

Dental education at Dundee Dental Hospital and School – a notable past and inspiring future

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Key points

Provides a brief history of Dundee Dental Hospital and School and describes the innovative undergraduate curricula and widening participation agenda.

Describes Dundee's international reputation for teaching and research and the wide portfolio of activity underpinning this, including innovative teaching and assessment developed in response to the COVID-19 pandemic.

Emphasises the close working relationship between the University and the NHS, culminating in the development of the Dundee Dental Research Hospital and School.

Abstract

Dundee Dental Hospital and School has been present on Park Place, Dundee for over 100 years. During this time, it has been at the forefront of dental care and education, first as part of the University of St Andrews and subsequently the University of Dundee. This innovation continues with novel undergraduate curricula for dental and dental therapy students, providing early clinical experience and integrating clinical teaching with the appropriate sciences. We also offer several taught postgraduate programmes, popular particularly with international students. Dundee was at the forefront of the response to the COVID-19 pandemic, with the Scottish Dental Clinical Effectiveness Programme leading the world on guidance for safe clinical practice. Innovative solutions for the ongoing delivery of teaching and assessment also were developed. Research underpins teaching and the delivery of dental care and Dundee has an international reputation for its research portfolio. All of the above can only be achieved by close working relationships between the University and NHS, which will be strengthened further by the creation of the Dundee Dental Research Hospital and School. Our international reputation will continue to attract students and staff from across the world.

The history of Dundee Dental Hospital and School

Dundee Dental Hospital and School is perhaps unique among UK dental hospitals and schools, having remained on the same site for nearly 110 years. The original aim of the Hospital was 'to provide surgical aid to persons in poor circumstances suffering from diseases or irregularities of the teeth, with an emphasis on the need for preservation of teeth from the outset. The Hospital has its origins in the Dundee Dental Club, formed in 1909 by local dentists who provided their services free of charge to the destitute. Care was provided from a flat in Park Place, preceding the Dental Hospital, which was established there in 1914.

Initially, the Dental Hospital was only open for five hours per week and had two treatment rooms, staffed by dentists who would provide treatment before proceeding to their own practices. In these early years, the building had a number of benefactors which enabled gradual expansion of facilities, including the students themselves who would donate their rag day collections to the Hospital. From 1914–1948, Dundee Dental Hospital operated as a private venture until it was incorporated into the newly formed NHS.

Important in the early history of the Dental Hospital and School was its links to St Andrews University. In 1916, the first three Licence in Dental Surgery (LDS) trainees commenced their studies at Dundee Dental Hospital and thus the Dental School was established within the College of St Andrews University in Dundee. The Dundee LDS was awarded as a Diploma from the University of St Andrews and gradually, the provision of dental education shifted towards a university setting. By 1930, the first postgraduate dental diploma in the UK (the Diploma in Public Dentistry) was jointly

established by the British Dental Association and St Andrews University, reflecting the high regard in which Dundee Dental Hospital and School was held. In 1936, the Bachelor of Dental Surgery (BDS) degree was established by St Andrews, which required five-year training and was the first degree of dentistry to be awarded by any university in Scotland.

In 1948, recognising the need for dedicated teaching space, a new Dental School was built by the University adjacent to the Dental Hospital on Park Place but lack of clinical space continued to be an issue. Plans were developed for a new, ten-storey dental tower (Fig. 1), opened on 17 October 1968 by Her Majesty Queen Elizabeth, the Queen Mother. In the 1960s, there was also a drive to establish new universities across the UK and while the university in Dundee was not new (having been a college of the University of St Andrews), it gained independent university status by Royal Charter in 1967.

In more recent years, the Dental Hospital and School has been regularly refurbished and upgraded and has continued to expand the courses it offers, providing high-quality

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Fig. 1 Dundee Dental Hospital and School. The ten-storey dental tower opened in 1968 by HM The Queen Mother unites the original Dental Hospital (1914, near side of the tower) and Dental School buildings (1948, far side of the tower) with all three buildings, plus the Frankland Building (behind the buildings shown in this photograph) interconnected and comprising the present day Dental Hospital and School

postgraduate programmes in prosthodontics, endodontics, dental public health and forensic dentistry, alongside the undergraduate BDS (Dentistry) and Bachelor of Science (BSc) Oral Health Sciences (Dental Therapy) degrees, as well as research degrees at Masters and Doctorate levels.

