

The dental technician encounters problems to fix an appropriate price, on the one hand there is the pressure of the insurance and of the high own contribution of the patient, on the other hand there is the capacity to pay of the patient/the purchasing power of the patient. The growth of the productivity has caught/captured the increase of the costs. But, this has its limits. The big reliance of the dentists to the commission set a (n) big/important pressure on the price. The relation between dentists and dental technicians becomes more commercial it is not evident that the relation with a dental technician to a dentist is unlimited holy. Often the technician was depending on the dentist. The dentist of our time becomes more rational in the judgment/criticism and his choice for a dental technician. The aspect of the price is going to place an important role there/hereby. Otherwise, this aspect will not be considered as a total negative experience because now, more collaboration-meetings can be made on professional bases instead of personal relation bases.
The price agreements are for the most part dominated by the negotiation between the insurance and the dentist, whereby a good base/understructure (with capacity in price-quality-proportion and costs structure) which (for the most part)/is mostly absent according to the dental technician.

A number of companies which are purchasing in large-scale (a.o. in foreign countries) distribute the benefits of buying. This has also a direct effect on many small companies, which are not buying to the/with the same price. Namely/ that is to say that: the insurances fix/stop all the higher (priced) material costs together and estimate an average on the base of that. When the purchasing margin is performed, the insurances have thus to assume/pose/suppose a material price, without margin. The small companies lose (the) margin or have to calculate themselves on low prices than which is bought.

Conclusion

The important consequences which are following this trend are: It is difficult to bring a price increase as a consequence of a cost-prices increase. Margin erosion always leads to profit erosion if the company is not able to realize stable scaling up of quality (projects). Margin and price pressures are forming a greater menace to the continuity of companies and to the quality of the services which are given. Do the companies want to wrest from this price-margin pressure? On one hand they have to create a surplus value of their services and on the other hand, the attention has to be focussed on transparency. A transparency concerning tariffs and clearly, costs structure does anyway differences in qualities of products and services. Consequently, more thought-out choices can be made and maybe this can bring a better step to the qualitative eminent services with a favourable price fixing for the dental technician (see the following point).

Transparence: more comprehension in price and quality

Also, with an eye to the negotiation with insurances, it is determined that there is not a vision on how the structure of costs looks like for qualified professions. Insurances do not take the figures of the dental technique company as a base, but the information of the sector. In term, the insurer acquires a larger vote in the quality from the persons who want it for the costumers. Now, there is too much inaccuracy on the quality-price relation (ship). With more transparency in quality, it is possible to deliver custom-made goods and standard work(s) and apply different prices. Besides, it is important that the dental technician always wants to deliver the very best thing, and that, the dentist or the patient asks less. This last-one is not convenient with the opinion of the dental technician: this one wants to deliver what he has learned (products as good as possible). With the use of more expensive materials, with stable prices, at the expense of the detriment of the result (profitability of the company). Now, the patient does not have any perception about the technical costs. In more cases in the invoice of the dentists, there is not any specification of the dental technician attached. This creates the chance to give an incorrect image of the dental technician: expensive. There is not any interest in the choices for the use of material etc. The dentist decides. With a bigger independence of the patient, more openness will be demanded. There is a chokepoint in the branch which is the fact that the average is from professional entrepreneurs and less normal than people have the difficulty to make a structure of tariffs.

Conclusion

The important consequences following this trend are:

- Clarity in the structure of the costs makes the appropriated prices bookable
- A system with different qualities/relations brings more possible choices to the patient.
- A system with different qualities/relations forces the dental technician to use more appropriated products, so that the result/efficiency boosts: opposite to an exceptional compensation.

Transparency of tariffs is welcome. The demanded

Participation of all parties, especially the dental technicians themselves. It is to be commanded that the branch organizations give too much rules to the capacity of this transparency: how the costs structure have to be standardized in order to have the wanted transparency? Which information has to be divided, and how does this information go to the people (dentist, insurance)? Here, there is a clear task for the branch organizations.

Special needs populations and individuals with limitations and/or disabilities

Access for special needs populations and individuals with disabilities is difficult because of the special needs of these individuals and the complex management of their care. Many of these patients are homebound, institutionalized or unable to cooperate with care in a traditional dental setting. Furthermore, health providers require special skills and educational background to effectively manage some of these individuals' health problems. Financing for the care of this group of people will require reimbursement rates at levels that will attract providers to undertake the additional training necessary to manage these patients. In addition, educational programs to train providers with the necessary specialized skills should be developed and widely implemented.

Cultural competency
The dental profession should reflect the diversity of the population and have the cultural understanding and skills needed to provide services to a growing and diverse patient population. Dental schools have a responsibility to recruit and retain under-represented minority students and faculty and for training students to be culturally competent in dealing with various populations.

- Dental schools should develop programs in which students, residents and faculty provide care for members of the underserved populations in community clinics and practices.
- Dental education curriculum should include training in cultural competency, as well as the necessary knowledge and skills to deal with diverse populations.

Regulation of high administrative costs
The dental technique branch is menaced by a European instruction with preservation of the information of the products for the duration of the product. Crowns and bridges can be used during decades. This evokes the question on how this can be accomplished with an eye on archiving. At the moment, there is an obligatory registration, which is very infinitesimal (reduce to a microscopic scale). The consequence is that the dental technique branch has/receives high administrative costs. Also for the administrative costs pressure pretend that notably the branch organizations have to take some initiatives in order to bring this cost pressure as image, and also to bring the possibilities of decrease under the attention of the authority of the government.

Dental laboratory technician certification issues
The value of certification should be increased. Manufacturers should promote the importance of technician certification. Organizations should promote the importance of dental laboratory technician certification. A new education program must be developed and technician certification should be made mandatory. A list should be made of all dental laboratory technicians to allow communication, encourage certification and solicit for continuing education. Laboratory owners should be educated about the desirability of allowing the names of all noncertified laboratory technicians to be placed on a national list to allow solicitation for continuing education, certification and organizational membership.

Science and technology trends
The rate of scientific and technological advancement has accelerated in recent years, a trend that will continue into the next decade and beyond. Through research, dentistry and dental technology has improved its understanding of the causes and sequelae of diseases and conditions and their interrelationships. The social, biological, and physical sciences have evolved and begun to merge, fostering an improved understanding of human health. Through sophisticated biotechnology research, science is mapping the human genome and gaining knowledge of the organisms and microbes associated with such conditions as dental caries, oral candidacies and periodontal diseases. Genetically engineered animals and foods have become a reality, and it is now possible to mimic nature by applying biomimetics to

design and fabricate new drugs, tissues and organs. With these developments come critical ethical, legal and social questions that must be addressed.
Miniaturization and nanotechnology provide additional tools contributing to improved health care and communication. These technologies have tremendous potential, particularly in connection with optical laser systems and computer-assisted informatics. Information technology is revolutionizing the teaching and delivery of health care through virtual-reality systems, telemedicine and teledentistry. The Internet makes global communications possible, increasing access to information around the world, breaking down national and other barriers and accelerating the speed of communication. Among other effects, these new technologies are improving efficiency in patient scheduling, referrals and record keeping. New technologies also are changing traditional methods of disseminating information through scientific journals, books and other documents. Increasing numbers of Americans are using the Internet to seek health information and make health care choices. The frenetic pace of this activity has an important downside: some of the materials disseminated in this way are bound to be of questionable value and accuracy.
The decades ahead will witness advances in science and technology as yet unforeseen. Dentistry will benefit from these advances and must be intimately involved in their progression.

