THE CURRENT TRENDS OF DENTAL LABORATORY TECHNOLOGY

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CHAPTER I

INTRODUCTION

The National Security Act of 1947 established the Department of Defense (DOD) and created the United States Air Force (USAF) as a separate branch of the Armed Forces. The Air Force Medical and Dental Corps hired civilian employees to provide certain critical medical and dental functions, including the duties of dental laboratory technicians. The USAF identified the need to train the enlisted military members to become dental laboratory technicians. In 1952, the first formalized School of Dental Laboratory Technology was established at Gunter Air Force Base (AFB) in Alabama.

After graduation from the technical school, the recent graduates were sent to bases having dental laboratory facilities and were taught additional skills based on the needs of local dental clinics, not the needs of the patient population.

> Care was provided according to location of trained resources and not the needs of the patient (Huff, 1984, attachment 2).

Rudimentary on the job training (OJT) programs were implemented but did not take into consideration new techniques, advancing technologies and ever increasing state

of the art materials and equipment (Ring, 1985).

As new equipment, materials, theories and techniques were introduced into the career field, it was apparent that additional training and continuing education had to be conducted.

> Our technology got ahead of our education. We can take the mouth apart, but we can't properly put it back together again (Elkins, 1981, p. 34).

The OJT and continuing education programs were limited. There were no guidelines concerning who would be trained, what was to be taught and what prerequisite skills should be mastered (Huff, 1984).

The field of dental laboratory technology in the USAF progressed from a handful of members to more than 600 specialists. Technology evolved from being a manual skill to a fine art and science (Klien, 1984). Formalized schooling and supplemental training have been moved from Gunter AFB, Alabama, to their present location at Sheppard AFB in Texas.

Training is no longer conducted on a random or individual basis, but is based on information gathered from an Occupational Survey Report (OSR). This report was developed, analyzed, written and validated by the USAF Occupational Measurement Center, and sent to Air Force dental laboratory technicians world-wide.

Statement of the Problem

The problem with which this study dealt was the

insufficiency of information relative to the current trends of prosthetic dentistry in the field of dental laboratory technology in the USAF.

Need for the Study

There have been several studies conducted on the trends of civilian dental laboratory technology. However, there has been little or no research done in the field of dental laboratory technology in the USAF. This study could contribute toward creating a continuing education and training program for all USAF dental laboratory technicians.

Purpose of the Study

The purpose of this study was to survey Air Force dental laboratory technicians to determine the current trends of prosthetic dentistry in the dental laboratory career field in the USAF.

This study sought to answer the following questions:

1. Is there an increase in the use of gold base and gold free metal alloys in the fabrication of full metal crowns and bridges?

2. Is there an increase in the use of gold base and gold free metal alloys in the fabrication of dental ceramics?

3. Is there an increase in the number of complete and overdentures fabricated?

Limitations of the Study

Limitations of the study were:

1. Only active duty enlisted members with the USAF Specialty Code (AFSC) of 982X0, Dental Laboratory Technology, were surveyed.

2. Only four large continental United States (CONUS) USAF bases were surveyed and were representative of other AFB dental laboratories world-wide.

3. Only graduates from the basic UASF dental laboratory school were surveyed.

4. Only a questionnaire was used to measure the stated objective.

Assumptions

The following assumption was made:

1. The study participants responded to the questionnaire truthfully.

Definitions

The following terms have been defined for use in this study:

1. Air Force Specialty Code (AFSC) - A five-digit numerical code assigning an individual an Air Force job.

2. Alginate - An irreversible type of hydrocolloid made with salts of alginic acid.

3. Alloy - A mixture of two or more pure metals.

4. Area Dental Laboratory (ADL) - Large USAF dental

laboratory that specializes in the manufacturing and dispensing of prosthodontic devices.

5. Base Dental Laboratory (BDL) - USAF satellite laboratory that sends out requests for and receives back prosthetic devices from the ADL.

6. Base Metal - A metal other than noble metals.

7. Bridge - (see Crown and Fixed Partial Denture)

8. Complete Denture - A dental prosthesis that replaces all natural teeth and associated oral structures.

9. Crown and Fixed Partial Denture - A fixed dental prosthesis that restores one or more of the missing natural teeth.

10. Dental Laboratory Technician - One who fabricates artificial prosthetic appliances.

11. Dental Laboratory Technology - The art and science of creating artificial teeth, bone, and surrounding tissue.

12. Gold - A noble or precious metal.

13. Gold Alloy - Gold combined with other metals.

14. Impression - A negative reproduction of a given area.

15. Noble Metal - A metal not readily oxidized at ordinary temperatures.

16. Overdentures - Dentures that are supported by clinically prepared tooth surfaces.

17. Oxidize - To combine with oxygen.

18. Precious Metal - A metal highly resistant to

corrosion and oxidation.

19. Prosthetic Dentistry - The dental science which restores the oral health by replacing missing teeth and structures with artificial appliances.

20. Removable Partial Dentures (RPD) - Removable appliances that replace one or more missing teeth.

21. Semiprecious metals - Metals that contain trace or minute quantities of noble metals.

Organization of the Study

Chapter I introduces the study by presenting the problem, the need for the study, the purpose of the study, objectives to be addressed, limitations of the study, assumptions and definitions of terms. Chapter II includes a review of literature concerning past, current, and projected trends in the field of dental laboratory technology. Chapter III reports the procedures utilized in this study, including the selection of subjects, data gathering instrument, collection of the data, and analysis of the data. Chapter IV presents the findings of the study while Chapter V contains the summary, conclusions, and recommendations for further use and research.

