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Prosthodontics specialization programs around the globe

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ABSTRACT

Statement of Problem: Prosthetic treatments account for more than half of the all provided dental services, as well as the highest number of lawsuits in some countries. The quality of Prosthodontics postgraduate programs has profound effect on the improvement of provided patient health care and reduction of patient complaints.

Goal: The goal of this study was to survey different universities around the globe for the duration and subjects of Prosthodontics specialty programs, the title of degree awarded and the programs that are offered in conjunction with other disciplines.

Materials and Methods: This study surveyed Prosthodontics specialty programs offered by different universities available on their websites, and reviewed published research on this subject using search engines such as Google, Pubmed and Medline. The published Accreditation Standards for the program and minimum requirements for achieving competency after completion of the program was reviewed.

Result: The results of survey showed that prosthodontics specialty is not recognized by all countries. In 42 universities surveyed, the duration of program ranged from two to four years. The title of awarded degree varied in different universities. In some universities, prosthodontics and other disciplines were integrated in one program. Few universities offered additional subjects like photography, geriatrics and pain in their educational curriculum.

Conclusion: The core subjects of the programs seemed identical. However, programs differ in duration, title and extra subjects.

Keywords: Prosthodontics; Prosthetic dentistry; Post graduate; Residency; Specialty; Education; Curriculum.

Introduction

According to the American dental association (ADA), Prosthodontics is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation and maintenance of the oral function, comfort, appearance and health of patients with clinical conditions associated with missing or deficient teeth and/or oral and maxillofacial tissues using biocompatible substitutes [1]. Prosthetic dentistry added reconstructive phase to tooth extraction, the ablative and most common form of dental treatment throughout history [2]. Although modern prosthetic dentistry began in 18th century by pioneers like Pierre Fauchard who developed springs to hold the dentures in place [3], evidences of dental prosthetics can be traced back to 2500 BC, when Egyptians used gold

wires to stabilize teeth [4]. Around 500 BC, the Etruscans replaced missing teeth using oxen bones. Phoenicians at about 300 AD, used carved teeth from ivory and stabilized them by gold wire to make fixed bridges [4]. The first evidence of successful dental implant is found in Maya population, who used shells for replacing mandibular teeth about 600 AD [4]. In 1600s, human teeth collected from the poor or the cadaver were allotransplanted. From 18th century to present day prosthetic dentistry has developed rapidly in materials and treatment techniques and technology, hence, today variety options for reconstruction of oral health are available.

In the beginning of the 20th century, prosthetic dentistry was performed mostly by general dentists. However, as a result of significant progress in materials, technologies and increased complexity of prosthodontic treatments, in 1918 a number of knowledgeable dentists gathered in Chicago to form the "National Society of Denture Prosthetists" [5,6]. At that time, prosthodontics as a specialty began to stablish and gained recognition by ADA in 1948 second to oral surgery [2]. Today the Commission on Dental Accreditation grants approval to the programs, and American Board of prosthodontics is the certifying organization that sets standards for being recognized as a board-certified prosthodontist [7,8]. Although according to FDI, the establishment of dental specialties should not legally limit the right of the general practitioner to practice the full spectrum of dentistry including specialist tasks, the purpose of proposing a specialty is to enhance patient care, greater focus on the research and academic field [9].

Advanced education programs should be designed to provide special knowledge and skills beyond the accepted general dentistry training and prepare postdoctoral student for complicated treatments [10]. Each country has an organization responsible for defining and coordinating the content and length of specialty programs. Also, there might be a certifying board to qualify the candidates.

Since prosthodontics consists of diverse disciplines like esthetic dentistry, computer aided dentistry, implant dentistry, temporomandibular joint disorders, maxillofacial prosthetics, geriatric dentistry and dental materials, the curriculum should reflect this diversity. The aim of this study was to survey prosthodontics specialty programs around the globe.