- Strengthen and expand dentistry's and technical research and education capabilities.
- Dental practitioners, including technicians, educators, researchers and policymakers should develop a common definition of evidence based practice;
- The dental profession, in concert with all other interested parties, should identify ways in which to integrate science from systematic research, practitioner expertise, and patient choice to ensure the appropriate application of the latest knowledge into the delivery of care.
- An appropriate system of diagnostic codes should be developed and integrated into the daily practice of dentistry.
- The dental profession should strive to develop the leading repository of the most accurate dental diagnostic and therapeutic databases.

Technology transfer
Clinical practitioners must apply the most appropriate technology to patient care. New diagnostic and treatment methodologies are available that would improve care, but are not swiftly implemented because of cost or concern about the ease of integration into dental practice. Lack of familiarity makes many practitioners hesitant to use new technologies.

- A consortium of representatives of dental practice, research, education, and the dental product industry should be established to ensure the rapid transfer of information regarding new modalities of oral health care to private practitioners.

Integrating dental technique education into other health curriculum
Dental technical is an integral part of total health. A closer collaboration between dental technique and the other health care disciplines (dentistry, material science) is imperative to assure that the public is best served.
All health care professions should convene to discuss how best to incorporate oral health content into their curricula and practices. To do this, the dental profession should be prepared to consider those aspects of the respective health care professions that could be incorporated into dental education and practice. This effort will require the cooperation of health teaching institutions and universities.

- A formal dialogue among all health care professions should be established to develop a plan for greater cooperation and integration of knowledge in medical and dental pre-doctoral education, hospital settings, continuing education programs, and research facilities.
- An inter-disciplinary structure between dental and medical schools should be established to promote close cooperation between health teaching institutions and universities.

Research
There are insufficient numbers of appropriately trained individuals in dental technical research to conduct the planned agenda. Mostly the development is coming from the industry. This is especially true in material and clinical research, on which there is less emphasis in training programs. The allure of lucrative private practice seems to draw students away from considering these career avenues. Stimulate teaching; this may help students to enter careers in research. The profession should monitor the need for researchers and the number of training positions necessary in order to assure that adequate numbers of qualified researchers are available. Without an adequate research workforce, the opportunities for advancement in scientific knowledge will be severely diminished.

The perceived value of dentist-technician interaction should be increased.
The dental profession and the laboratory industry should collaborate to publish a "White paper," including scientific data, to support the position that technicians are necessary and valuable to dentists and patients. Laboratory technicians should be encouraged to hold membership in professional dental societies and specialty organizations. The public should be educated about laboratory technicians through media publications and advertisements; manufacturers should share with dental organizations the responsibility for the costs of this effort. Dental societies and laboratory organizations should be educated regarding how to inform the public about dental technology. Professional organizations should be combined with local technical schools to provide support for equipment purchases, internships and so forth. The patient's can meet with technicians if needed and desired.

Chapter 10

RECOMMENDATIONS I

Possible scenarios of the laboratory industry for the future
In the preceding pages, too much trends have been described, which can have negative and positive impacts on the position of the dental technique branch in the future. Which direction will be taken if for the moment is not yet clear to give? The trends are insufficient for that and the market is still very active. It is evident that the trends can have radical consequences; the possible total effect can be symbolized around 3 scenarios.

1)The disaster scenario
The dental technique branch as an independent industrial branch which will disappear if the existent lack of balance is not removed. This can notably take place if the pressure on price and margin results in a small place by existing as independent. For the moment, this situation seems to be afar, but there certainly are signals indicating that the trend concerning the pressure on price and margin will not dominate.

2)The integration scenario
With a vertical integration between professional groups, dental technique companies become elements of bigger groups of dentists practices (with tasks delegation of dentist and denturist/dental technician), under maintenance of the existence of legal cadres whereby the dentists and prosthesists (are) negotiate(ing) with insurers. Big multidisciplinary groups of practices will eventually survive.

3)The liberalization scenario
With enlargement of the mechanism of the market, in this case with more transparency and ad judgement of the great competences of the dental technique companies, more decisive, professional, companies arise, with entrepreneurship, motivated companies instead of laboratories working with a perspective of professional discipline. With liberalization in the mechanism of the market, the government can cause to the dental technique companies, a real chance to a some sort of form of quality products to address to the consumer, which more or less size can be compensated by their insurances. In the scenario there is a development of a variety of specialties and the size of companies.

To do nothing, a strategy which will eventually announce the first variant, this is not an option for the branch organizations. They will stay and will preserve an eminent, innovative dental technique branch and, create and respect real conditions which are advocated by the other associated parties.

Actions in short-term
In the preceding pages a (big) number of trends which can have an influence on the position of the dental laboratories in the future are discussed. Besides, the possible impact and how

the entrepreneurs and branch organizations have to handle with this trends. Naturally, it is not possible to fix everything in short-term or bring all the solutions to the development. For that, choices are needed. In order to make this choice, a discussion group with different parties of the wide field of the dental technique companies took place. This discussion group was focused on the determination/fixation of the trends with the maximal impact on the branch and on the fixation of the trends which ask in short-term, action and prudence to the entrepreneurs and coordinated organizations. The result of this discussion is here after reproduced.

The most important developments
In the discussion of the group, an order is made to the trends of the list. It was asked to the participants to give an order of the importance of the trends. Then the urgent trend of the moment was given/communicated, which trend has to be applied in short-term.
In the order of importance, there is the recapitulation of the trends which should be taken in short-term, as follows;

1) outsourcing
2) CAD/CAM - technology
3) Collaboration and scaling-up
4) Collaboration and vertical scaling-up
5) Changing costumer (type of products/demography)
6) Margin under pressure
7) Free competition and the position of the dental technicians
8) Transparency (more info in price and quality)
9) New care/health system (financing)
10) Specializations/functions in the dental technique

This order is recognizable in the size of influence ability. With the first trends, companies have more direct influence. With the other trends, which are also important, people have less influence, just like for example the public prudence with regard to the financing of the care and the margins are staying under the pressure of the other parties.