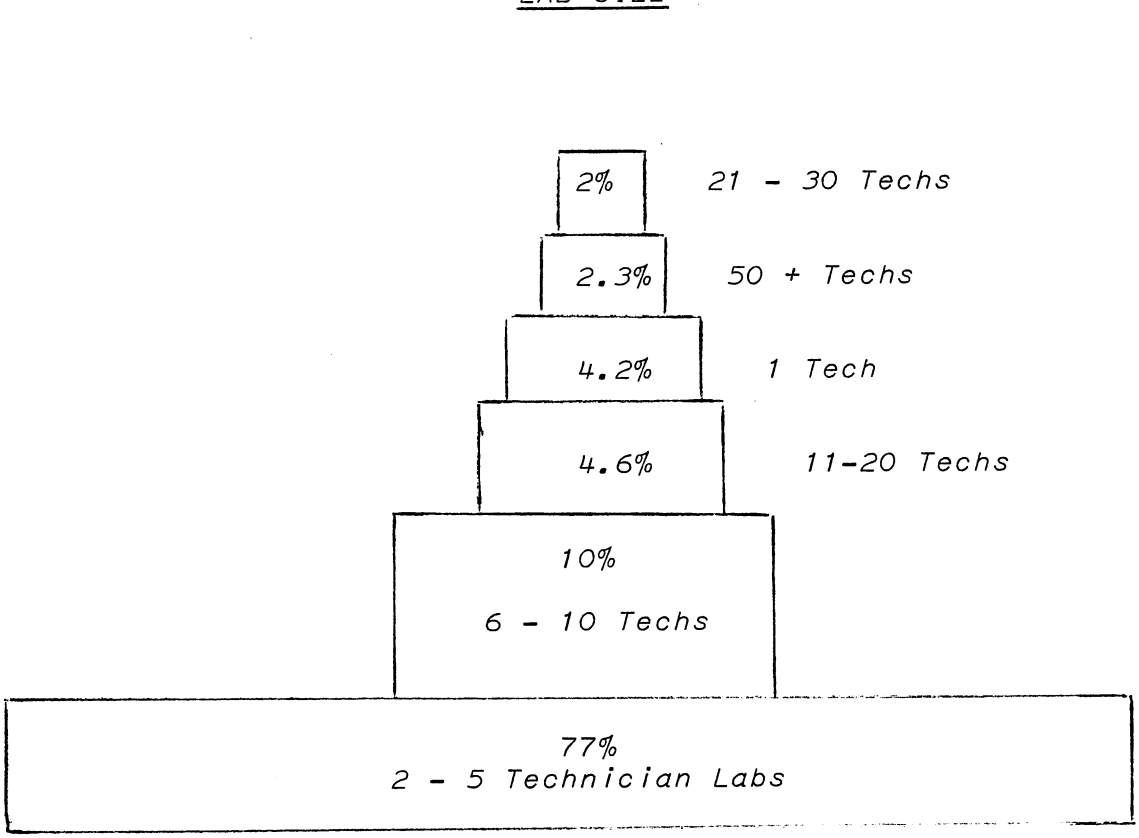
CHAPTER II

REVIEW OF THE LITERATURE

This chapter reviews the literature in the following areas: Data describing the past, current, and projected trends and future needs in the civilian field of dental laboratory technology. Included are statistics, graphs, rationale, costs, and types of metal alloys currently in use.

Projected Trends and Future Needs of Dental Laboratory Technology

One of the most extensive research studies concerning the trends and needs in the dental laboratory was conducted jointly by Dental Laboratory Review and the Massachusetts Institute of Technology (DLR-MIT) at the end of 1983 (Overmyer, see Wong, 1984). According to this 1983 study, there were over 24 million units of crown and bridge services provided by dentists in the United States. This figure is representative of approximately 35% of the more than $20 billion national expenditure for dental care (Wong, 1984). Additionally, this study shows that dental laboratories were employing fewer technicians. More than 90% of all dental laboratories (Figure 1) have fewer than



Source: Tony Wong. "Industry Survey Points to Rosy Future," Dental Laboratory Review (September, 1984, p. 10.)

Figure 1. Ninety Percent of All Labs Have Fewer Than Ten Technicians Employed

ten technicians employed. Furthermore, almost half (46%) of the nation's dental laboratories each work for fewer than ten dentists.

The National Center for Health Statistics shows a 26% increase in dentists from 96,000 in 1970 to 121,000 in 1980. During this same period of time, dental laboratory technicians increased 71% from 30,670 in 1970 to 52,600 in 1980. The ratio of technicians to dentists has increased from one technician to every five dentists in 1970 to one technician for every two dentists in 1980 (Figure 2). The 1,657 laboratory owners responding to the DLT-MIT survey indicated that 60 percent of the industry is offering crown and bridge service (Figure 3) and 36% indicated an increase was noticed in the number of requests for crown and bridge.

Full metal crown and fixed partial denture structures and substructures in the past have used primarily a gold based precious alloy (Figure 4). Recently, however, considerable research has been conducted on nonprecious alloys and there is an indication that these metals will produce a clinically acceptable prosthesis (Gettleman, 1980). It was apparent that more laboratories are moving toward this less expensive, non-noble alloy based on the DLR-MIT survey findings (Figure 5).

There is much experimentation currently conducted with semiprecious palladium-based alloys that are cheaper than gold, but more expensive than its nonprecious counterpart (McLean, 1984). There are certain advantages and disadvantages of gold alloys (Figure 6) as are there ad-

ESTIMATED NUMBER OF ACTIVE DENTAL LABORATORY TECHNICIANS AND NUMBER PER 100 ACTIVE DENTISTS:

SELECTED YEARS 1950 - 1982

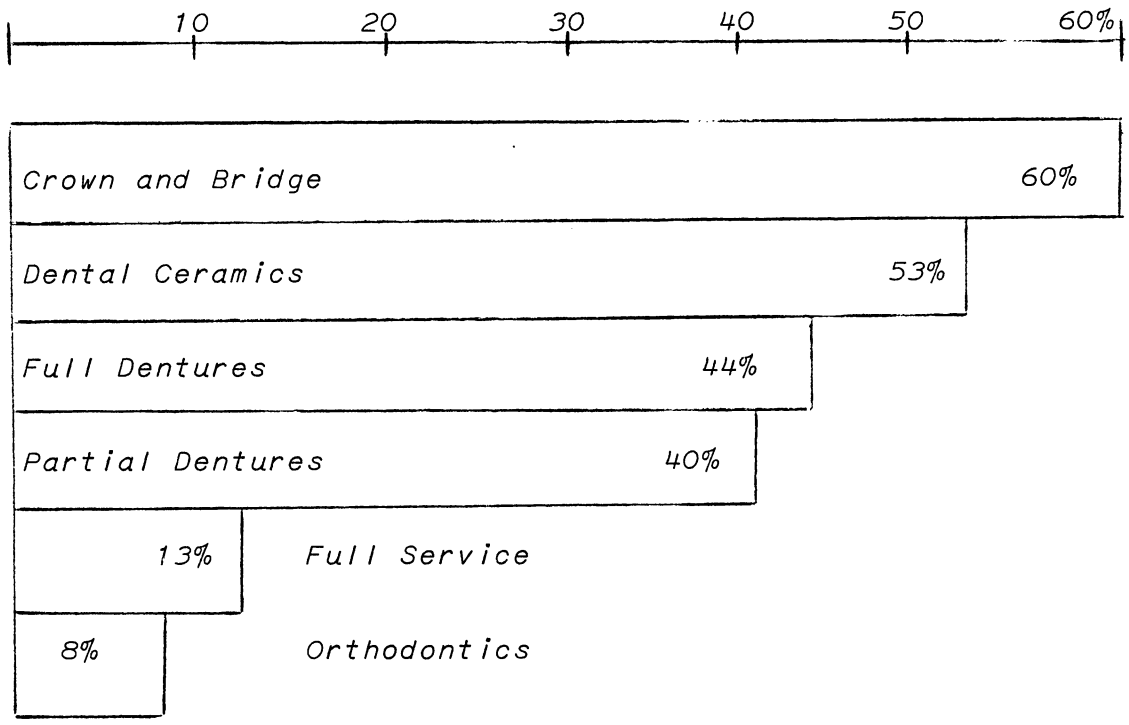
YEAR	NUMBER OF ACTIVE TECHNICIANS	NUMBER PER 100 ACTIVE DENTISTS
1950	15,000	18.9
1955	16,870	20.0
1960	19,000	21.1
1965	24,250	25.3
1970	30,670	30.0
1975	41,600	37.1
1980	52,600	40.7
1982	55,300	41.9

Source: Tony Wong. "Industry Survey Points to Rosy Future," Dental Laboratory Review (September, 1984, p. 12.)

Figure 2. The Ratio of Technicians to Dentists Has Increased From One Technician to Every Five Dentists to One Technician for Every Two Dentists

SERVICES OFFERED

BY DENTAL LABS



Source: Tony Wong. "Industry Survey Points to Rosy Future," Dental Laboratory Review (September, 1984, p. 11.)

Figure 3. Crown and Bridge Services are Offered by 60% of the Dental Laboratory Industry

PERCENT OF LABORATORIES

PRODUCING PRECIOUS

UNITS

(August 1983)

NUMBER OF UNITS	PERCENT OF LABS
1 - 10	12%
11 - 25	14%
26 - 50	17%
51 - 75	11%
76 - 100	10%
101 - 150	11%
151 - 200	6%

Source: Tony Wong. "Industry Survey Points to Rosy Future," Dental Laboratory Review (September, 1984, p. 12.)

Figure 4. Percent of Laboratories Using Precious Alloys for Crown and Bridge

PERCENT OF LABORATORIES PRODUCING

NONPRECIOUS UNITS

(August 1983)

NUMBER OF UNITS	PERCENT OF LABS
1 - 10	9%
11 - 25	10%
26 - 50	14%
51 - 75	10%
76 - 100	8%
101 - 150	9%
151 - 200	7%
201 - 250	4%
251 - 300	3%
301 - 400	3%

Source: Tony Wong. "Industry Survey Points to Rosy Future," Dental Laboratory Review (September, 1984, p. 14.)

Figure 5. Percent of Laboratories Using Non-precious Metals for Crown and Bridge

ADVANTAGES AND DISADVANTAGES OF GOLD ALLOYS

GOLD ALLOYS	ADVANTAGES	DISADVANTAGES
Gold-platinum	Excellent bonding to porcelain. Will produce fine margins, easy to finish & polish Excellent for reproducing occlusal surface	Low sag resistance; Yield strength low for long bridges High cost
Gold-palladium	Higher melting range High yield strength Higher elasticity Good-castability Easy to finish and polish Nontoxic Lower cost than gold-platinum alloys	May "green" porc. Absorbs hydrogen gas when casting Bonding procedures affected by oxides

Source: John W. McLean. "Alloys for Porcelain Bonding," Quintessence of Dental Technology (1984, p. 410.)

Figure 6. Advantages and Disadvantages of Gold Alloys

vantages and disadvantages for gold free alloys as shown on Figure 7.

There are conflicting views on the use of nonprecious alloys in porcelain fused to metal restorations. A study conducted by the Council on Dental Materials, Instruments, and Equipment (February, 1980) suggested that although certain semiprecious alloys do contain trace amounts of gold (10%), porcelain is not intended to be fused to these semiprecious silver-palladium alloys. Evidence was presented in the DLT-MIT study of mild incompatability with oral fluids which has a tendency to have a corrosive effect on the low-gold or nonprecious alloy. Certain hazardous elements may be found alloyed with these metals, such as beryllium, cadmium, and lead (June, 1976).

Heymann (1984) presented an alternative to the conventional metal crown and bridge prostheses. He recommended the use of an all acrylic resin material for the fabrication of prosthetic devices. He stated the use of these devices eliminated the incompatability with oral fluids. Recommendations were also presented for the clinical preparation of the teeth and the laboratory procedures for fabrication.

> When the patient's age, economic condition, or dental health dictate a more conservative approach, the acrylic denture-tooth pontic can provide a viable alternative to conventional prosthetic treatment (Heymann, 1984, p. 117).

Berger (1979) presented techniques for the fabrication of dental ceramics. He outlined procedures for the

ADVANTAGES AND DISADVANTAGES

OF GOLD FREE ALLOYS

GOLD FREE ALLOYS	ADVANTAGES	DISADVANTAGES
Palladium-silver	High yield strength More resistant to metal creep Nontoxic Low cost	Harder to cast Bonding or discoloration problems Increased gas absorption
Palladium-tin-gallium	High yield strength Less metal creep Long span bridges Nontoxic Low cost Some cast as easy as gold alloys	Variable bonding Increased gas absorption

Source: John W. McLean. "Alloys for Porcelain Bonding," Quintessence of Dental Technology (1984, p. 411.)