Materials and Methods

A web search query on the google search engine was carried out about prosthodontics specialty programs around the globe using "prosthodontics" or "prosthetic dentistry" and "specialty", "postgraduate", "advanced education" as key terms. An electronic search of the literature was also conducted through Google scholar, PubMed and Medline using same keywords. The websites of different universities with prosthodontics specialty programs were also surveyed from September 2018 until January 2019. Since most of the universities shown in the search results were in USA, UK or countries associated to them, more search was performed by adding the name of specific countries like China and Japan or continents like Africa or South America to the query.

Results

The location of the universities based on their continent, the length of the program and the title of awarded degrees to the graduates are shown in Table 1.

	Name of university	Country	Awarded degree	Year	Extra Subjects
1	Marquette University	USA	Master	3	
2	University of Connecticut	USA	Prosthodontist	3	Surgical Implant placement
3	University of California San Francisco	USA	Prosthodontist	3	
4	University of Michigan	USA	Master	3	Surgical Implant placement
5	Harvard School of Dental science	USA	Prosthodontist & MMSc in oral biology DMSc	3 4	
6	Indiana University	USA	MSc in Dentistry (MSD)	3	
7	Boston University	USA		3	Surgical Implant placement
8	University of Rochester medical center	USA			
9	University of Florida	USA	Prosthodontist, MScDS	3	Surgical Implant placement
10	Tufts University	USA	Prosthodontist, MS	3	
11	UT Health science center at Houston	USA	Prosthodontist+MSc	3	Surgical Implant placement
12	UT Health San Antonio	USA	Prosthodontist+MSc	3	
13	Ohio State university	USA	MS plus certificate	3	
14	University of Central Lancashire	UK	MSc	3	
15	University of Edinburgh	UK	DClinDent MClinDent	3 2	Prosthodontics, Endodontics, Periodontics and Restorative Dentistry
16	King's college London	UK	MlinDent	3*	
17	University College London	UK	MClinDent	2*	
18	University of Dundee	UK	MDSc	2*	
19	University of Sheffield	UK	DClinDent	3*	Prosthodontics, Endodontics, Periodontics and conservative Dentistry
20	Trinity College Dublin	Ireland	P.Grad.Dip. in Clinical Dentistry	1	
21	Trinity College Dublin	Ireland	Professional Doctorate in Dental Surgery (D.Ch.Dent.)	3	
22	University of Sydney	Australia	DClinDent	3	
23	University of Melbourne	Australia	DCD in prosthodontics	3	
24	University of Adelaide	Australia	DCD in prosthodontics	3*	
25	University of Otago	New Zealand	Postgraduate Diploma in Clinical Dentistry	2*	
26	University of Otago		DClinDent	3*	
27	University of British Columbia	Canada	Combined MSc and Diploma in Prosthodontics	3	
28	University of Toronto	Canada	MSc	3*	
29	Medical University of Vienna		MSc	2*	
30	Malmo University	Sweden	Oral Prosthodontics	4	
31	University of east	Philippine	Master of science in dentistry	3	
32	University of Malayav	Malaysia	Master of Restorative Dentistry (Prosthodontics)	4-7	
33	Chulalongkorn University	Thailand	MSc	2	Restorative and implant dentistry

34	The University of Hong Kong		Master of Dental Surgery in Prosthodontics	3	provide dental surgeons with advanced training in prosthodontics
35	European University College	UAE	MSc in Restorative & Prosthodontics	3*	Restorative & Prosthodontics
36	National University of Singapore	Singapore	Master of Dental Surgery in Prosthodontics	3*	
37	University of Witwatersrand	South Africa	Prosthodontist	4*	
38	University of Pretoria		MChD in Prosthodontics MSc (only by research) Diploma in Dentistry(prosthodontics)	4* 2 1	
39	MSA University	Egypt	Master in Conservative and Esthetic Dentistry	2.5**	Operative Dentistry, Fixed and Removable Prosthodontics, Endodontics and Dental Materials
40	Future University	Egypt	Master	2*	Prosthetic dentistry Fixed prosthodontics
41	Damascus University	Syria	Prosthodontist	3	
42	Tehran University of Medical Sciences	Iran	Prosthodontist	3	

Table 1. The name of countries, their universities, the granted degree, duration of the program and conjunct specialties.