The first five trends which have great impact on the functioning of the branch and which have to be applied in short-term, are in the second central paragraph. Hereby, the actions to be applied are individually described. This does not say that the other trends are not important, but they have less priority to be described. Hereby, it is also mentioned that transparency (more info about price and quality) also is taken under outsourcing because the price fixing plays an important role in the (sub) contracting problems.

Trends to be started immediately
The five most important trends which have big impact in the functioning/working of the branch and on which it will be worked in short-term are:

- Outsourcing
- CAD/CAM - technology
- Collaboration and scaling-up in the sector (horizontal)
- Scale expansion and vertical collaboration

- Changing costumer (type of products/demography)

Before the trends, the actions to apply eventually are described. The above-mentioned solutions are issue of the discussions of the group. Before the completeness clearness, the trend is once again shortly described. With the solutions, there is a distinction between the activities which can be shown by the entrepreneurs and the activities which concern more the area of the branch organizations.

Actions
The following actions are mentioned, distinguished by role player in the market:

Branch organizations
The item "outsourcing" itself
- Make an overview of the outsourcing: how big is outsourcing how it is composed, and on which specific outsourcing is it concerned?

More transparency
- The initiation of the transparency with the branch organizations (price fixing, quality, etc)
- Definition of various qualities: this makes it possible to deliver different qualities for different prices, by which the buyer can make a good consideration.
- Explanation of Why the technique costs are different
- Appliance of the European minimum quality norm.
- Introduction of quality hallmark.
- Dentist has to have knowledge about the social consequences by choosing cheap products of the foreign countries.

Improving of the position concerning the competition
- Cad cam stimulation, with this, the position of the dental technique branch can compete with the production of foreign countries concerning the price and the quality.

Remaining
- The collaboration with other branch organizations in order to tread good negotiation partners.

Dental laboratories
Enter them selves into the outsourcing
- Independent putting out into the foreign countries in order to ameliorate the cost price to press. Besides the offer can have consequence on having bigger demand of low-budget products.
- Catching of good collaborations with other dental technique companies in order to form a jointed party in the market, and to buy cheap, not expensive from foreign countries.

Price fixing

- Reduction of the work in foreign countries and also pass on the higher prices to the patient (control upon this for example with the authority which anticipates that the reduction of dentist stays/stops). Or the technique is not settled via dentist, but directly.
- Make a good cost price calculation.

Investigate the item collaboration

- The formation of chains (collaboration) is the best protection against/of the outsourcing (thus outsourcing partly in foreign countries) the technique price can be concurred with the products of the foreign countries.
- Collaboration with other mouth care companies (vertical), strike together: the all mouth care under “a roof”, so that the activities of every part can be successive.

Quality product/service

- Focus on high technological work: this is too complicated to communicate with the foreign countries and it makes the contracting out impossible.
- Too much attention to the service and quality: mostly there are more important than the price, for the costumer.
- Enlightenment of he dentist and enlargement of the services.
- The price is important for the costumer if only it makes differences. Taking care of the transparency: price-quality relationship.

Remaining

- Dentist has to be free concerning choices for the dental technique.
- Dentist has to enlighten the patients concerning the possibilities of the home and the abroad products.
- Dentist/insurer has to enlighten the costumer over technique costs; with this a good balance can be made; also taking care of the making of a technique invoice with mention to the sub-contractor ship(s).
- Insurers: ask under invoice concerning dental technique.
- Insurers: ask the prove after coming of the European directive of medical expedient.
- Education: updating of the instruction programs and engagement of new technologies (CAD/CAM), until the labour force is ready to work with new technologies which make possible to produce efficient goods/products, and the concurrency with foreign countries can be caught.

Summarize

- The dentist / oral surgeon will make the choice. Or the dental technician as a colleague, just around the corner, or import from countries with a lower standard of living (grey market) with al the disadvantages;
- The insurance companies will force dental laboratories to work in a more economical way and if applicable: the grey market;
- There will be more medical (dental) tourism;
- The influence of digitalization will be bigger;
- Less dental technicians, with a higher qualification. Are we prepared?

Chapter 11

RECOMANDATION II

Future education dental technician

It's clear that the profession of the traditional dental technician will change very rapidly. Which choices are made, which developments are winning, the future will be different.

The politic have chosen for less oral surgeons instead of dentists, the oral hygienists will be (professional bachelor) and there are plans for a crown and bridge clinical technician. Further we have the clinical dental technician for removable dentures. Both technicians are working under responsibility of the dentist. Apart from this we have the assistances on very different levels and the denturists. The possible loss of quality is considerably and it's a waist of money and energy that the education of such a small branch in a small country is divided over several schools.
The outsourcing of dental work and digitalisation will grow and the more basic work will disappear.

And, as mention before: dentistry is a jungle for the patient and concerning quality (control): it will be more unclear.

After the extended literature review and conversations is my proposal is to start a new training for dental technicians.

For the basic jobs it's enough to keep the same system. One day per week to school (IVT, Nieuwegein) and four day's per week as an employee in a dental laboratory, dentist practice or in a denturist practice, guided by the IVT. Three years must be sufficient. The level of entrance can be VMBO.

After that the student can go on with the training on bachelor level.

For students with a higher entrance level (HAVO/VWO) is there a possibility to start directly.

The other continuation studies (Master / PhD) can be according the Swedish system.

The complete program must be done in cooperation with the three universities and also the present school of denturists (Hogeschool Utrecht) must be part of this cooperation. The technical part of the study can be offered by the IVT. Both schools are located in the centre of Holland, so logistic it makes sense.

The cooperation will make the cooperation between the different dental professionals better; it will improve the understanding of each others work, and last but not least: the

education of the (clinical) dental technician is connected with the reality and necessary demands of the profession in the near future.

DEVELOPMENT CURRICULUM DENTAL TECHNICIAN

Starting points in general:

- the knowledge and proficiency needed to work as a dental technician,
- the knowledge and proficiency needed to assemble the different kinds of appliances used in dental treatment and the ability to judge and evaluate the quality of a dental technicians work,
- a knowledge of dental materials and their influence in the oral cavity and on the environment, general principles of odontological treatment, stomatological anatomy, physiology and hygiene,
- insight into his or her professional role in preparation for cooperation with other professionals,
- The ability to safeguard and respect the patient's needs within the framework of his or her professional activities.
- Be able to tackle the variation in skills between dentists and dental technicians with greater competence in order to critically assess new products and processes based on scientific information.
- Depending of the job en education level: able to work alone and in a team.
- Have sufficient knowledge in dental material science to be able to follow contemporary research in this field.
- Be able to search, elaborate on and interpret scientific information.
- Be able to take responsibility for his/her postgraduate training and competence development.
- be able to make ethical priorities in areas such as the use of new methods/materials and to follow the rapid development of new materials and production processes
- Have knowledge of new processing means in the field of dental technology.
- Have good communicative abilities verbally and in writing and comprehension of the clinical processes and the patient situation.
- Have good awareness of how quality-control and quality assurance practices are organized and carried out.
- Respect the integrity of other people and have an understanding for their emotions and life situation.
- Have increased knowledge and understanding of the demands that society makes on the dental health care organizations and their actors.
- Develop the practical skills on the level of the specific study.

