

UNDERGRADUATE IMPLANT EDUCATION IN AUSTRALIAN AND NEW ZEALAND DENTAL SCHOOLS

Dr John Hyun Uk Cho

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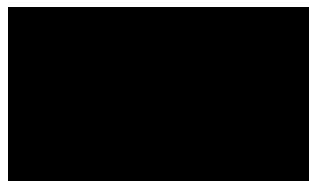
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May the words of my mouth and the meditation of my heart
be pleasing in your sight,
O LORD, my Rock and my Redeemer.

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Abstract

Background: The teaching of implants within dental schools in Australia and New Zealand has responded to the challenges of providing students with the most contemporary and evidence-based forms of dental treatment. The purpose of this study was to provide an overview of the history and current status of oral implant teaching in undergraduate (or pre-doctoral) dental programmes in Australia and New Zealand, compared with dental schools from Europe and North America.

Methods: A written questionnaire was sent out to all the dental schools across Australia and New Zealand in 2006 and repeated in 2008 to gather information relating to the content, delivery, and assessment of implant programmes. In addition, a review of the literature on implant education was undertaken via a Medline search.

Results: All six dental schools surveyed in 2006 and all seven schools surveyed in 2008 indicated that they delivered implant programmes at an undergraduate level. The schools varied significantly in 2006 in the content of their programmes; however, these differences were less significant in 2008. A review of the literature revealed similar trends in North America and Europe, albeit at an earlier stage compared to Australia and New Zealand.

Conclusions: Dental schools within Australia and New Zealand have responded appropriately to the increasing need for dental implant education. Future developments in implant programmes need to address the multi-disciplinary nature of implant treatment as well as incorporate newly recognized standards of care by equipping students with the necessary skills to evaluate the evidence.

Key words: dental implants, teaching, education, undergraduate, predoctoral, Australia, New Zealand, dental schools, curriculum.

Introduction

The introduction of osseointegrated implants to dentistry by Branemark in 1977¹ significantly advanced and changed forever the methods of tooth replacement in dental rehabilitation. Not only has the range of treatment options increased for both the practitioner and the patient, expectations of the community have also progressed. Practitioners therefore require new knowledge and skills sets to meet these changes. As always, the needs of the community must be an indicator and guide for the education of future practitioners, who must be prepared and equipped to implement the most appropriate evidence-based treatment. The challenge of educating the profession, both at tertiary and post-graduate levels requires a judicious assessment of the needs of the community, the treatments available, and the evidence-base surrounding them. To that end, dental schools within Australia and New Zealand have begun to incorporate the teaching of dental implants within their curricula. The historical data available on the teaching of oral implants within these schools has been sparse. There is only one study (Henry and Klineberg, 1995²) outlining the results of a brief survey undertaken in 1993, which showed a large variance between the schools in terms of didactic programmes, course content, and clinical exposure.

The purpose of this study was to provide an overview of the history and current status of oral implant teaching in undergraduate (or predoctoral) dental programmes in Australia and New Zealand, compared to that from Europe and North America.

1. LITERATURE REVIEW- THE INTERNATIONAL PERSPECTIVE

1.1. Introduction

Whilst the reporting in the literature with regards to dental education in general is expansive, the relative novelty of implant treatment and the education of students in this field have limited the amount of scientific reporting. The inevitable delay between empirical research, primary clinical application and widespread acceptance into mainstream clinical practice has resulted in a 'time-shifted' or delayed reporting of the ways in which new clinical knowledge is transferred to educators and students. Both clinicians and researchers, especially those who have undertaken studies to examine clinical efficacy, have always had concerns about the time taken for novel treatments to reach widespread use. Indeed, even consensus statements which have produced new standards of care for patients have been slow in being adopted by clinicians and by educators and their students. In addition, the increasingly litigious nature of society, coupled with generally higher expectations of quality of life outcomes for patients, necessitate a professional, legal and ethical obligation to inform patients of and implement the best available standards of care in accordance with the most up to date literature. This process must begin at the 'grassroots' level of teaching future professionals how to critique and implement new health care technologies. The aim of this study is to critically examine the available literature in the field of implant education specifically at the undergraduate level.

1.2. Methods

The available literature was searched using a MEDLINE search engine and the following keyword terms: *dental implants, dental education, curriculum, undergraduate, pre-doctoral, teaching, students*. The terms were combined with *and/or* parameters to yield appropriate articles. Strict limits of English language and date of publication between 1990 to 2008 were placed in order to maximize the number of relevant articles returned. Additional searching of references from the selected articles was also performed, in conjunction with hand-searching of relevant publications for the last 10 years.

1.3. Search results

The MEDLINE search yielded a total of 26 articles, of which ten were selected as being relevant and appropriate. Additional searches in the journals and article reference lists yielded an additional 14 articles, creating a total of 24 articles. These articles were then sorted according to geographic regions – North America, Europe, and others. For the purpose of this review, key papers representing the best quality of evidence reporting on the status of educational of implant treatment in these regions at the undergraduate or pre-doctoral level were selected.