Figure 7. Advantages and Disadvantages of Gold Free Alloys

application of porcelain to the metal-alloy substructures. He included the esthetic quality of several types of porcelain powders available. Eckes (1979) presented dental ceramic staining techniques. He stated poor lighting in dental laboratories as a major cause of remakes.

Impression materials, both reversible and non-reversible, have made technological improvements over the past several years (Kuwata, 1983). He also presented evidence of a decline in the use of water-soluble impression plasters. Kuwata suggested that the decline was due to the development of more accurate and easier to handle and manipulate alginates and rubber base impression materials currently available. Worley and Chapman (1983) reported techniques for success using alginate and rubber base impression materials. They stated positive predictable outcomes and high success rates for their technique. They suggested modifying the recommended mixing ratios of these impression materials. They also stated advantages, disadvantages and precautions. The alginates and rubber base materials were the most widely used and dimensionally stable for use with both fixed and removable impressions according to Polyzois and Zissis (1983).

The council on Dental Materials, Instruments and Equipment (June, 1980) reported several guidelines to follow for both the technician and the dentist when fabricating removable partial dentures. These guidelines concerned the tooth preparation, maintaining oral health, avoidance of

fracturing the framework, and improving the esthetic value and fit of the prosthesis. Stewart and Rudd (1983) presented recommended sequence of steps for treatment of removable partial denture patients. They presented a correlation of the basic science of prosthetic dentistry with the treatment procedures of older patients. Also presented were suggestions for the dental laboratory technician concerning the fabrication of removable partial dentures. Lorton (1979) outlined procedures for the stabilization of removable partial dentures. He presented the types of these devices and suggested the placement of stabilizers at selected sites. Haker (1984) presented several designs for the fabrication of these prostheses. Haker also stated effective communication between the dentist and the laboratory technician resulted in fewer errors or remakes of these removable appliances.

Appelbaum (1983) suggested procedures for the fabrication of complete dentures. He recommended the use of a temporary denture. He also stated the device allowed the denture patient to become familiar with the prospect of wearing dentures. He described the philosophy of the approach taken. Listed in this report were several advantages to his technique. He cited the major advantage was the patient had an extra denture in the event of breakage or loss of the definitive denture.

As many more Americans are living longer, complete denture and overdenture requirements were on the rise and

have received much attention in recent years (Robbins, 1980). Toolson and Smith (1978) reported increased reliability with the overdenture technique. They cited a dramatic increase in the percentage of overdentures fabricated at the University of Washington School of Dentistry. In 1966 approximately two percent of the dentures fabricated were overdentures. By 1976 the percentage rose to 65%. Reitz (1977) cited that a major drawback to the overdenture technique is that the long-term use can cause periodontal disease. Brewer and Morrow (1969) recommend the use of a high-impact acrylic resin in overdenture construction to reduce the risk of fracture. A cast metal chrome-cobalt alloy could be an alternative to the high-impact acrylic resin (Morrow, 1969).

Technological changes are appearing in the field of prosthetic dentistry (Hein, 1984). These changes have impact upon the dental laboratory technician. Hein (1984) identified the need to revise education into re-education to prevent the current practices and procedures from becoming obsolete. He also recommended that future education and training be based on past failures and broaden the laboratory technician's perspective.

Rivers and Schmidt (1983) stated that the establishment of open channels of communication between the dentist and the technician must be formally addressed. They presented five components that contributed toward the effective interpersonal communication process. They

presented these components as

> (1) self-concept, (2) effective listening, (3) clarity of expression, (4) coping with angry feelings and (5) self-disclosure (p. 51).

According to Crawford (1980), when conducting continuing education and training, areas to avoid are duplication of effort and repetition. He also stated that when selecting continuing education courses, one ought to research the content of the courses and the course description to insure that state of the art requirements were met. He also identified that the selection and attendance should satisfy the needs of the individual and the needs of the profession. He related that the course should be structured to allow the maximum utilization of time.

Bebau and Kress (1982) stated that continuing education and training would increase technical competence, knowledge and performance. They indicated that education must teach something if it is to be effective. They also stated that the continuing education and training must be based on sound findings and trends.

Dickler (1983) presented training as a necessary evil. He recommended that training should address background, experience and evaluations of performance. He also stated training should be tailored to current and future needs based on the needs of the individual and the needs of the occupation.

Summary

Overmyer (1985) related that 24 million units of crown and bridge were produced in 1983. This figure is representative of approximately 35% of the more than $20 billion national expenditure for dental health care in the crown and bridge specialty area.

Gettleman (1980) related the ever increasing need to reduce the cost of quality oral health care. He also stated that gold or gold based alloys were the most widely used metals. These metals were used for both crown and bridge and for dental ceramics. Due to the rising costs of dental health care costs, he stated that much experimentation is currently conducted using semiprecious and nonprecious metal alloys. These alloys have shown an increase in use in both specialty areas. These metal alloys were providing clinically acceptable oral prostheses. McClean (1984) presented alternative metal alloys to replace gold as the metal of choice with dental ceramics.

Robbins (1980) stated evidence from the National Center for Health Statistics that showed 60% of civilian dental laboratories were offering crown and bridge and dental ceramic services. Additional evidence was presented showing a 36% increase in the number of crown and bridge requests.

Dental laboratories were employing fewer technicians

(Wong, 1984). Wong also stated that 90% of dental laboratories employ fewer than ten technicians. Robbins (1980) reported the ratio of technicians to dentists has increased. This increase was one technician for every five dentists in 1970 to one technician for every two dentists in 1980.

The Journal of the American Dental Association (1980) reported guidelines for the technician and the dentist to follow in the fabrication of removable partial dentures. There was no evidence presented to indicate an increase in the number of requests for removable partial dentures.