STUDY PROGRAMME IN DENTAL TECHNOLOGY - ACADEMIC CAREER

EU Harmonization (Bologna process)
BSc – 3 yrs full-time (4-5 yrs part-time)
Master – 2 yrs
PhD – 3 yrs

Programme information
3 years, 180 ECTS credits, 20 places every autumn semester. Dental technicians work in close co-operation with the rest of the dental healthcare team. The aim is to provide patients with high-quality replacements for their missing or damaged teeth. A dental technician should therefore be dexterous and have artistic skills for colour, form and aesthetics. Becoming a dental technician involves six semesters of study. The programme is conducted at Dental Technique Academy in Nieuwegein, the Hogeschool Utrecht and the university of Nijmegen. The programme is based on a variety of teaching and learning formats, including lectures, seminars, demonstrations and practical tasks. Extramural training, in the form of workplace training in dental laboratories, comprises 27 weeks of the programme. The workplace training takes place in external dental laboratory. During the programme, the student is also required to undertake a special assignment or project, equivalent to 15 ECTS credits. Each course is concluded with an examination designed to test and link theoretical and practical knowledge. During the last year there may be opportunities to undertake the extramural training abroad. Throughout the study programme, students are trained in communication skills with other dental professionals in order to create a basis for co-operation. After passing the undergraduate examination, dental technicians may continue with graduate studies.

Educational goals
The aim of the programme is to provide students with the necessary knowledge, skills and competence to work in any area connected with dental technology.

Language of instruction
The language of instruction is Dutch. The course literature is in Dutch, German and English.

Qualification awarded
On successful completion of the three years of full-time study programme, students are awarded a Bachelor of Science and fulfil the requirements for a Bachelor of Medical Science in Dental Technology.

Further studies
Dental technicians may also undertake research to obtain the degree of Doctor of Medical Science, a postgraduate degree at Ph.D. level, requiring presentation and successful public defence of a thesis. This postgraduate degree usually takes about 4 years of full-time study.

Professional goals
The profession of dental technician is similar to precision mechanics, and requires artistic skills in colour, form and aesthetics. The majority of dental technicians work in the private sector, either self-employed or as employees. A dental technician produces crowns, bridges and removable prostheses at the request of dentists and in consultation with them. The

dental technician does not work directly with patients but in a dental laboratory. The profession of dental technician is similar to precision mechanics. The discipline of dental technology is undergoing rapid and extensive technical development, especially involving CAD/CAM technology and implant treatment.

Semester	Course	ECTS Credits
1	Introductory	4.5
	Dental Materials 1	6
	Prosthodontics 1	10
	Prosthodontics 1	9,5
2	Dental Materials 2	4.5
	Fixed Prosthodontics 2	10.5
	Removable Prosthodontics 2	7.5
	Oral Histology/Pathology	3
	Behavioural Science	3
	Orthodontics	1.5
3	Dental Materials 3	4,5
	Fixed Prosthodontics 3	18
	Removable Prosthodontics 3	7.5
4	Computerised Oral Rehabilitation	4.5
	Workplace Training 1	25.5
5	Implants 1	4,5
	Removable Prosthodontics 4	3
	Degree Project	7.5
	Workplace Training 2	15
6	Fixed Prosthodontics 4	10.5
	Implants 2	7.5
	Removable Prosthodontics 5	4.5
	Degree Project	7.5

3 YEARS: BACHELOR OF MEDICAL SCIENCE IN DENTAL TECHNOLOGY

180 ECTS credits.

Curriculum

Dental Materials Science	Total 9 weeks
Fixed Prosthodontics	Total 33 weeks
Removable Prosthodontics	Total 22 weeks
Implants and Computerised Oral Rehabilitation	Total 10 weeks
Workplace training (2nd and 3rd yr)	Total 27 weeks
Degree Project (3rd yr)	Total 10 weeks

The main courses run parallel with student's dentistry.

Parallel courses in dental materials, fixed and removable prosthodontics:

- to simulate the normal work situation
- the students have to train planning
- the students have to keep up all courses all time

Fixed Prosthodontics

- 1st year:
  - Teeth anatomy, full crowns, posts, inlays
  - Metaloceramic crowns, temporary bridges
- 2nd year
  - All ceramic crowns
  - Bridges and soldering
- 3rd year
  - Full lower with 4 fixtures
  - Single implant
  - 2 fixtures and bridge on top
  - Large metaloceramic bridges

Removable Prosthodontics

- 1st year
  - Upper denture, occlusal splints
  - Lower denture, full denture, relinings
- 2nd year
  - Full dentures, partial denture with clasps
- 3rd year
  - Partial denture with CoCr framework
  - Duplicate denture and post retained lower denture

Workplace training:

At universities, Hogeschool Utrecht and IVT
Stages: dental laboratories, dental & denturists practices in the Netherlands.

Scientific part

- 1st year, Dental Materials
  - Impression materials and stone: Expansion and contraction

- 1st year, Dental Materials II
  - Strength of dental materials: Acrylics, metals and ceramics

  Three-point flexure test, uniaxial bending test, diametric compression test

- 2nd year, Dental Materials III
  - Bonding characteristics, shear strength
  - Surface energy and wetting characteristics
  - Abrasion

Degree Project
3rd year, ten weeks full time

- Experimental, qualitative or literature studies
- Written report and oral presentation
- Prepare and act as opponent for fellow students

Examples of subjects:

- Laser welding and soldering of cobalt chromium alloys: strength characterisation;

- Effect of zirconium-oxide ceramic surface treatments on the bond strength to adhesive resin;

- Implant treatment: A comparison of delayed versus immediate loading and description of various technical solutions;

- Inter professional cooperation
  In the past and present;

- In the professional life, the cooperation within the dental team is essential for high quality dental care;

- Digital applications.

Inter professional part
1st year, Introduction:

- Ethics
- Communication including cultural aspects
- My clinical self - Professional identity:
- Introduction of how to meet the patient,
  to the oral cavity and clinical hygiene.
  Impression and casts

1st year, fixed Prosthodontics

- Students demonstrates and guides dental students (3rd year) in making definitive casts

2nd year, Fixed Prosthodontics:

- Pre clinical collaboration with dental students (3rd year)

2nd and 3rd year, Work place training:

- Clinical collaboration with dental students (3rd and 4th year)

POSSIBLE MASTER - PHD SUBJECTS

Computer aided analysis in dental surface digitization

- 3D applications in general- how well do they work? Precision and accuracy?
- Contact scanner vs. laser scanner
- CT and other digitization devices
- How will the geometry of an object change during the manufacturing process?
- Quality assurance
- Rapid Prototyping
- New CAD/CAM applications as removable dentures

How do dentists, denturists and technicians communicate?