MDSc: Master in Dental Science.

DCD: Doctor of Clinical Dentistry.

MScDS: Master of Science in Dental Sciences.

MChD: Master of Dental surgery.

Discussion

Recognition of prosthodontics as a specialty

According to Owall et al. about 50 countries around the globe have recognized Prosthodontics (Prosthetic Dentistry) as specialty [9]. It was first recognized in United states of America in 1948 and later on in 1965 in Canada [11]. British Society for the Study of Prosthetic Dentistry, was founded in 1953 [12]. Australian society of prosthodontics was founded in 1961 [13].

Europe consists of about 50 countries and 28 of them are members of European Union. About 20 countries including Switzerland and Sweden have "Prosthodontics" or "Prosthetic Dentistry" specialty [9]. Most of remaining countries such as Germany and France only recognize orthodontics, oral surgery, pedodontics and periodontics as specialty. However, in these countries there might be graduate training programs in prosthetic dentistry [9] offered by the universities but not recognized by the governments [14]. In Asia, China has recently launched dental residency programs [15]. Although Japan prosthodontics society was founded in 1933, a board certification system for prosthodontic specialists was established in 2005 [16]. In India, first postgraduate degree in prosthodontics (MDS) was started in 1959 [17]. In Saudi Arabia postgraduate dental education programs started in 1990 and the first group graduated from the Prosthodontics Master's Degree program in June 1993 [18]. In Iran the program began in 1975.

Duration of the programs

The advanced specialty education program must provide special knowledge and skills beyond the D.D.S. or D.M.D. training. American Commision on Dental Accredition (CODA) has suggested minimum 34 months duration for the program in order to successfully address educational requirements, patient care services and conducting a research [19]. The time might be extended because of completion of complex cases or succeeding research projects. If the program includes maxillofacial training the duration should be 45 months [19].

It is proposed that 30% of the total time of the program to be devoted to didactic instructions and research. A minimum of 60% of the total program time must be devoted to providing patient services, including direct patient care and laboratory procedures. The majority of the programs surveyed in this study including Iran were of 3 years duration. It was four years for sweden, Malaysia, South Africa, Pretoria and Harvard university. UK, Australia, New Zealand, and Pretoria had shorter programs too.

Standards for Facilities and Resources

The institution which offers the advanced program must have physical, clinical and laboratory facilities and resources required to successfully meet the goals of the program including easy access to equipments and supplies necessary for managing medical emergencies, sufficient completely equipped operatories and laboratory space to accommodate the enrolled residents and accessible radiographic equipment [19]. Also the number of academic and faculty staff, and laboratory technicians must be enough to fulfill the educational requirements of the program. Library, digital and audiovisual resources must be well equipped and accessible [19].

Standards for Curriculum

Didactic Program

The standards set by CODA for didactic part of the program [19] are mentioned below.

Instructions must be provided at the in-depth level (thorough knowledge of concepts and theories for the purpose of critical analysis and synthesis) for the diagnosis of diseases affecting prosthodontic treatment, including caries risk assessment and intervention; and in the following areas:

a. Fixed prosthodontics.

b. Removable prosthodontics.

c. Implants and implant therapy.

d. Occlusion.

e. Esthetics.

f. Biomaterials.

g. Digital technology.

h. Wound healing.

i. Surgical principles.

j. Infection Control.

k. Craniofacial anatomy and physiology related to prosthodontic therapy including dental implant placement.

l. Diagnostic Imaging, including three dimensional imaging related to prosthodontic therapy including dental implant placement.

m. Prosthodontic diagnosis and treatment planning.

Residents must receive instructions at the understanding level (Knowledge and recognition of the principles and procedures involved in a particular concept or activity) in each of the following biomedical areas:

a. Oral pathology.

b. Applied pharmacology.

c. Oral microbiology.