1.4. Discussion

Much of the available literature regarding dental implant education at an undergraduate level is derived from surveys of educational institutions, educators, and their students. The earlier studies (i.e., pre-1990, and early 1990s) were largely generalized surveys which gave large overviews of the status of dental implant education in the United States and Europe, with some studies arising from Australia in the early 1990s. One of the earliest studies in the United States (Chappell, 1974³) showed that by 1974, 20 per cent of dental schools presented implant lectures to both pre-doctoral and doctoral students. At that time, however, the implant systems being taught and utilized were not the same type being used today and consisted largely of sub-periosteal or submucosal-type implants, rather than the osseointegrated implants currently available. Nonetheless, the data from that period is valuable in providing a background to today's educational perspectives, keeping in mind the new teaching paradigms and modalities which have arisen in the last decade.

By 1989, in the United States at least, there was a significant increase in the teaching of implants both at predoctoral and graduate levels as demonstrated in a survey by Bavitz⁴ (1990) which showed 73 per cent of schools were delivering implant lectures at the predoctoral level. Similarly, Arbree and Chapman's⁵ (1991) study of implant education programmes in North American dental schools stated that 65 per cent of schools (52 respondents) taught implants to predoctoral students. However, this survey outlined the amount of exposure to implants and degree of involvement of students and found that most of the programmes offered lectures but very little practical components such as laboratory, pre-clinical or clinical exercises. Whilst 74 per cent of schools reported 1-6 hours of didactic teaching, only 7 per cent of predoctoral

students were included in treating implant patients and 3 per cent allowed students to perform implant prosthetic laboratory work. Interestingly, some of the schools reported an elective approach to some components of their implant course (e.g. prosthodontics or surgery), with only advanced students being considered for participation in aspects such as surgery. A reported commonality with all of the schools however, was recognition of the need to present implant teaching as an interdisciplinary responsibility and prosthodontics being most commonly involved, followed by oral surgery and then periodontics.

In 1990, the American Association of Dental Schools and the American College of Oral Implantology formulated and approved curriculum guidelines for predoctoral implant dentistry⁶. These guidelines suggested that on completion of the dental school programme, graduates should be familiar with and discuss aspects of implant dentistry including the historical background and current trends. Graduates should also be able to compare oral implants use with other modes of treatment and provide a basic description of the surgical and prosthodontic procedures. The guidelines recommended that students be given didactic instruction in implant dentistry and that courses should be aimed at providing basic knowledge and understanding.

By 1993, Weintraub et al⁷ reported that 86 per cent of US dental schools provided an implant dentistry curriculum. Their survey of 53 dental schools showed that of the 50 respondents, 43 indicated that they had an implant programme and five others had plans to establish a programme within the next three years. However, two of the schools had a separate implant course which was not an integrated part of the general dental curriculum and four had separate implant dentistry departments. Those without implant programmes cited reasons of lack of financial resources,

inadequate curriculum time and teaching of oral implants as part of their postdoctoral programmes. Questions regarding the history of implant teaching showed that almost 70 per cent of the schools had taught implants at a predoctoral level at least since 1991. Pre-clinical laboratory experiences were offered by 42 per cent of schools with an implant programme; of those, over 80 per cent included less than 10 hours of laboratory instruction. Clinical experience varied across the schools, with a minority (6 per cent) permitting students to place implants in patients and a larger proportion (48 per cent) participating by assisting in surgery. Participation in restorative procedures for implants was more common (88 per cent) but when all clinical experiences were considered, a large majority (83 per cent) of schools only permitted selected students to be involved. In most schools, teaching of implant dentistry was carried out as a collaboration between departments, with periodontics and oral surgery being the major providers of teaching, followed by prosthodontics.

Lim et al's⁸ 2002 survey of US dental schools revealed that 84 per cent of the respondent schools (32 in total) required their predoctoral students to undertake an implant course, with 84 per cent having established a course since 1991. Again, the proportion of teaching in didactic, pre-clinical and clinical areas varied greatly between schools. Seventy-three per cent required laboratory work, 69 per cent required students to be present at surgery and 88 per cent reported that students restored implant cases, ranging from single units to multiple unit bridges and implant-retained overdentures. This study also included detailed information regarding the content of the courses offered which often reflected the changing paradigms of implant dentistry. For example, all schools surveyed with the exception of one reported that they did not

advocate the connection of implants to natural teeth for fixed partial dentures, based on the outcomes of research in this area.

A survey undertaken in 2004 by Petropoulos et al⁹ of 56 dental schools across the United States and Canada found that of the 39 respondents, 38 (97 per cent) provided didactic instruction on implants. In comparison to the study by Arbree⁵ in 1991, this survey found that a much higher proportion of schools provided some hands-on clinical experiences (86 per cent), although it was not an actual requirement in most of these schools and only a minority of students participated in the programmes. The most common implant restorations were single teeth (molars and premolars), followed by mandibular overdentures retained by two implants and ball abutments. Further detail was provided by the responding schools regarding reasons for not including certain aspects of implant teaching (such as clinical experience in restoration). Common reasons included lack of finance, difficulties in finding adequately qualified teaching staff and lack of appropriate patients. Notwithstanding, most schools were in the process of planning and developing future programmes to include a wider range of clinical experiences. Various specialist staff across a number of disciplines were involved in teaching different aspects of the course (e.g. restorative, surgical).