Robbins (1980) reported an increase in the number of requests for over-dentures. He stated that in 1966 approximately two percent of the dentures fabricated were over-dentures. In 1976 this figure rose to 65%. Toolson and Smith (1978) reported increased reliability with the over-denture technique. Brewer and Morrow (1969) recommended the use of a high-impact plastic with this technique to reduce the chance of fracture. Stewart and Rudd (1983) presented a correlation of the basic science of prosthetic dentistry with the treatment of older patients. Also presented were suggestions for the laboratory technician.

Worley and Chapman (1983) presented techniques for rubber base and alginate impression materials. Appelbaum (1983) recommended the use of temporary dentures in the removable specialty area. Berger (1979) outlined procedures for porcelain application in dental ceramics.

Robbins (1980) stated an increase in the number of requests for overdentures. Brewer and Morrow (1969) suggested the use of high-impact acrylic resin with the overdenture technique.

Several recommendations were presented for continuing education and training. Bebau and Kress (1982) indicated increased competency and performance were rewards of continuing education and training. Hein (1984) suggested revising educational practices. Dickler identified training as a necessary evil. Crawford (1980) suggested avoidance of duplication of efforts and repetition. He also stated that selection and attendance needs to satisfy the individual and the needs of the profession. Rivers (1983) stated that open channels of communication between the technician and dentist must be formally addressed.

CHAPTER III

METHODOLOGY

This chapter details the procedures for collecting data relevant to surveying USAF dental laboratory technicians to ascertain if there is an increase in (1) the use of gold base and gold free metal alloys in the fabrication of full metal crowns and bridges, (2) the use of gold base and gold free metal alloys in the fabrication of dental ceramics and (3) the number of requests for complete and overdentures in the United States Air Force. The chapter includes the population and sample, data gathering instrument, support for the study, collection of the data, and the procedures selected for analyzing the data.

Population and Sample

Criteria were established for the selection of the USAF dental laboratory subjects for this study. The study population included four large CONUS Air Force bases. The bases chosen (1) represent approximately one-third of all USAF dental laboratory technicians world-wide, (2) have the greatest number of assigned dental laboratory technicians, and (3) are representative of all other AFB dental laboratory technicians specializing in the crown and bridge and

removable denture specialty area.

The study population included only graduates of the basic USAF school of dental laboratory technology. There were 195 AF technicians assigned to the four selected AF bases.

Data Gathering Instrument

A two-part questionnaire was developed for use in this study. Part I of the questionnaire determined both the specialty area where the technician currently was working and whether or not the subject was a graduate of the USAF basic dental laboratory school. Part II addressed six areas in the dental laboratory career field. The subjects were requested to answer questions in the following areas: (1) crown and bridge fabrication using gold base alloys, (2) crown and bridge fabrication using gold free alloys, (3) dental ceramics using gold base alloys, (4) dental ceramics using gold free alloys, (5) complete denture fabrication, and (6) overdenture fabrication.

The questionnaire was developed by a panel of experts in several brainstorming sessions. The contributing experts were an Air Force nationally certified prosthodontist by the American Dental Association, a practicing prosthodontist, two general dental practioneers, a retired military dental laboratory technician and the author of this study. All members were selected for their level

of expertise and were regarded as subject matter specialists in the crown and bridge and removable specialty areas.

The questionnaire was put into a format and a field test was conducted. Five USAF dentists were asked to participate in the field test and provide feedback on the clarity, comprehension, presentation, and format. Revisions were made during additional brainstorming sessions. A pilot test was conducted with four USAF dental laboratory technicians assigned at Tinker AFB. The questionnaire was then finalized and ready for implementation. (See Appendix A for a copy of the instrument.)

Support for the Study

A meeting was scheduled with the Tinker AFB Dental Surgeon. Permission was requested and obtained to conduct the study. The objectives, methods and procedures for the study were outlined and questions regarding the study were answered (see Appendix B).

Collection of Data

Telephone interviews were conducted and laboratory managers of the selected Air Force bases agreed to participate in this study. A cover letter (see Appendix C) accompanied each questionnaire. The instruments were mailed to the contacted laboratory managers for distribution to the individual respondents. The data were

collected and returned during the first two weeks of March, 1985. The time expected to respond to the survey was from 15 to 20 minutes. Return of the instruments was encouraged by the enclosure of a prepaid envelope.

Analysis of Data

To analyze the data, the questionnaires were first checked for completeness. Incomplete surveys were not included. Respondents who were not graduates of the USAF dental laboratory school were not surveyed. The data were analyzed by the use of comparing percentages. The use of gold base versus gold free alloys in full metal crown and bridge fabrication was compared. The same comparison was used for dental ceramics. The number of requests for fabrication of complete and overdentures were compared individually.

CHAPTER IV

PRESENTATION OF FINDINGS

In this section the results of the two-part questionnaire administered to USAF dental laboratory technicians are presented in detail. This chapter is divided into five sections. The sections are presented in the following order: (1) response rate, (2) dental specialty area, (3) crown and bridge trends, (4) dental ceramic trends, and (5) complete and overdenture trends.

Response Rate

A total of 195 USAF technicians were asigned at the selected Air Force bases. All instruments were returned. The laboratory managers were contacted one time to insure that the questionnaires were received and to answer any questions. Only one survey respondent was not a graduate of the Air Force laboratory school and was not considered in this study. A total of five surveys were not completely answered and these were not considered. A total of 189 questionnaires were usable and considered for a response rate of 96.9 percent. This response rate of participants was considered sufficient and adequate.

Dental Laboratory Specialty Area

The laboratory technicians who participated in this study were graduates of the basic USAF dental laboratory school. Participants were requested to respond to their specialty area. One hundred and seventeen respondents (61.9 percent) were currently working in the crown and specialty area. There were 72 technicians (38.1 percent) currently working in the removable or denture specialty area. Fifty-one of the respondents (27 percent) have never worked in the crown and bridge or dental ceramic specialty areas. These figures are shown on Table I. This information was gathered from Part I of the questionnaire. Appendix D contains the overall response totals to Part I and Part II of the questionnaire.