Instruction must be provided at the understanding level in each of the following clinical areas:

a. Temporomandibular disorders and orofacial pain.

b. Evidence-based health care principles including identifying, appraising and applying available evidence.

c. Ethics and professionalism.

d. Preprosthetic surgery.

e. Geriatric considerations in prosthodontic care.

f. Maxillofacial prosthetics.

g. Medical emergencies;

h. Research methodology.

i. Pain control and sedation.

Students/Residents must receive didactic specialty instruction in following subjects:

a. Craniofacial growth and development.

b. Biostatistics.

c. Intraoral photography.

d. Practice management.

e. Scientific writing.

f. Sleep disorders.

g. Teaching methodology including public speaking.

h. Behavioral science.

Clinical Program

Residents should achieve clinical competence at the prosthodontic specialty level in the following areas [19]:

a. Patient assessment, including medical history, dental history, temporomandibular assessment, extraoral and intraoral examination, radiologic assessment and occlusal analysis.

b. Systemic, infectious and neoplastic disease screening, including patient education for prevention.

c. Diagnosis.

d. Risk assessment and prognosis.

e. Treatment planning.

f. Adjunct referral.

g. Patient Care.

h. Outcomes assessment.

i. Maintenance.

Students/Residents must be competent in:

a. The application of principles related to caries risk assessment and intervention.

b. Managing and treating a wide scope of complex clinical conditions for edentulous, partially edentulous and dentate patients.

c. The application of principles associated with fixed prosthodontics, removable prosthodontics and implants, and as members of a treatment team.

d. The application of evidence-based health care principles, regarding principles of ethical decision making pertaining to academic, research, patient care and practice environments.

e. The application of principles of esthetic dentistry.

f. The placement and restoration of dental implants including referral.

g. Leading and coordinating oral health care with other members of the health care team.

h. Selection and application of biomaterials recognizing esthetic, biomechanical and biocompatibility implications of prosthodontic therapies.

i. The application of digital dentistry and its principles.

j. Laboratory procedures used in the treatment of edentulous, partially edentulous and dentate patients.

k. The prosthodontic management of patients with temporomandibular disorders and/or orofacial pain.

Students must have experience with patients requiring maxillofacial prosthetic care.

Minimum Requirments for Achieving Competency Suggested by International College of Prosthodontics. In July 2014 International College of Prosthodontics published guidelines for the education and training of specialists in Prosthodontics and minimum requirements for achieving competency at specialty level. The followings are ICP suggested guidelines.

ICP Suggested Minimum Requirments For Pre-Clinical Courses

a. Construction of at least one cast gold and one all-ceramic crown, one ceramo-metal crown with shoulder porcelain, an implant-supported crown and a CAD/CAM restoration from preparation to delivery including all laboratory works.

b. Construction of provisional crowns and bridges by direct and indirect methods.

c. Construction of a direct and indirect dowel and core.

d. Programming of a variety of articulators.

e. Occlusal analysis exercise on casts mounted on a semi-adjustable articulator, and methods for occlusal equilibration.

f. Occlusal waxing exercises building up stable, static and dynamic occlusal relationships.

g. Carrying out all the laboratory work for at least one case of complete dentures. To provide characterisation of gingiva, flange and teeth.

h. The production of a minimum of 10 design drawings for each of acrylic- and metal-based dentures.

i. The laboratory procedures for the processing of at least one acrylic-based denture incorporating preformed wire components.

j. The observation of all stages in the construction of a cast metal base.

k. The creation of wax replicas for an auricular, nasal, orbital and/or facial prosthesis.

l. The laboratory procedures for one case of a bar and clip retained implant supported overdenture.

ICP Suggested Minimum Requirments For Complete Removable Denture Clinical Courses:

a. At least 5 sets of complete dentures, with a difficulty factor (for example extreme residual ridge resorption, neuromuscular disorders, following trauma or cancer, children, immediate dentures).

b. Competence must be demonstrated in different ways of achieving jaw registration positions using extra-oral and intra-oral registration methods.

c. Use of different occlusal schemes, in particular cusped articulation and lingualised occlusion, for different skeletal jaw relations and according to clinical indications.

d. Different techniques (for example for taking impressions) must be demonstrated.

e. In addition, 3 single maxillary dentures opposing natural teeth must be made, as well as the use of a duplication technique for 2 cases.