Similarly, most of the research on implant education in Europe has been gathered from surveys and questionnaires from educational institutions. One of the earliest studies by DeBoever¹⁰ (1989) described the teaching of prosthodontics in general across undergraduate and graduate programmes. A survey consisting of 25 questions was sent to 42 prosthodontics department heads across five European

countries and of these, 32 respondents provided data on their programmes. DeBoever outlined six essential factors for a basic prosthodontic education, one of which was the need to recognize the significant evidence-base supporting the success of implant therapy. However, in a reflection of the relatively minor role of implants in prosthodontics at the time, only a single question was asked regarding the teaching of implant prosthodontics, under the category of 'maxillofacial prosthetics and implant prosthodontics'. Eleven of the 32 respondent schools indicated that they taught implant prosthodontics, while 18 did not. It is interesting to note that at that time, it was widely recognized that implant prosthodontics would become the treatment modality of choice for partially and fully edentulous patients and yet most schools lacked emphasis in providing for future-directed teaching within their curricula.

In comparison, Watson¹¹ in his 1992 survey of the teaching of osseointegrated implant dentistry in schools in the United Kingdom (UK) and Ireland found that all 17 respondents (from 18 schools contacted) delivered implant teaching. His comments regarding the delayed uptake of osseointegrated implants across the UK and Ireland are noteworthy in their recognition of the fact that implants had a poor reputation prior to 1985 due to the unsubstantiated and often questionable success rates of previous 'implants' of varying materials and designs, some with broad-ranging and catastrophic consequences. This study revealed that while the majority of the teaching was provided by prosthodontics departments in most schools (17), other departments were also often involved, most commonly oral and maxillofacial surgery and periodontics. By this stage, most schools had already adopted a 'team approach' to implant teaching. Whilst a wide variety of implant systems were in use, the majority of schools used either the Branemark (12) or Straumann (7) systems. Most of the

teaching consisted of lectures (no more than five), and case presentations; however, other experiences were limited – only two schools provided training in laboratory techniques, and one school in clinical techniques. Others supplemented their didactic teaching with attendance at surgery, consultation clinics, and observation of prosthodontic procedures.

One of the most extensive surveys across several countries outside of the United States was carried out by Seckinger et al¹² in 1993, who collected data from 44 respondent schools (from 55 contacted). Of these, 55 per cent offered an undergraduate implant programme, while others cited reasons (most commonly) for not having an implant programme as lack of curriculum time, financial and staffing resources, as well as the belief that implants should be taught at a higher level. However, 60 percent of these schools (12) reported plans to incorporate implant teaching into their curricula within the next five years. In a reflection of the American dental schools, most (81 per cent) of the implant courses available had been offered within the last four years (since 1989). Again, the departments of prosthodontics and oral surgery were the main providers of implant teaching, with most of the teaching being didactic, although the amount of time dedicated to this was unspecified. Most schools covered similar topics of instruction, including the concept of osseointegration, historical overviews, pre-surgical assessment, and surgical procedures; while the least common topics covered were surgical complications and biomaterials. In addition, 38 per cent of schools offered laboratory instruction, and 46 per cent provided some clinical experiences, ranging from implant placement (one school) and surgical assisting (nine schools) to implant prosthodontic rehabilitation (11 schools). Similar to the US study by Weintraub et al, most schools permitted only select student

participation in clinical treatment than those which allowed all students to be involved at this level. Finally, geographical analysis of the data carried showed that implant education was more prevalent in schools in industrialized nations.

Following on almost a decade later, Ashfarzand et al¹³ (2005) gathered similar data from 40 schools across Europe in a survey containing 32 questions detailing the extent and content of their implant teaching. Of these, 75 per cent required their students to take a course in implant dentistry, while most of the ten schools that did not, cited reasons of lack of curriculum time and financial resources. However, it should be noted that three of the schools without dedicated implant courses indicated that their implant lectures were integrated as part of a restorative / prosthodontic course. Compared to previous studies, there was a greater degree of interdisciplinary involvement in implant teaching, with most of the collaboration being between prosthodontics, oral surgery, and periodontics departments. The mean number of lecture hours was 15.5, ranging from 10 to 50. Given this relatively high emphasis on didactic teaching, only 10 per cent of schools made lectures available for students to access on the internet. Thirty-seven per cent of schools reported having a laboratory component to their implant course; of these, 91 per cent required less than ten hours of laboratory work. Once again, clinical experiences were limited, with 63 per cent of schools requiring students to be present at surgery, and 37 per cent with students restoring implant cases. Although this is a significantly larger proportion than reported by Watson¹¹ in his 1992 survey of the UK and Ireland, it is consistent with the emphasis on providing students with the ability to adequately inform patients regarding implant therapy rather than equipping them with the skills to provide treatment. Interestingly, perhaps in a reflection of the difference of philosophies, 43

per cent of the European schools surveyed advocated connection of implants to natural teeth, compared to Lim's survey of the US (in the same year) where 94 per cent (of a similar number of respondents) of schools did not advocate this treatment approach. Historically, Europe and North America had a comparable introduction of implant teaching at the undergraduate level; 77 per cent of schools in Europe had a programme in place by 1999, and 90 per cent by 2000.