The impact of communication between dentists and dental Technicians on the quality of prosthetic restorations (design, aesthetics, function)

Carbon fibre reinforced polymer materials for implant supported prostheses

Evaluation of two different polymer matrices, fibre treatment and fibre loading in relation to mechanical, thermal, biochemical and bonding properties.

Simulating periodontal effects in dental implants

Damping of implants.

Removable dentures

Existing techniques and possible digital applications.

Appendix I

RESEARCH

Educational needs and status of the Dutch (clinical) dental technicians and Denturists

Summarized

- The education and training system for (clinical) dental technicians and denturists in the Netherlands is on a high level, but there is a lack of co-operation and tuning with each other, the universities and branch organisations;
- The advent of mandatory Continuing Professional Development (CPD) following registration is advised. So far it is difficult in the Netherlands to set up because of a lack of co-operation and tuning between the schools;
- The shortage of funding for CPD poses a problem for dental technicians;
- There must be a possibility, according the Swedish system, to study dental technology on an academic level;
- Rates of remuneration are inadequate and unlikely to encourage people in to the profession in the future;
- The changed political view (less dentists / oral surgeons) make it necessarily to "upgrade" the profession of the Dutch (clinical) dental technicians and Denturists;
- Also, the average age of dental technicians is relative high. Togheter with the fact that labour intensive work will be made more and more in countries with a lower level of income and the influence of computers and Cad/Cam, demanding another, better trained, technician.

Introduction
The oral health, function and appearance of patients receiving modern-day dental technics are dependent upon the clinical skills of those involved in the provision of treatment and the technical prowess of the dental technician. Dental technician education and training has changed over the last 25 years, however, many aspects of their position in terms of status and professional profile within the dental team have unfortunately remained the same.

Historically, these professionals were known as dental mechanics and no restriction was placed on their capacity to undertake duties associated with dental technology, whether trained or not. Dental technician are not registrated and a diploma is not necessarily. Not for employees, even not for owners of laboratory.

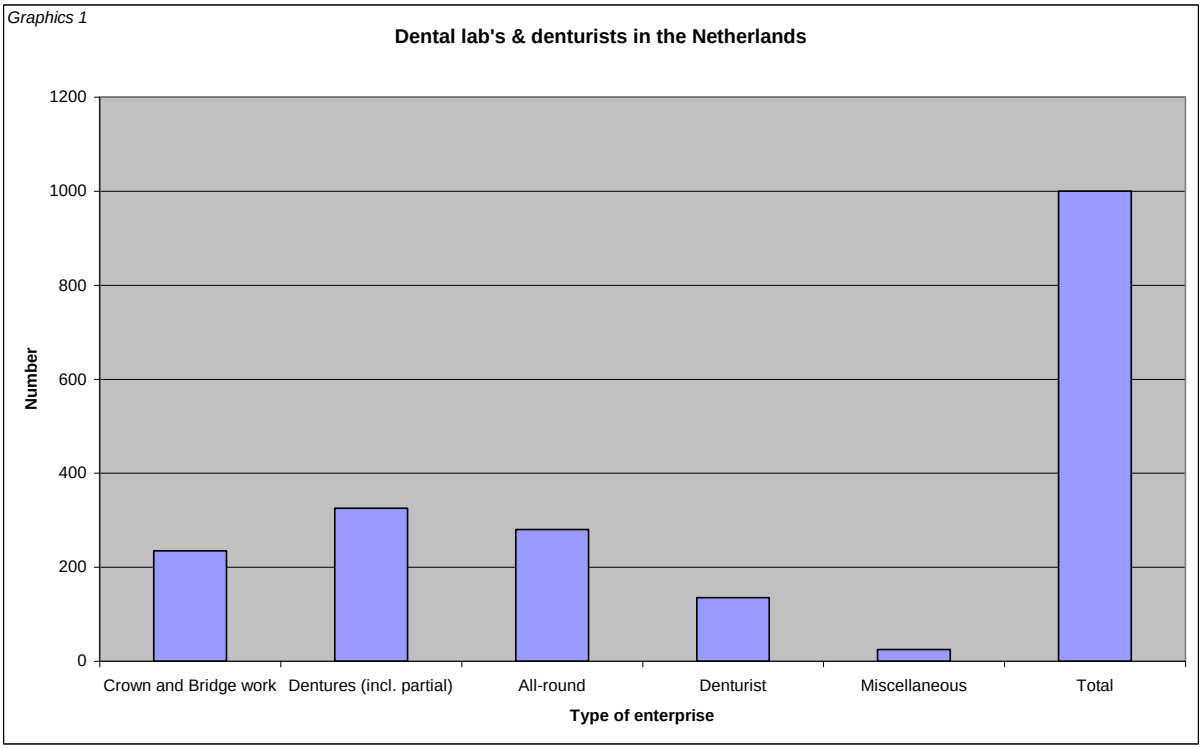
Currently, education in dental technology is available in part-time settings and offers Certificates and Diploma's. Only one city in the Netherlands offer such training. In Nieuwegein is the Instituut Vakopleiding Tandtechniek (IVT). The clinical dental technicians are trained in a 10 weeks program by the IVT and the University of Nijmegen. Denturist get there diploma in Hogeschool Utrecht (HU) after a part-time training of 4 years.

Methods and materials
Used are the information of the Chambers of commerce, the data base of the sales department of ENTA B.V. (more than 400 customers in the Netherlands).
After the lliterature review, interviews and conversations with university professors and teachers of the school for dental technicians, denturists and dentists a questionnaire was developed en send to: 25 dental technicians – response 17, 15 denturists – response 13 and 50 laboratory owners – response 44.

Enclosed the results. As far as compatible – there are no relevant differences with the research reports of EIM, in assignment for Hoofd Bedrijfschap Ambachten (HBA).