ICP Suggested Minimum Requirments For Partial Removable Denture Clinical Courses:

a. At least 5 conventional metal-frame partial dentures, using different techniques such as altered cast, dual path of insertion.

b. At least one precision attachment denture.

c. Overdentures of different designs.

d. Acrylic-based dentures with preformed components.

ICP Suggested Minimum Requirments For Fixed Partial Denture:

a. The use of face-bow recordings and appropriate inter-occlusal recording materials and methods to mount models on a semi-adjustable articulator, to appropriately adjust the articulator, and to use custom incisal guide tables and diagnostic wax-up procedures.

b. The use of a suitable scheme to analyse a natural dentition and carry out a systematic adjustment of the natural occlusion to produce an optimum and harmonious occlusal scheme within the patient's stomatognathic system.

c. Make appropriate recordings, construct, fit, and adjust a Michigan type occlusal splint.

At least 5 completed cases demonstrating total patient care and interdisciplinary management incorporating the following aspects:

a. The rehabilitation of posterior occlusal surfaces using cast restorations.

b. The restoration of missing teeth by means of resin-bonded retained prostheses, both metal and porcelain based, as well as with the use of polymer impregnated fibres.

c. Rehabilitation of the complete dentition with combinations of individual crowns and fixed partial prostheses (bridges).

d. Rehabilitation of the dentition for a periodontally compromised patient.

e. Restoration of function for severe attrition.

f. Restoration of function for severe bone loss.

g. Cases including the use of implants.

ICP suggested clinical courses for implant dentistry:

a. Interdisciplinary planning for the placement of implants, including the use of special investigations

such as imaging, rapid prototyping, templates, interim prostheses, etc.

b. Participation in the surgical procedures for the placement of implants both intra- and extra-orally.

c. The design and placement of implant retained prostheses for complete and partial tooth loss.

d. The use of removable prostheses over implants, both with individual retainers, bar and clip retainers, ball and precision-attachment retainers, etc.

e. The restoration of missing teeth with single and multiple implants.

f. The fixed restoration of the severely resorbed maxilla and mandible.

g. Exposure to different technologies for the construction of implant supported prostheses such as CAD/CAM, milling, casting, etc.

h. The management of complications by treating patients in an implant maintenance clinic.

ICP Suggested Clinical Courses for Maxillofacial Prosthodontics:

a. Participation in the planning of cases with different surgical and allied disciplines including the use of special investigations such as imaging, rapid prototyping, templates, interim prostheses, etc.

b. Colour matching of prostheses to skin tones.

c. Impressions for the following:

- o Facial moulage.
- o Undercut lesions (2 or more parts).
- o Palatal defects.
- o Velo-pharyngeal defects.
- o Optic and orbital defects.
- o Auricular defects.

d. The use of a variety of different speech prostheses.

e. Restoration of a variety of congenital or surgically created defects such as facial features, maxillectomies, partial and complete mandibulectomies, palatal defects, etc.

f. The use of a variety of retention devices for prosthesis, both intra- and extra-oral, including the use of implants.

g Participation in clinics providing neo-natal care such as for cleft palate patients.

h. Participation in clinics providing radiation oncology.

i. The management of radiologically and immunologically compromised patients.

ICP also suggested completion of at least 5 cases of interdisciplinary care, managed and documented in cranio-mandibular disorders and orofacial pain.

ICP suggested that proficiency in dental geriatrics includes:

a. Knowledge of the physiology of aging and the influence of medications and disease on oral healthcare for a geriatric population.

b. Understanding of the delivery of oral healthcare to frail elders.

c. Management of oral healthcare in geriatric clinics, long-term care facilities, palliative care, and other supportive environments for in-patients and out-patients.

d. Delivery of oral healthcare to a range of abled and frail elders.

e. Collaborative practice on inter-professional teams with other healthcare providers in the medical and social services associated with the needs of frail elders.