Finally, there is a paucity of literature available on implant education outside of Europe and North America. Specific to the Asia-Pacific region, a limited survey of the dental schools of Australia and New Zealand was carried out by Henry and Klineberg in 1993². This was the first of its kind in this region and though brief, it provided the foundation on which educators could analyse and compare their curricula with the rest of the world. The results showed a variety of experiences ranging from two to six hours of lecture time, and limited surgical observation and laboratory exercises. One school reported plans to further develop their implant programme with the introduction of implant-retained overdentures and pre-clinical exercises in single-tooth procedures. The problem of lack of curriculum time was apparent again, with one school opting to offer an implant elective outside of normal university hours, and met with significant success. Conclusively, this survey showed and recognized the fact that schools within this region were not at the same level of provision of implant training as those in Europe or the United States, while also recognizing the lack of practical hands-on experiences in all schools across the world.

2. AUSTRALIAN AND NEW ZEALAND DENTAL SCHOOL SURVEY

2.1. Methods

In 2006, a written questionnaire (appendix i) was sent to all dental faculties at universities across Australia and New Zealand. The questionnaire contained both directed and open questions regarding the content, duration, delivery, assessment, and future planning of implant programmes offered, as well as opportunities to expand on certain responses. Questionnaires were sent by fax, ordinary post, or email to the appropriate head of department, dean, or senior educator who was most informed about the oral implant teaching within that faculty. Respondents were given one week to complete the questionnaire and return it to the sole administrator of the questionnaire. After one week, non-respondents were reminded and given a further seven days to respond. Any questionnaires which were not completed or required further explanation of any of the answers were followed-up by email or telephone. Data from this survey was presented by Professor Klineberg at the education forum at the Nobel Biocare World Conference in Sydney in 2006.

The same process was repeated in 2008 with one additional school which was established after 2006.

The questionnaires completed were collated and data extracted analysed to create comparisons between the dental schools, provide an overview of the different aspects of the implant programmes offered, as well as reporting the evolution of dental implant education within these schools.

2.2. Results

In 2006, all six of the dental schools contacted responded to the questionnaire. Griffith University dental school was added to the 2008 survey and all seven schools responded.

2.2.1. Lecture programme (see table 1)

In 2006, all six responding schools presented lectures across a variety of topics within a number of disciplines, including prosthodontics, periodontics, and oral surgery. Most lectures were given in the senior years of the programme, with between 4-16 hours of lecture time. The most common topics were biology of implant treatment, site assessment, treatment planning and surgery (all schools), and the least common were implant loading, failure, and abutment selection (covered by three schools only). Other topics including case selection, implant systems, and maintenance were well represented in all six schools.

Follow-up data from 2008 showed an increasing number of hours dedicated to seminars and lectures, as well as a greater range of material covered by most schools. Significantly, the addition of Griffith University also saw the introduction of a new discipline (implantology) being involved in implant teaching.

2.2.2. Pre-clinical programme (see table 2)

Five of the six responding schools in 2006 delivered a pre-clinical programme, varying in length from three to ten hours. Of these five programmes, two had provisional crown fabrication exercises, three prepared single-tooth casts, four performed single

tooth impressions, and all five delivered exercises in implant componentry. The most common systems used were Nobel Biocare and Straumann.

It is interesting to note that whilst the number of schools delivering a pre-clinical programme did not increase in 2008, the range of exercises and experiences broadened across most schools, with one school adding implant placement to their programme, and in another simple restorative procedures.

2.2.3. Clinical programme (see table 3)

In 2006, four schools offered a clinical component during the final years of their course; of these, three involved clinical observation of either staff or post-graduate students or both, and one involved actual restoration of single teeth by students. Two schools involved their students in the treatment planning process, and the hours involved in total for the clinical programme varied from three to eight hours, depending on the clinical cases presented and observed.

Similarly in 2008, four schools offered a clinical component consisting of single tooth restorations. Additionally, students were involved in surgical procedures, as well as in areas of treatment planning, surgical guide fabrication, and restoration of implant overdentures. Interestingly, two of the schools had an elective / selective approach where students could either elect or were selected to undergo implant training in their senior years.

Table 1. Lecture programme

Lecture programme - 2006											
Topics											
	Year / disc.	Hrs	Bio.	Sys.	Case selec.	Site asses.	T/P; surg.	Impl. abut.	Load.	Fail.	Maint.
Ade.	3 Perio 4 Res 5 Inter		Y	Y		Y Y	Y				Y
Melb.	4 Pros	9	Y		Y	Y	Y	Y	Y	Y	Y
Otago	4	10	Y	Y	Y	Y	Y				
Sydney	1 Pros 3 Res 4 OS, Perio	1 6 6	Y	Y	Y	Y	Y	Y	Y	Y	Y
QLD	3 4	4	Y	Y	Y	Y	Y				
WA	3 Pros 4 Perio 5 OS	1 16 5	Y	Y	Y	Y	Y	Y	Y	Y	Y

Lecture programme - 2008											
Topics											
	Year / disc.	Hrs	Bio.	Sys.	Case selec.	Site asses.	T/P; surg.	Impl. abut.	Load.	Fail.	Maint.
Ade.	3 Perio 4 Res 5 Inter		Y	Y		Y Y	Y				Y
Melb.	4 Perio, Pros, OS	10	Y	NB	Y	Y	Y	Y	Y	Y	Y
Otago	3,4,5 / Perio, Pros, OS	10+	Y	Y	Y	Y	Y	Y	Y		Y
Sydney	1,3,4 / Perio, Pros, OS	10+	Y	NB	Y	Y	Y	Y	Y	Y	Y
QLD	1,2,3 / Pros, Oral Rehab.	12	Y	NB, As, 3i, S	Y	Y	Y				Y
WA	see plans for 2009/2010										
Griffith	4 / implantol.	13	Y	NB, As, 3i, S	Y	Y	Y	Y	Y	Y	Y