Crown and Bridge Trends

Sixty-three (53.8 percent) of the 117 respondents performing crown and bridge work indicated an increase in the number of requests for gold base alloys. Forty-one (65 percent) indicated the increase was due to their increased speed or ability to perform. However, 47 (74.6 percent) indicated the increase was not a change in the trends of the career field (see Table II). The responses from crown and bridge technicians indicated an increase in the number of requests for gold free alloys. There were 26 technicians (22.2 percent) that indicated an increase was

TABLE I

USAF DENTAL LABORATORY TECHNICIANS
WORKING IN THE FIXED AND
REMOVABLE SPECIALTY AREA

	N	%
Currently working in the fixed specialty area	117	61.9
Currently working in the removable specialty area	72	38.1

N = 189

TABLE II

INCREASE IN REQUESTS FOR GOLD BASE ALLOYS IN CROWN AND BRIDGE

(A) INCREASE IN REQUESTS

	RESPONDENTS YES	NO
Increase in the number of requests for gold base alloys	63	54

N = 117

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	41	22	63
Change in trends	16	47	63

N = 63

noticed. Nine (34.6 percent) indicated the increase was their increased speed or ability (see Table III). Sixteen respondents (61.5 percent) indicated the increase was due to a change in the trends of the career field.

Dental Ceramic Trends

A total of 69 respondents (59 percent) indicated an increase in the number of requests for dental ceramics. This increase was for gold base alloys in dental ceramic restorations as shown on Table IV. Forty respondents (58 percent) indicated the increase was their ability to produce. Nearly one-fourth of the respondents (24.6 percent) indicated the increase was a change in the trends of the career field. The use of gold free alloys also indicates an increase. Twenty-one technicians (17.9 percent) surveyed indicated more gold free alloys are used in the fabrication of dental ceramics. Nine technicians (42.8 percent) felt the increase was a change in trends. Eight respondents (38 percent) indicated the increase was a result of their ability to produce dental ceramics. This figure is shown on Table V.

Complete and Overdentures

There were 72 respondents currently working in the removable or denture specialty area as shown on Table I. Thirteen respondents (18 percent) indicated an increase in

TABLE III

INCREASE IN REQUESTS FOR GOLD FREE ALLOYS IN CROWN AND BRIDGE

(A) INCREASE IN REQUESTS

	RESPONDENTS YES	NO
Increase in the number of requests for gold free alloys	26	91

N = 117

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	9	17	26
Change in trends	16	10	26

N = 26

TABLE IV

INCREASE IN REQUESTS FOR
GOLD BASE ALLOYS IN
DENTAL CERAMICS

(A) INCREASE IN REQUESTS

	RESPONDENTS	
	YES	NO
Increase in the number of requests for gold base alloys in dental ceramics	69	48

N = 117

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	40	29	69
Change in trends	17	52	69

N = 69

TABLE V

INCREASE IN REQUESTS FOR
GOLD FREE ALLOYS IN
DENTAL CERAMICS

(A) INCREASE IN REQUESTS

	RESPONDENTS	
	YES	NO
Increase in the number of requests for gold free alloys in dental ceramics	21	96

N = 117

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	8	13	21
Change in trends	9	12	21

N = 21

the number of requests for complete dentures. Eleven respondents (84.6 percent) indicated the increase was the result of their ability to produce. However, only four respondents (30.7 percent) indicated the increase was a a change in trends of the career field. More than one-half (56.9 percent) indicated an increase in the number of overdentures fabricated. Forty-one technicians indicated this increase. Twenty-nine (70.7 percent) felt the increase was a result of their ability to produce. Twenty-three respondents (56 percent) indicated a change in the trends of the specialty area. These figures are shown on Table VI and Table VII.

Summary

One hundred and seventeen (61.9 percent) of the respondents were currently working in the crown and bridge specialty area. A total of 138 (73 percent) had at some time in their Air Force career worked in the crown and bridge specialty area. More than one-half (53.8 percent) stated there was an increase in the use of gold base alloys for crown and bridge fabrication. Twenty-six respondents (22.2 percent) stated an increase in the use of gold-free alloys for crown and bridge. Dental ceramics showed an increase in the number of requests for gold base alloys. Twenty-one technicians (17.9 percent) indicated an increase in the use of gold free alloys. Complete dentures showed an increase in the number of requests. Eleven technicians

TABLE VI

INCREASE IN REQUESTS FOR COMPLETE DENTURES

(A) INCREASE IN REQUESTS

	RESPONDENTS	
	YES	NO
Increase in the number of requests for complete dentures	13	59

N = 72

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	11	2	13
Change in trends	4	9	13

N = 13

TABLE VII

INCREASE IN REQUESTS FOR OVERDENTURES

(A) INCREASE IN REQUESTS

	RESPONDENTS	
	YES	NO
Increase in the number of requests for overdentures	41	31

N = 72

(B) YES RESPONSES TO INCREASES

	YES	NO	TOTAL
Speed of technician or ability to produce	29	12	41
Change in trends	23	18	41

N = 41

(84.6 percent) stated the increase. Only four (30.7 percent) stated the increase was a change in trends of the career field. More than one-half (56.9 percent) stated an increase in the number of requests for overdentures. Twenty-nine respondents (70.7 percent) stated the increase was from their ability to produce. However, 23 (56 percent) stated the increase was a changing trend of the specialty area.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The content of this chapter is divided into four sections. The first section presents a summary of the study followed by the conclusions of the study. The third section contains recommendations for establishing dental laboratory continuing education programs. The final section contains recommendations for further research and study.

Summary

The purpose of this study was to determine the current trends of prosthetic dentistry in the dental laboratory career field in the USAF.

This study sought to answer the following questions

1. Is there an increase in the use of gold base and gold free metal alloys in the fabrication of full metal crowns and bridges?

2. Is there an increase in the use of gold base and gold free metal alloys in the fabrication of dental ceramics?

3. Is there an increase in the number of complete and overdentures fabricated?

A comprehensive review of literature was conducted by

the researcher. The review indicated a rising cost of dental health care in the United States. The cost of providing crown and bridge and dental ceramic prostheses has increased. This increase was caused by the increasing price of gold, the primary metal used in the fabrication of these devices.

Nonprecious metal alloys were presented as possible alternatives to gold base metal alloys. The literature cited several advantages and disadvantages for each.