Clinical competence includes modification, adaptation and use of appropriate techniques in the treatment of the elderly patient with a partial or transitional dentition, as well as in the provision of complete dentures for the elderly patient. In Iran, specialty curricula are developed by ministry of health, treatment and medical training. Universities are allowed for minor modifications to the programs. Iranian prosthodontics specialty program, from total 2915 hours, 586 hours are didactic courses, 1921 hours are clinical courses and 408 hours are workshops.

Awarded Degrees

The titles awarded to the graduates of prothodontics specialty programs also differ. Master of Scince (MS) is awarded by 14 universities as “MS” and by 9 universities as “MSc”. The title awarded by Universi-

ty of East is "Master of science in Dentistry" (MScD). Harvard grants " Master of Medical Science" (MMSc), that is a double master of science.

India, Indiana University, National university of Singapore and University of Hong Kong awarded "Master of Dental science" (MDS). The University Of Connecticut, university of Dundee and Malmo university awarded "Master of Dental Science" (MDSc). In the MDSc and MScD programs there was more research based credits. These four universities offered their programs as MClinDent: University of Edinburgh, University of Malaya, King's college London University and College London. "MClinDent" stands for Master of Clinical Dentistry and this is the title mainly awarded in English Universities. Accredited by the Australian Dental Council, Universities of Sydney, Melbourne, Adelaide and Otago awarded "Doctor of Clinical Dentistry" (DClinDent).

University of Florida and University of Toronto awarded their graduates "Master of Science in Dentistry" (MSD) degree. The graduates of Boston University are granted CAGs title- Certificate of Advanced Graduate Study. Trinity College of Dublin granted its graduates D.Ch.Dent, which stands for professional Doctorate for Dental Surgery Degree, a degree accredited by the Irish committee for specialist training in Dentistry. As mentioned the MSc and MDSc degrees are more research based. The MSc degree almost corresponds to specialty training in some countries, but in some other, including Switzerland, it is applied to research in basic sciences, with no clinical training [14]. In Switzerland, the specialty training is called "Master of advanced studies in prosthodontics". Finland has specialty in Clinical Dentistry that includes periodontology, cariology/endodontics, prosthetic dentistry, and stomatognathic physiology, paediatric dentistry and diagnostics (including oral pathology and oral radiology) [9].

UK has both speciality in Prosthodontics and speciality in Restorative Dentistry which includes Periodontology, Endodontics and Prosthodontics (Prosthetic Dentistry) [9]. Some other universities had prosthodontics and restorative dentistry in a single specialization. Representing 31% of the total, 13 universities, including Iran had separate restorative dentistry specialty. Universities like University of Florida and University of Sydney offerd certificates in restorative dentistry. Some other offered it as PG Diploma like University of manchester and King's College London. The policy of countries regarding the certified specialists deffers. In some countries specialists might be restricted to work only in their specialty field and are not allowed to practice as general dentists. In other countries there is no restriction. On the other hand the non specialists are not allowed to advertise themselves as specialists [9]. In Iran prosthodontists are not restricted to their specialty field.

The quality of graduate and postgraduate prosthodontics programs plays an important role in the reduction of legal claims against dentists after prosthetic treatments. This kind of lowsuits is high at least in iran and is reported to be high in other countries like Sewden and Saudi Arabia [22,23]. In 2012, the JPS Global workshop took place in Tokyo, Japan, focusing on the current status of the prosthodontics specialty, including the requirements for specialty training in different regions of the world. In their consensus statement, they asked for prosthodontics to be recognized as specialty in all countries [24].

Conclusion

The reasults of this study showed that:

- The specialty of Prosthodontics is not recognized around the globe.
- In countries that the specialty is recognized, there are rigorous guidelines to set the curriculum, to improve the standards education and patient care.
- The title of degree awarded to the graduated residents is different in different countries.
- The duration of the program in most countries is three years.
- There are specialty programs training prosthodontics in conjuction with other diciplines.

Conflict of Interest

There is no conflict of interest to declare.

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