Legend: Ade. = Adelaide, As = AstraTech, asses. = assessment, Bio. = Biology, disc. = discipline, Fail. = Failure, impl.abut. = Implant abutment selection, Implantol. = Implantology, Sys. = Implant system, Inter = Interdisciplinary, Load. = Loading, Maint. = Maintenance, Melb. = Melbourne, NB = Nobel Biocare, OS = Oral Surgery, Perio = Periodontics, Pros = Prosthodontics, Rehab. = Rehabilitation, Res = Restorative, S = Straumann, selec. = selection, T/P; surg. = Treatment planning and surgery

Table 2. Pre-clinical programme

Pre-clinical programme - 2006								
	Year	Hrs	Implant system	Implant components	Single tooth impression	Single tooth cast	Provisional crown	Other
Adelaide	5	3	Y	Y				
Melbourne	4	9	NB, S, 3i	Y	Y			
Otago	4 5	3 7		Y	Y	Y		wax-up
Sydney	1 3 4		NB	Y	Y	Y Y	Y Y	
QLD	not offered							
WA	5	3	NB, S	Y	Y			

Pre-clinical programme - 2008								
	Year	Hrs	Implant system	Implant components	Single tooth impression	Single tooth cast	Provisional crown	Other
Adelaide	5	3	Y	Y				
Melbourne	4	9	NB, S, 3i	Y	Y	Y		fixture placement
Otago	4	8	Y	Y	Y			
Sydney	3,4	10 +	Y	Y	Y	Y	Y	
QLD	not offered							
WA	see plans for 2009/2010							
Griffith	4	6	basic restorative procedures					

Legend: As = AstraTech, asses. = assessment, NB = Nobel Biocare, S = Straumann

Table 3. Clinical Programme

Clinical programme - 2006						
	Year	Hrs	Implant system	Single tooth	Overdenture	Other
Adelaide	5		S	observe staff / PG		
Melbourne	not offered					
Otago	5	case dependent	NB, S, other	treatment planning & restoration		2 unit bridge treatment planning & restoration
Sydney	4	8	NB	observe staff / PG	selected cases	
QLD	case dependent	3 Pros 4 Perio	S, other	observe treatment planning		
WA	not offered					

Clinical programme - 2008						
	Year	Hrs	Implant system	Single tooth	Overdenture	Other
Adelaide	5		S	observe staff / PG		
Melbourne	not offered					
Otago	5		NB, S	restoration only	Y	treatment planning & guide fabrication
Sydney	3 (observe) 4 (patients)	case dependent	NB	all stages	Y	
QLD	not offered					
WA	see plans for 2009/2010					
Griffith	5 (selected students only)			Y		

Legend: As = AstraTech, NB = Nobel Biocare, PG = Post-graduate, S = Straumann

2.2.4. Assessment (see table 4)

Assessment was undertaken by all six schools offering implant programmes in 2006. Assessment included written and viva voce examinations, as well as objective structured clinical exam (OSCE). Clinical and pre-clinical components were assessed by attendance and observation in one school. The multi-disciplinary nature of implant teaching was reflected in the assessment carried out by the different disciplines of prosthodontics, periodontics, and oral surgery. Two schools assessed their students through more integrated programmes, including general dental practice.

By 2008, the modes of assessment took on more varied forms, including case reports and increased supervision in the clinical setting.

2.2.5. Future plans (see table 5)

It is interesting to compare the 2006 data with that from 2008 to observe how schools managed the implementation of plans which they had set in 2006. At that time, four of the six respondent schools had plans for a clinical component consisting of the restoration of single tooth implants; however, only three had implemented this procedure by 2008. In 2006, two of the schools had planned to include implant overdentures in their programmes and they succeeded in delivering this in 2008.

Future plans from 2008 showed that most schools were in the process of continuing to develop their implant programmes, with either increased funding for dedicated implant courses or modifying the existing programme.

Table 4. Future plans

Plans for 2007/2008								
Lectures		Pre-clinical			Clinical			
Year	Hrs	Components	Single tooth	OD	Single tooth	OD	Other	
Adelaide	currently planning programme							
Melbourne	4+5	9	Y	4 th year	Y	Year 4+5		
Otago	Integrated part of undergraduate programme				Year 3	Year 4+5	Year 3	
Sydney	1 3 4	1hr 1 day 1 day	Y Y Y	Year 2+3	Year 3	Year 4 Integrated clinics	Year 4	
QLD	none stated							
WA	5	12	Y	Year 5		Year 5 Integrated dental practice		

Plans for 2009/2010								
Lectures		Pre-clinical			Clinical			
Year	Hrs	Components	Single tooth	OD	Single tooth	OD	Other	
Adelaide	none stated							
Melbourne	to be announced							
Otago	none stated							
Sydney	2 3 4	10+	Y Y	Year 2+3	Year 3	Year 4 Integrated clinics	Year 4	Procera, Nobleguide
QLD	3					surgical assisting		
WA	funding received for dental implantology programme, to be delivered in 4 th year							
Griffith	none stated							