The changing demographics of applicants

Since the 1980s, there had been debate over the best way to encourage people from disadvantaged backgrounds to apply to university, with the *Dearing report* in 1997 urging universities to embrace widening participation.¹ Following devolution, this became a policy objective of the Scottish Government, leading to formation of the Commission on Widening Access, with recommendations for fair access to university for all within a generation.² The University of Dundee was already committed to widening participation, as demonstrated by the creation of the Access Summer School 30 years ago. Participation in the Summer School has consistently proven to provide valuable preparation for the transition from school to self-directed university learning.

The School of Dentistry has also worked closely with the Reach Project, established in 2011, to work with target schools to help individuals from disadvantaged, under-represented or non-traditional backgrounds apply to high-demand courses at university, including dentistry. Reach organises events to explore careers in dentistry and provide support with the application process. Since its launch, entrants to dentistry from the Reach Tayside target schools have risen from 1.8% of the Scottish total (2008–2010) to 5.2% (2019–2021), with 100% retention on the course. The Scottish Index of Multiple Deprivation (SIMD) is frequently used to demonstrate disadvantaged backgrounds, with SIMD Q1 the most deprived quintile. Applications from and offers to SIMD Q1 candidates have increased over the period 2013–2021, rising from 6.3–11.9% and 5.6–14.3%, respectively, with matriculations also increasing.

4D at Dundee

The transition from new entrant student to dental graduate has traditionally involved the 2 + 3-year approach of a two-year largely scientific pre-clinical foundation before three-year clinical training. In this model,

early clinical experience is limited and the importance and relevance of the scientific foundation can be lost as it is often delivered out of context. The transition to clinical student at the start of Year 3 can be abrupt and challenging for students as they deal with the demands of clinical practice. In Dundee, a review was undertaken to develop a revised curriculum to support the transition to clinical practice from the beginning, by integrating the foundation sciences outcomes with clinical practice goals and endpoints. The 4D curriculum (Dentistry @ Dundee Driven by Discovery) was introduced in 2018. Its title reflects the aim of developing motivated, lifelong learners and provides early clinical experience starting in the students' first week at dental school. BDS and BSc Oral Health Sciences Years 1 and 2 are closely integrated, supporting the dental team ethos and the curriculum balances relevant foundation sciences with their clinical application. One example of innovation is the use of the unique anatomy facility in the University of Dundee Centre for Anatomy and Human Identification, where flexible, Thiel-embalmed cadavers are used not only for dissection, but also to realistically simulate clinical skills (for example, the administration of local anaesthesia and extraction of teeth). Core clinical cases also provide a contextualised clinical setting for topics such as infection control, human factors and professionalism, so that students clearly understand their role as a dental professional. Students additionally have the opportunity to explore interests outside the core curriculum through 'discovery' weeks. The theme of discovery is carried throughout the course with a move from traditional lectures to interactive 'iClasses', encouraging discussion and teamwork within each year of the course.

Clinically, students work in cross-year teams, with early-years students timetabled on clinics with later-years students, affording the latter mentoring opportunities and giving the former insight into where they are heading. Such peer-to-peer learning and clinical mentoring are popular with students, as it helps build clinical confidence and enables students to take on patient care gradually. Reflection also is an essential component of the curriculum, starting with a simple reflective model in the first year, which is expanded through the course. Student feedback has been overwhelmingly encouraging, including from later-years students who enjoy working with their more junior counterparts.

Education impact of the pandemic and innovations in teaching delivery

The global COVID-19 pandemic significantly impacted dental schools, but training and education continued – a testament to hard-working, innovative educators and students utilising modern technologies. In dental education, theoretical content blends with simulated and real patient encounters, creating comprehensive training experiences. Theoretical teaching could rapidly recommence using online tools to deliver interactive streamed and pre-recorded classes. This brought with it several advantages, as asynchronous and remote lessons empowered students to learn where and when it suited them.

Advanced 3D technologies also presented innovative solutions to simulated training for students. 3D-printing and modelling software are evolving with the potential to transform how and what we teach, with software platforms becoming more intuitive and user-friendly. During the pandemic, the School used relatively inexpensive filament printers to transform a lecture theatre into a clinical skills space where simulated orthodontic and caries lesion management courses were undertaken, providing the students with hands-on training in safe, socially distanced environments. Developments in live streaming provide another opportunity and we have developed a protocol for live streaming, providing remote interaction with real patient care while ensuring patient and student safety.