Many more civilian dental laboratories are offering fixed and removable services. Laboratories are employing fewer technicians. There has been an increase in the number of individuals selecting the dental laboratory as a career. There was also cited an increase in the ratio of technicians to dentists.

There was not a noticeable increase in the number of complete dentures fabricated. There was however an increase in the number of fabricated overdentures.

There were 189 Air Force participants cooperating in this study. The participants were assigned to four large CONUS Air Force bases. They were all graduates of the Air Force basic dental laboratory school. All were working in the fixed or removable specialty area. The instrument was administered and returned during the first two weeks of March, 1985.

The instrument was a two-part questionnaire with terminal questions. Part I of the questionnaire was

designed to determine in which specialty area the technician worked. Part II was used to determine the trends of the dental laboratory career field in the USAF. Included were the trends of gold base and gold free metal alloys used in the fabrication of crowns and bridges and dental ceramics. Also addressed were the trends in the removable specialty areas of complete and overdentures. The instrument was determined to have sufficient validity and reliability for measuring the objectives in this study.

The Air Force respondents indicated most worked in the crown and bridge and dental ceramic specialty areas. Both specialty areas indicated an increase in the number of prostheses fabricated. This increase was using gold base and gold free metal alloys. There was an increase in the numbers of complete and overdentures fabricated by the Air Force technicians.

The data were compiled and analyzed utilizing comparing percentages. Percentages were the techniques used to present the data.

Conclusions of the Study

The conclusions that resulted from the findings of the study follow.

1. Sixty percent of civilian laboratories re offering crown and bridge services. This trend is paralleled in the USAF that showed that 61.9 percent of the technicians surveyed indicated they were currently

working in the crown and bridge specialty area. Also, 73 percent of the Air Force technicians surveyed had at sometime in their career worked in the crown and bridge specialty area.

2. The percent of civilian laboratories producing nonprecious crown and bridge restorations (3 to 14 percent) is approaching the same percentage of crown and bridge restorations produced using precious alloys (6 to 17 percent).

3. A total of 53.8 percent of the Air Force participants stated an increase in the use of precious alloys for crown and bridge fabrication. Also, 59 percent stated an increase in the fabrication of dental ceramics with precious alloys. The use of nonprecious alloys in the Air Force showed a 22.2 percent increase in crown and bridge and a 17.9 percent increase was shown in dental ceramics.

4. Forty-four percent of civilian laboratories were offering full denture services and have noticed a dramatic (60 percent) increase in the number of overdentures fabricated.

5. Thirty-eight percent of Air Force technicians have worked in the crown and bridge specialty area. A total of 56.9 percent of the participants stated an increase in the number of requests for overdentures.

The civilian dentists and laboratory technicians considers the patient's needs and desires, their ability to

pay and the profit margin. Economics was a major consideration. The civilian community has more latitude to function and make decisions on types of materials to be used in the construction of various dental prosthetic appliances. They do not function in an institutional environment.

The Air Force dental service does not consider the patient's ability to pay. Economics was not a major consideration. The institutional bureaucracy limits the types or variety of materials available. Dental peer review tends to insure high quality dental practices.

Recommendations for Continuing Education

The following recommendations were made for the establishment of a dental laboratory continuing education program:

1. An in-depth needs assessment at the base level should be conducted to determine local needs of the population. A review of procedures conducted in specialty areas would be helpful. The assessment should include both fixed and removable fields of prosthetic dentistry. This would be beneficial since the assessment would be based on sound findings rather than perceptions. This would allow for continuing education and training to be addressed toward the greatest need.

2. All Air Force dental laboratory supervisors should conduct continuing education and training as a

monthly requirement. New and advanced techniques should be reviewed and presented to subordinates during continuing education sessions.

3. Continuing education and training should be conducted based on actual needs. The topics should be researched to insure that current requirements are met.

4. Open channels of communication should be established. Included in the channels should be the health care provider, the manager of the laboratory and the worker.

Recommendations for Further Research and Study

The following recommendations for further research are given:

1. A similar study on the trends of orthodontia should be conducted to determine current trends and needs for the development of a continuing education and training program.

2. A study on the effects of a continuing education and training should be conducted. This would be helpful in aiding laboratory managers to plan realistic goals.

3. Future research should be conducted on the findings of this study with a larger population for comparative analysis.

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APPENDIXES

APPENDIX A

DATA GATHERING INSTRUMENT

PART I

GENERAL INFORMATION

Please answer the following questions by placing an "X" or "✓" by the appropriate space.

	YES	NO
1. Were you a graduate of the 3ABR98230 BASIC Dental Laboratory Specialist Course?	___	___
2. Are you currently working in the crown and bridge specialty area?	___	___
3. Have you worked in the crown and bridge specialty area, other than in the BASIC course?	___	___

PART II

The following questions deal with full metal crown and bridge restorations using a GOLD-BASE alloy.

4. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-BASE alloy over the past 12 months?	___	___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #5 & #6.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #7.

5. Is this due to your increased speed or ability to produce?	___	___
6. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	___	___

The following questions deal with full metal crown and bridge restorations using a GOLD-FREE alloy.

7. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-FREE alloy over the past 12 months?	___	___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #8 & #9.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #10.

8. Is this due to your increased speed or ability to produce?	___	___
9. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	___	___

YES NO

The following questions deal with ceramic crown and bridge restorations using a GOLD-BASE alloy.

10. Have you noticed an increase in the number of requests for CERAMIC C&B using a GOLD-BASE alloy over the past 12 months? ___ ___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #11 & #12.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #13.

11. Is this due to your increased speed or ability to produce? ___ ___

12. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)? ___ ___

The following questions deal with ceramic crown and bridge restorations using a GOLD-FREE alloy.

13. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-FREE alloy over the past 12 months? ___ ___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #14 & #15.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #16.

14. Is this due to your increased speed or ability to produce? ___ ___

15. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)? ___ ___

COMPLETE AND OVER-DENTURES

16. Have you noticed an increase in the number of requests for COMPLETE dentures over the past 12 months? ___ ___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #17 & #18.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #19.