GRAPHICS

Graphics 1



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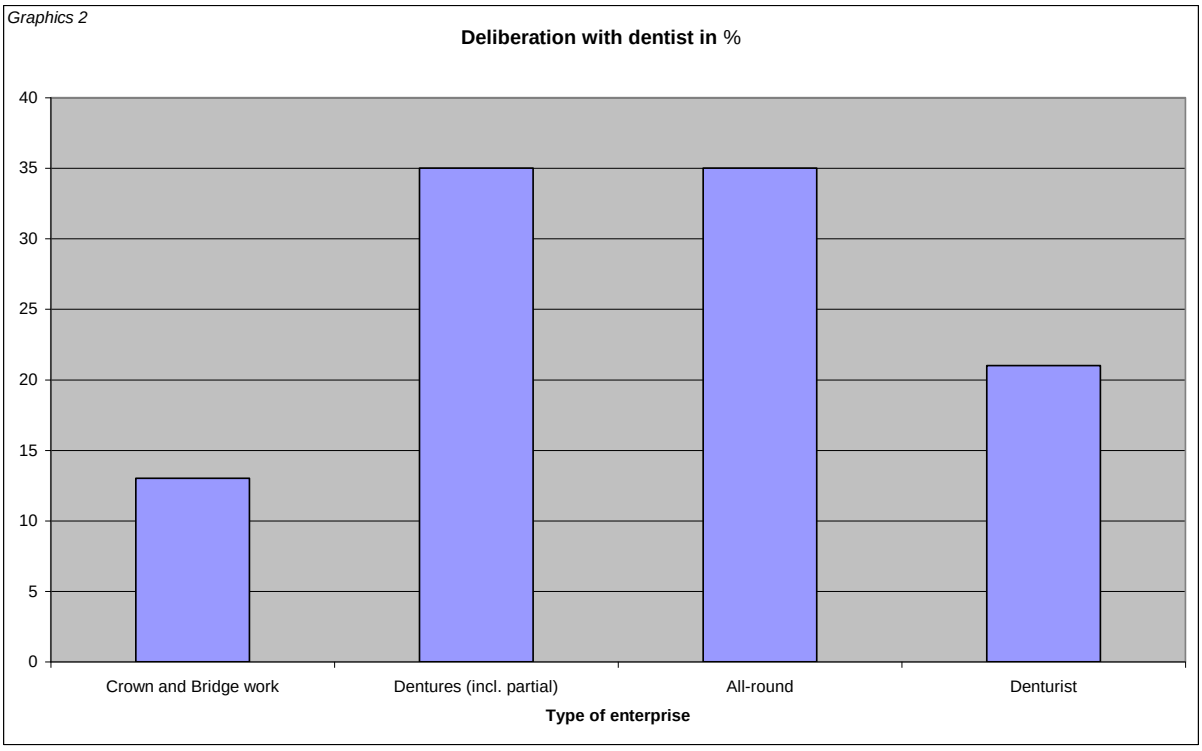
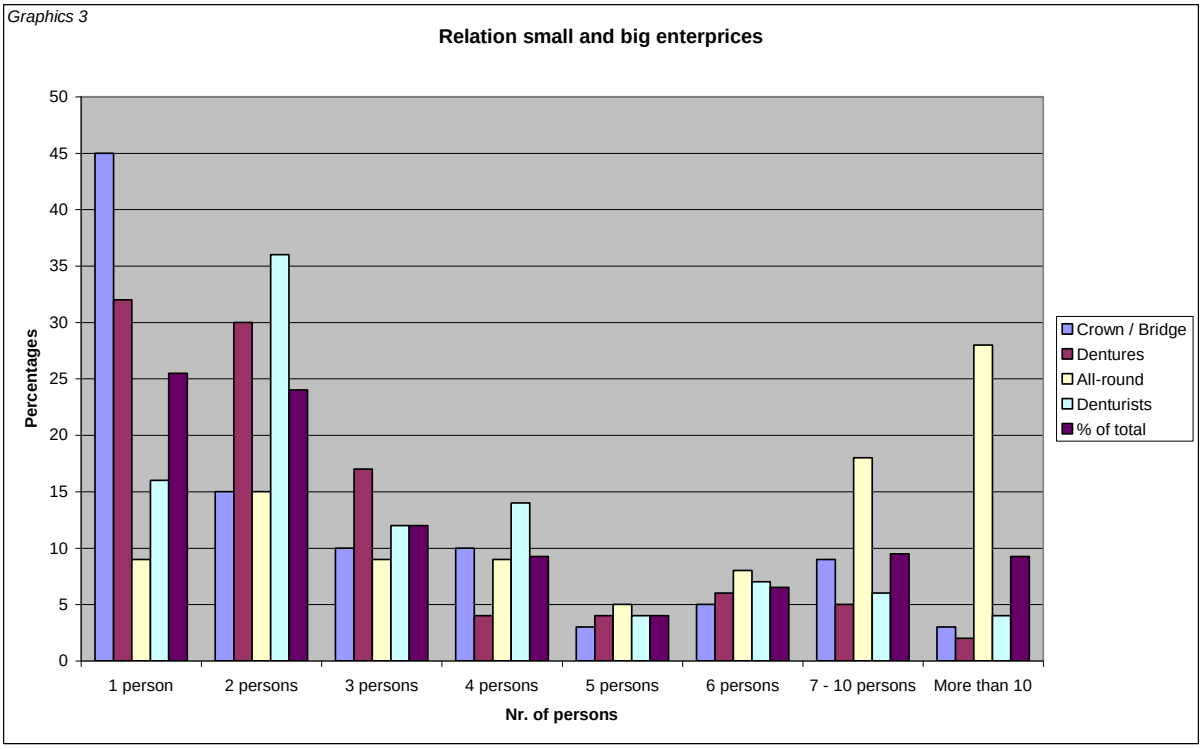