Legend: OD = overdenture

Table 5. Assessment

Assessment - 2006				
	Year	Lecture programme	Pre-clinical	Clinical
Adelaide		integrated within programmes		
Melbourne	4 5	written viva voce	OSCE OSCE	written viva voce
Otago	3 4 5	written (removal prosthodontics)	removal prosthodontics	removal prosthodontics general dental practice general dental practice
Sydney	3 4	prosthodontics oral surgery	fixed prosthodontics	prosthodontics + oral surgery
QLD	3 4	periodontics / prosthodontics periodontics / prosthodontics		
WA	4 5	written	attendance	observation

Assessment - 2008				
	Year	Lecture programme	Pre-clinical	Clinical
Adelaide		integrated within programmes		
Melbourne	4,5	written, viva voce, OSCE	written, viva voce, OSCE	written viva voce
Otago	5	written	not assessed	supervisor assessment
Sydney	3,4	written	supervisor assessment	written, viva voce, OSCE
QLD	3,4	written	not assessed	case report
WA	see plans for 2009/2010			
Griffith		written	formative assessment	formative assessment

Legend: OSCE = Objective Structured Clinical Exam

2.3. Discussion

Maalhigh-Fard et al¹⁴ (2002) showed that recent graduates were more inclined to offer and perform implant prosthodontics in their practices when their dental school curricula included implant courses. This must be acknowledged in the light of the established evidence for the clinical success of implant treatment. A brief review of the literature has shown that most developed nations (primarily those of North America and Europe) have developed implant programmes at the undergraduate level within the last ten to fifteen years. Much of the progress has been made over the last five years, particularly with regards to an increased range of student learning experiences such as pre-clinical laboratory and simulation exercises, clinical attendance and hands-on experience in the placement and restoration of implants. However, most schools have recognized the difficulty in providing both the range and depth of experiences to adequately equip students to implement implant treatment in practice on graduation. These limitations are largely due to lack of curriculum time, finances, and qualified teaching staff. Schools in Europe and North America have attempted to overcome these issues in a variety of ways, including electives, extra-curricular sessions, small group problem-based learning, integrated multi-disciplinary teaching, and partnership with or sponsorship by implant companies. In comparison, schools within Australia and New Zealand have been similar in their implementation of undergraduate implant teaching, although the preliminary data from the early 1990s indicates progression of curriculum planning compared with the rest of the world.

The two updated surveys demonstrated the commitment by Australian and New Zealand dental schools to include implants as a core part of their curricula, predominantly by integration into the disciplines of prosthodontics, periodontics, and

oral surgery. The range of experiences provided for students varied, although the overall level of non-didactic teaching has broadened across most schools. No doubt the advances in simulation facilities and techniques have aided the provision of these experiences, despite the ever-increasing pressures to include more material into already congested curricula.

The increasing trend towards student-centered learning must also be considered in the development of implant curricula at the undergraduate level. A number of studies have reported on the feasibility and success of small-group interaction both at a didactic theoretical level as well as practical components. These studies indicate that students are not only more receptive in small-group problem-based, self-directed learning environments, but also derive a richer knowledge and experience base through these forms of interaction between teachers and students, and amongst students themselves^{15,16}. In addition, supervised treatment of patients is a preferred method of learning by students and graduates¹⁶. Similarly, it should be noted that the provision of implant treatment by students is not necessarily an impossible task and educators should take note of the outcomes of other institutions in which students have taken part in implant treatment of patients, under varying degrees of supervision and with success. One study by Esfandiari et al¹⁷ found that practicing dentists with limited experience were capable of providing implant overdenture treatment with limited supervision. Studies dating back to the early and mid-1990s also showed that students were able to treat patients with implants successfully¹⁸.

The different implant programmes in dental schools across the world may be summarized into four key models (fig.1):

- (a) the elective model, in which all students may elect to undergo implant training;
- (b) the selective model, where only selected students participate in implant training;
- (c) the extra-curricular / advanced training model, whereby students are provided the opportunity to be taught outside of the normal curriculum; and
- (d) the integrated model, which seeks to integrate all aspects of implant teaching into already-established courses and disciplines.

Whilst all of these models have been employed with varying success across many universities at the undergraduate level, the data from this latest Australian and New Zealand survey suggests that most schools have implemented, or are in the process of implementing an integrated approach to implant teaching.

The authors suggest that the integrated model is the most efficient way to deliver implant education at the undergraduate level. While all teaching models have their advantages and disadvantages, the presentation of a new treatment modality has always been integrated into existing curricula by the appropriate disciplines involved (fig.2). The closer interaction of departments and disciplines has also been suggested as a means of reducing the ever-increasing pressures of finances^{9,19}, and the perceived need for educational institutions to pursue financial assistance from private implant companies^{20,21}. Some schools have attempted to limit the financial burden by deriving limited fees from patients treated by students²², and the development of a large

patient base has also been beneficial in providing databases for further studies²³. The holistic approach to dental education has been the driving force for an increasing number of dental schools²⁴, and as such, the introduction of implant teaching should follow the paradigm of integrated delivery across all disciplines involved, ranging from the basic sciences (e.g. chemistry, biology, physics) which establish the foundations necessary to understand more involved concepts progressively; to applied sciences that introduce more clinically-relevant material (e.g. biochemistry, histology, materials sciences, physiology); and finally the specific theory to be taught within the various disciplines (such as prosthodontics and periodontics) which is based on pre-clinical and clinical learning experiences. The integration of implant teaching is the key to a multi-disciplinary approach which is crucial to the delivery of quality implant treatment. Dedicated courses operating outside of existing disciplines are more likely to encounter difficulty with a lack of qualified teaching staff, student attendance (if offered as an elective), and the danger of students perceiving implant treatment as a self-contained therapy.