17. Is this due to your increased speed or ability to produce? ___ ___

18. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)? ___ ___

19. Have you noticed an increase in the number of requests for OVER-DENTURES over the past 12 months? ___ ___

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #20 & #21.
IF YOU ANSWERED NO, DISREGARD THE LAST 2 QUESTIONS.

20. Is this due to your increased speed or ability to produce? ___ ___

21. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)? ___ ___

Thank you for your participation. Please use the back for any additonal comments you may have.

APPENDIX B

LETTER OF PERMISSION

DEPARTMENT OF THE AIR FORCE
USAF HOSPITAL, TINKER (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145-5300

REPLY TO ATTN OF: SGD

9 October 1984

SUBJECT: Permission to Research Masters Thesis

TO: Colonel William J. Corrigan

I am a student attending Oklahoma State University working toward the completion of my studies for a masters degree in Occupational and Adult Education. My course of study requires me to complete a thesis and I am requesting your support and guidance to aid me in fulfilling this requirement. I will be consulting with your staff to aid me in gathering data, and in the development and validation of my data gathering instrument.

Your help and support concerning this matter is greatly appreciated.

CHARLES L. MARTINSON

1st IND (SGD)

28 Feb 85

APPROVED/[redacted]

WILLIAM J. CORRIGAN, COLONEL, USAF, DC
Base Dental Surgeon

APPENDIX C

COVER LETTER FOR QUESTIONNAIRE

I am a student working on a Masters Thesis, and I am trying to determine the current trends in the field of dental laboratory technology in the Air Force. Your thoughts and comments concerning the trends are important to aid me in the collection of the data and analysis of the trends.

The attached questionnaire is being presented to you to determine the trends in the dental laboratory career field. In addition to completion of the questionnaire, general information is being requested to make the results more meaningful.

Please follow the instructions for each part of the questionnaire. DO NOT sign your name on the questionnaire so individual anonymity and confidentiality can be maintained. Completion of this questionnaire will indicate your consent to participate in this study.

Please take a few minutes now to complete and return the form. The form must be returned by 15 Mar, 85.

Thank you for your participation!

Sincerely,

Charles L. Martinson, MSgt, USAF
NCOIC, Base Dental Laboratory
Tinker AFB, Okla.
AUTO: 884-8216

APPENDIX D

OVERALL RESPONSE TOTALS

TO QUESTIONNAIRE

PART I

GENERAL INFORMATION

Please answer the following questions by placing an "X" or "✓" by the appropriate space.

	YES	NO
1. Were you a graduate of the 3ABR98230 BASIC Dental Laboratory Specialist Course?	189	___
2. Are you currently working in the crown and bridge specialty area?	117	72
3. Have you worked in the crown and bridge specialty area, other than in the BASIC course?	138	51

PART II

The following questions deal with full metal crown and bridge restorations using a GOLD-BASE alloy.

4. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-BASE alloy over the past 12 months?	63	54

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #5 & #6.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #7.

5. Is this due to your increased speed or ability to produce?	41	22
6. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	16	47

The following questions deal with full metal crown and bridge restorations using a GOLD-FREE alloy.

7. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-FREE alloy over the past 12 months?	26	91

NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #8 & #9.
IF YOU ANSWERED NO, PLEASE GO TO QUESTION #10.

8. Is this due to your increased speed or ability to produce?	9	17
9. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	16	10

	YES	NO
The following questions deal with ceramic crown and bridge restorations using a GOLD-BASE alloy.		
10. Have you noticed an increase in the number of requests for CERAMIC C&B using a GOLD-BASE alloy over the past 12 months?	69	48
NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #11 & #12. IF YOU ANSWERED NO, PLEASE GO TO QUESTION #13.		
11. Is this due to your increased speed or ability to produce?	40	29
12. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	17	52
The following questions deal with ceramic crown and bridge restorations using a GOLD-FREE alloy.		
13. Have you noticed an increase in the number of requests for FULL METAL C&B using a GOLD-FREE alloy over the past 12 months?	21	96
NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #14 & #15. IF YOU ANSWERED NO, PLEASE GO TO QUESTION #16.		
14. Is this due to your increased speed or ability to produce?	8	13
15. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	9	12
COMPLETE AND OVER-DENTURES		
16. Have you noticed an increase in the number of requests for COMPLETE dentures over the past 12 months?	13	59
NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #17 & #18. IF YOU ANSWERED NO, PLEASE GO TO QUESTION #19.		
17. Is this due to your increased speed or ability to produce?	11	2
18. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	4	9
19. Have you noticed an increase in the number of requests for OVER-DENTURES over the past 12 months?	41	31
NOTE: IF YOU ANSWERED THIS YES, PLEASE ANSWER QUESTIONS #20 & #21. IF YOU ANSWERED NO, DISREGARD THE LAST 2 QUESTIONS.		
20. Is this due to your increased speed or ability to produce?	29	12
21. Is this due to a marked change in the trends of the career field (not a manning shortage/overage)?	23	18

Thank you for your participation. Please use the back for any additonal comments you may have.

VITA 2

Charles LeRoy Martinson

Candidate for the Degree of

Master of Science

Thesis: THE CURRENT TRENDS OF DENTAL LABORATORY TECHNOLOGY

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in St. Paul, Minnesota, June 28, 1949, the son of Einar M. and Edith M. Martinson. Married to Connie J. Colvin on April 6, 1984.

Education: Graduated from Eden Prairie High School, Eden Prairie, Minnesota in May, 1967; received Bachelor of Science Degree in Occupational Education from Wayland Baptist College in February, 1981; completed requirements for the Master of Science degree in Occupational and Adult Education, with emphasis in Human Resources Development, at Oklahoma State University, Stillwater, Oklahoma in May, 1985.

Professional Experience: Enlisted in the USAF as Aircraft Maintenance Technician, 1968-1974; Dental Laboratory Technician, 1974-1979; Master Instructor, Dental Laboratory Specialist, School of Health Care Sciences, Sheppard AFB, Texas, 1979-1983; Superintendent, Base Dental Laboratory, Tinker AFB, Oklahoma, 1983 to present.