Graphics 3



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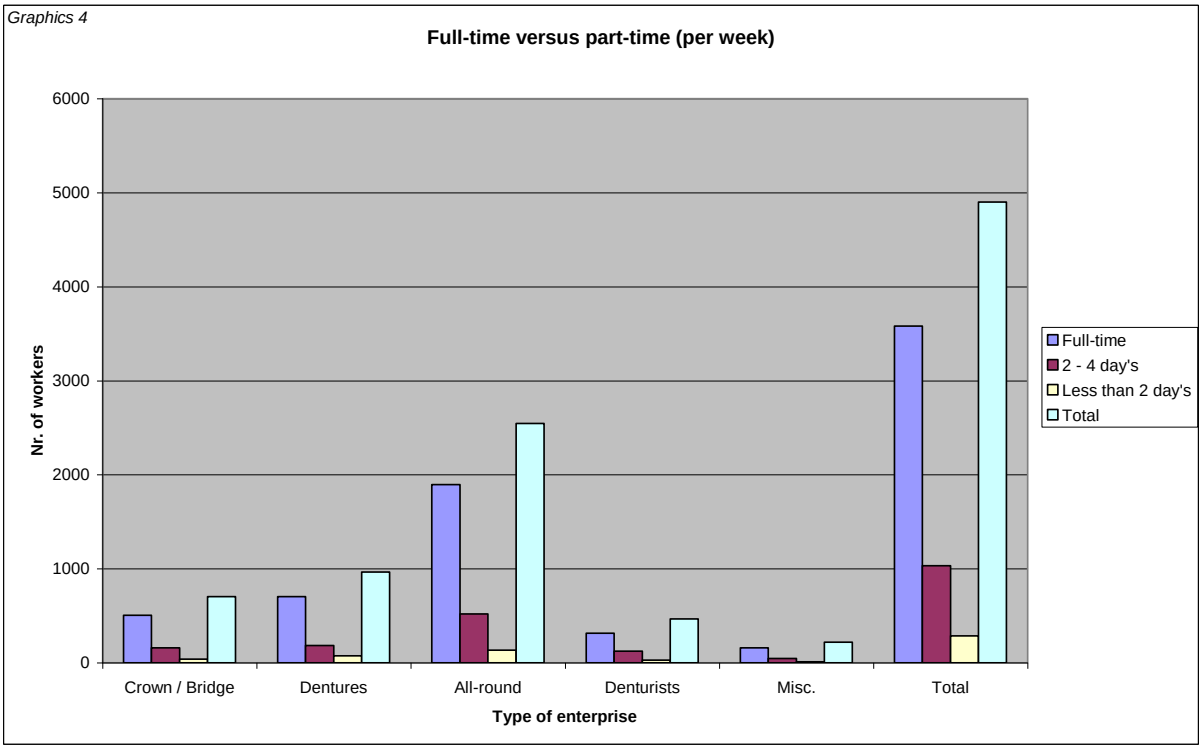
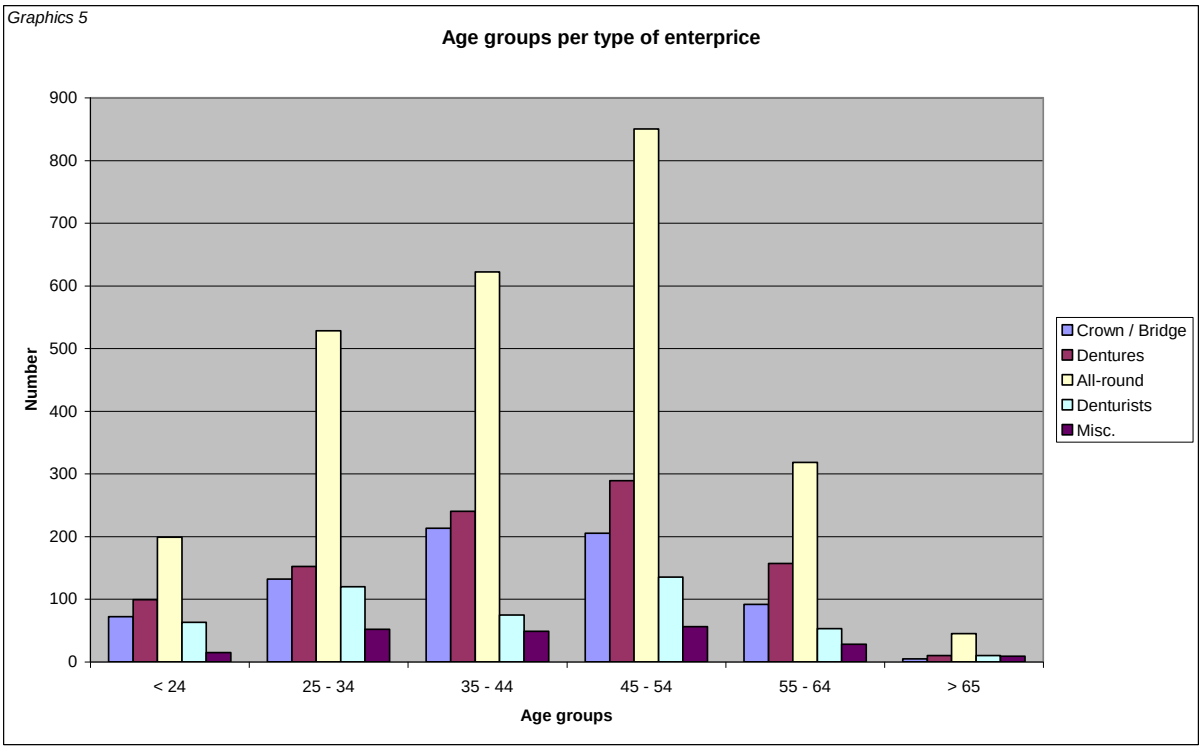
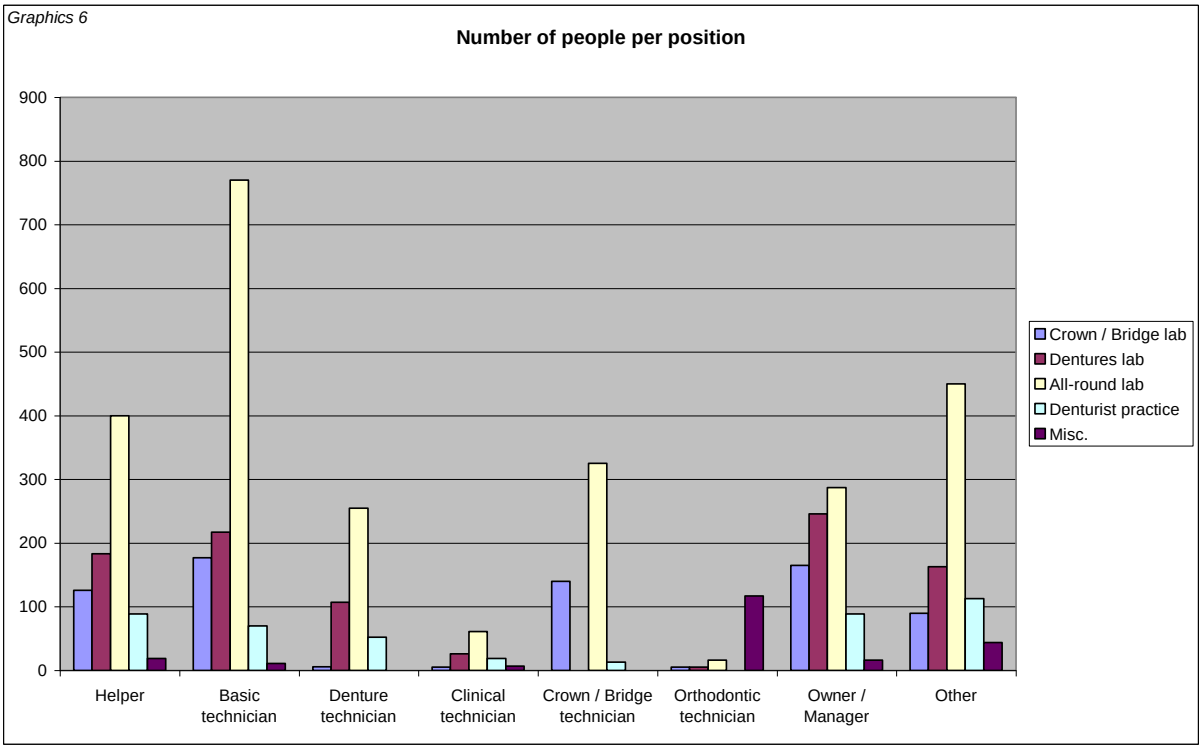