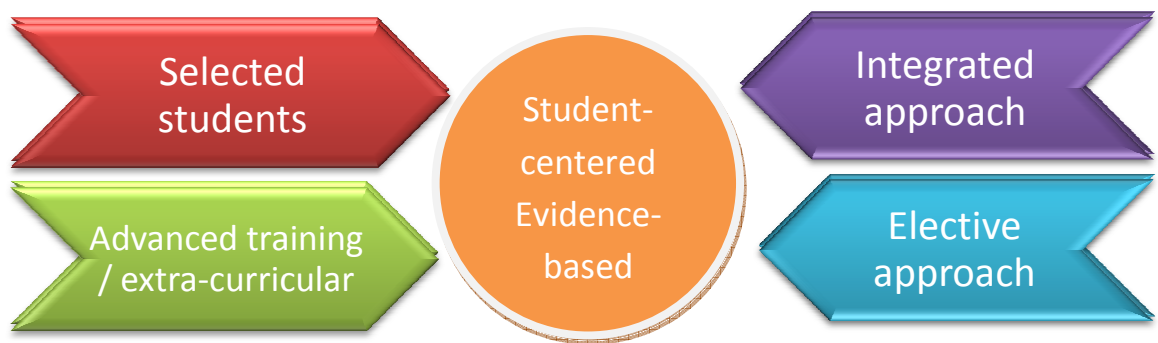
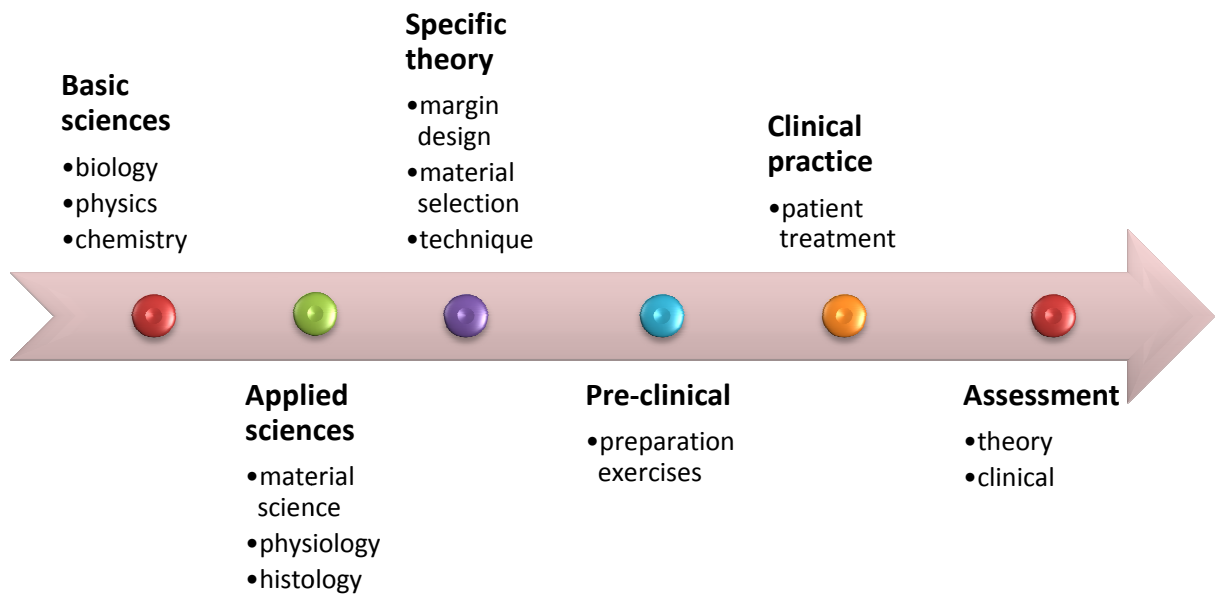


Figure 1. Models of implant education currently used. Among the Australian dental schools, a majority employed the integrated approach both in 2006 and 2008; the other models in use are the elective and advanced training / extra-curricular approaches.