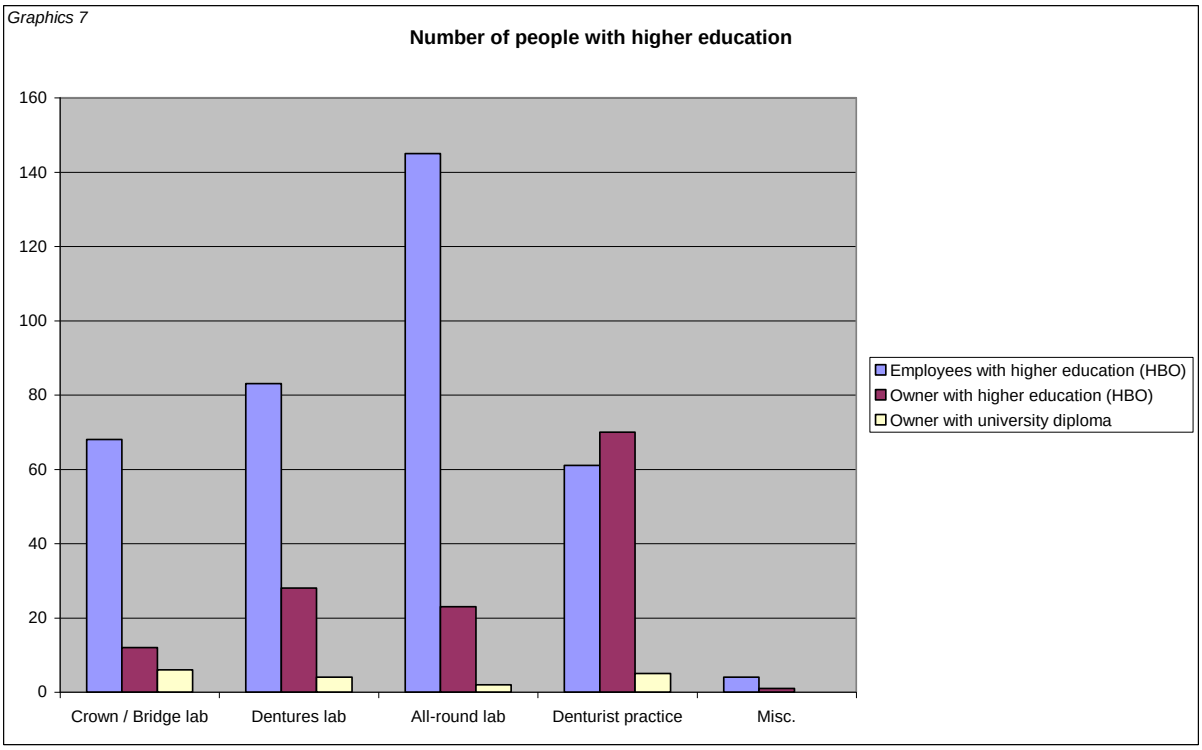
Graphics 5



Graphics 6



Graphics 7


Number of people with higher education
160
140
120
100
80
60
40
20
0
Crown / Bridge lab
Dentures lab
All-round lab
Denturist practice
Misc.
Employees with higher education (HBO)
Owner with higher education (HBO)
Owner with university diploma

Appendix II

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Appendix III

CONSULTED WEBSITES

3D LAB SERVICE GMBH
http://www.3dlabservice.de

3SHAPE
http://www.3shape.com

ACTA, ACADEMISCH CENTRUM TANDHEELKUNDE AMSTERDAM
http://www.acta.nl

ADA, American Dental Association
http://www.ada.org

ČESKÉ ZDRAVOTNICKÉ FÓRUM
http://www.czf.cz

COSTA RICA
http://www.edenia.com/medical/anfuba.htm
http://www.cocori.com/library/life/med1.htm

DENTAL LABORATORIES ASSOCIATION
http://www.dla.org.uk/news/items/chicago_apr06.php

DENTAL PRODUCTS REPORT
http://www.dentalproductsreport.com

GEORGE BROWN COLLEGE
http://www.georgebrown.ca

GRIFFITH UNIVERSITY
www.griffith.edu.au

HEALTHYNEWAGE.COM BLOG
http://www.healthynewage.com/2hi.html

HOGESCHOOL UTRECHT
http://www.hu.nl/HUInternational

HONGARIJE
http://www.kreativdent.co.uk/

INDENT, VERENIGING VAN NEDERLANDSE INDUSTRIE VOOR DENTALE PRODUCTEN
http://www.indent.nl

INTERNATIONAL FEDERATION OF DENTURISTS (IFD)
http://www.international-denturist.org

KAROLINSKA INSTITUUT
http://ki.se

KHALAF, SG
http://phoenicia.org. 2005

KAMERVRAGEN EN WET- EN REGELGEVING
http://www.overheid.nl

KUN, KATHOLIEKE UNIVERSITEIT NIJMEGEN
http://www.kun.nl

MARKETPLACE
http://marketplace.dentalproductsreport.com

NEDERLANDSE VERENIGING VOOR PARODONTOLOGIE
http://www.nvvp.org

NMT, NEDERLANDSE MAATSCHAPPIJ TOT BEVORDERING DER TANDHEELKUNDE
http://www.nmt.nl

NORTHERN ALBERTA INSTITUTE OF TECHNOLOGY
http://www.nait.ca

NTVT, NEDERLANDS TIJDSCHRIFT VOOR TANDHEELKUNDE
http://www.ntvt.nl/

RUG, RIJKSUNIVERSITEIT GRONINGEN FACULTEIT TANDHEELKUNDE
http://tandheelkunde.med.rug.nl

RIJKSINSTITUUT VOOR VOLKSGEZONDHEID EN MILIEU (RIVM)
http://www.rivm.nl/

SIRONA
http://www.sirona.com

SVGB, STICHTING VAKOPLEIDING GEZONDHEIDSTECHNISCHE BEROEPEN
http://www.svgb.nl

TANDARTSINFO.
http://www.tandartsinfo.net

TURKIJE
http://www.tandreizen.nl

UMEÅ UNIVERSITET, SWEDEN
http://www.odont.umu.se/utbildning/ttekn/

UNIVERSITY OF MARYLAND, BALTIMORE
http://www.dental.umaryland.edu

USA TODAY
http://www.usatoday.com/travel/news/2005-07-28-dental-tourism_x.htm

VAARTJES, JW
Geschiedenis van de orale implantaten
http://www.tandarts.nl

VERENIGING VAN TANDPROTHETICI
http://www.ont.nl

VGT. NEDERLANDSE VERENIGING VAN GROOTHANDELAREN IN DE TANDHEELKUNDIGE BRANCHE
http://www.vgt.nl

VITA ZAHNFABRIK - H. RAUTER GMBH & CO. KG
http://www.vita-zahnfabrik.com

VLHT, VERENIGING VAN LABORATORIUMHOUDENDE TANDTECHNICI
http://www.vlht.nl

WEBSITE VAN ZORGVERZEKERAARS NEDERLAND
http://www.zn.nl