a) Traditional fixed prosthodontics



b) Implant prosthodontics

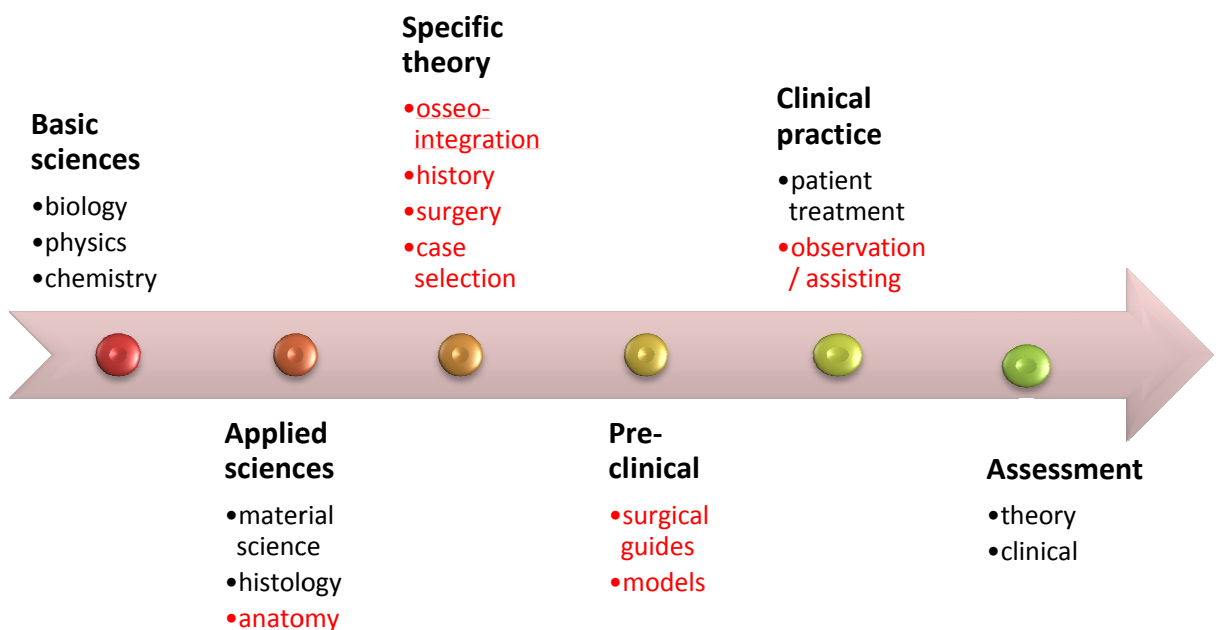


Figure 2. Flowcharts of the integrated approach to traditional and implant prosthodontics. The integration of implant prosthodontics into existing disciplines is analogous to the teaching of traditional prosthodontics (e.g., fixed) which is supported by several existing disciplines.

The content of an implant curriculum at the undergraduate level is difficult to establish, not least because of the overwhelming scope and depth of information available on the topic. However, the majority of research carried out in the field of oral implants is representative of the key aspects of successful treatment, and as such, should be considered to be the foundation in any implant course. The curricula of most dental schools reflect this body of research in the topics which are covered in their courses; however, some of the more important aspects of clinical implant treatment which are not necessarily the focus of empirical research (although perhaps theoretical) need to also be included. These areas include medico-legal responsibility, maintenance, and patient management to name a few. A study of young graduates in the United Kingdom revealed that one of the most significant reasons cited by practitioners for not providing implant treatment for patients was fear of the medico-legal risks involved¹⁶; such hesitations and reservations could be readily addressed by dental schools being sensitive to such data by providing adequate information and training in these areas.

Finally, it is essential that any implant curriculum be based on a student-centred and evidence-based approach. In light of the ever-increasing scientific knowledge base from empirical research, it is perhaps more important to provide students with a firm grasp of evidence-based practice and the skills required to judiciously read and apply scientific literature to clinical practice²⁵, rather than to solely equip them with the knowledge and expertise to provide implant treatment to a pre-determined clinical standard. As patients' awareness about dental treatment increases, it is imperative that future clinicians are equipped to engage in dialogue with patients about implant treatment and its risks, possible complications, benefits, and comparative merits

compared with other modes of treatment²³. The perception of need for oral rehabilitation has historically been clinician-centered, with little regard for patients' perceived needs. This approach has been challenged as the increasingly competitive market for implant treatment is being promoted largely by implant companies to the public. Future clinicians should be trained to embrace a professional attitude that empathizes with patient desires and treatment outcomes should be established only through informed dialogue in an atmosphere of mutual respect between the patient and the clinician²⁶.

3. CONCLUSIONS

The teaching of dental implants at the undergraduate level has been in progress to varying degrees in most developed nations since the early 1990s. Dental schools within Australia and New Zealand have responded appropriately to the increasing need for dental implant education. Future developments in implant programmes need to address the multi-disciplinary nature of implant treatment as well as incorporate newly recognized standards of care by equipping students with the necessary skills to evaluate the available scientific evidence.

Appendix i



University of Sydney
Faculty of Dentistry
Prosthodontics

QUESTIONNAIRE ON ORAL IMPLANTS IN THE UNDERGRADUATE DENTAL CURRICULUM 2006 and 2008 update

1. Does your Dental Faculty/School offer an undergraduate programme on Oral Implants?
Yes No

2. If so, is the programme

a) A lecture programme Yes No

How many lectures

At what stage in the course are lectures given
(tick more than one if applicable)

Year I Year II Year III Year IV Year V

Periodontics Prosthodontics Oral Surgery

Other

Which particular areas of oral implant management are covered in the lecture programme
.....

b) A laboratory (pre-clinical) programme? Yes No

Hours devoted to the programme

At what stage in the course is this programme offered
.....

Which pre-clinical tasks are required to be completed
.....

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