Effective assessment in dental education

The introduction and development of the 4D curriculum, unexpectedly during a pandemic, provided opportunities to explore and redefine assessment possibilities so that assessment delivery is more efficient and both breadth and depth of knowledge are better tested. We are working towards a 'one-stop-shop' to map, deliver and quality assure our assessments – an Assessment World. This is online and follows a standard architecture in its design. Assessments are compiled to cover the General Dental Council learning objectives in *Preparing for practice*. We are, however, mindful that these may change over time, therefore all assessments are also mapped to the more specific learning objectives of our 4D curriculum. As many of the assessments are shared in the early years

between BDS and BSc students, this approach brings efficiencies. The development of searchable and mappable question banks, using Excel as a platform, has proven invaluable in delivering single best answer papers and other assessments. The same platform also supports our standard setting process and question discussion among examiners to ensure all areas are covered. Our exams have now reverted to face-to-face invigilation but due to the high demand on IT facilities in the University, the candidates use their own devices, utilising the bring-your-own-device approach in a closely observed setting. Where a candidate is unable to attend, perhaps due to illness such as COVID-19, video-call technology has permitted candidates to be invigilated at home, as well as providing opportunity for external examiners to view our exams at a distance. In addition, video-streaming certain practical tasks enabled key assessments to be delivered during lockdown periods, facilitating student progression.

Partnership working between the University and the NHS

Close partnership working between the University and the NHS continues to be fundamental to the shared missions of both organisations in education, training, research and delivery of care. The Dental Hospital and School building has served the local people for over 100 years with around three million patient attendances to date. Within the Dental Hospital, all 13 dental specialties are provided, as well as multidisciplinary working in cleft lip and palate; head and neck cancer; the interaction of dentistry with various medical and surgical specialties; dental trauma; orthognathic surgery; restorative and orthodontic treatment; and joint paediatric/orthodontic care.

In total, the building has graduated approximately 6,500 dentists, dental hygienists and dental therapists over the years, with 500 dental nurses being trained and 1,000 dentists completing core and speciality training, many going on to work across all sectors in the dental industry. Dundee Dental Hospital and School therefore has been pivotal in training the dental workforce for several generations and will continue to do so for many years to come.

Dundee Dental Education Centre is located next to the Hospital and School and hosts the Scottish Dental Clinical Effectiveness Programme (SDCEP) which is of national and international importance, leading the world through the recent COVID-19 pandemic with

guidelines for safe dental practice. Dundee is a research-active institution, with a wide variety of research being undertaken at Masters and Doctorate level, along with National Institute for Health and Care Research-funded research; trials in primary and secondary care; oral and dental public health research for marginalised populations; orthodontic and craniofacial research; forensic odontology; cell and molecular biology; and dental materials science applied to clinical disciplines.

The global climate crisis and the impact this has on natural resources, energy and travel has brought the activities of the Hospital and School into sharp focus and we aim to become more sustainable in all that we do. We will transition to a Dental Research Hospital and School, emphasising social purpose and inclusion while making significant reductions in environmental impact. Research will be embedded in every activity, patient contact and process across the building, underpinning our dental teaching hospital in becoming an anchor institution in the transition to sustainable dental and oral healthcare for generations to come.

Perception of academia and research in dental education

Dundee has a long tradition of research-informed teaching – a key aspect of the 4D curriculum – where integrated teaching is delivered by staff involved in clinical and basic science research, as well as the development of evidence-based clinical guidance (for example, SDCEP guidance and Cochrane Reviews). This ethos provides students with a research-rich educational environment, designed to integrate clinical practice with research. Undergraduate students have various opportunities to get directly involved in research, either by undertaking formal qualifications (intercalated Bachelor of Medical Sciences degrees or an integrated Masters programme) or through the discovery week student-selected components of the 4D curriculum. Other opportunities include summer internships and the activities of the School's student research society (Dental Dundee Research and Academic Medicine Society). A Dundee student-led, Wikipedia editing project (Wikipedia Collaboration of Dental Schools), started in 2017, has developed into a multi-national initiative to ensure the information available on dental-related Wikipedia pages is up to date and research-evidenced.

These combined activities have resulted in a significant number of research publications and presentations at international conferences, such as the International Association for Dental Research (IADR) and Association for Dental Education in Europe (ADEE), involving undergraduate and postgraduate students, as well as speciality trainees.

A recent development in Dundee is the launch of a Postgraduate Certificate in Dental Education, in collaboration with the Centre for Medical Education, to provide dentists and dental care professionals with training in evidence-based teaching practice. This programme has proven to be highly attractive with participants from across the whole profession, both from the UK and overseas, and demonstrates the importance of dental education research on teaching practice.

Internationalisation and Dundee School of Dentistry

Internationalisation is a significant aspect of the profile of the University of Dundee, with students from 140 different countries forming 22% of the student population. Our internationalisation strategy is based on bringing the world to Dundee and taking Dundee to the world; this is manifest in the School's undergraduate and

postgraduate teaching and research programmes, which attract students from a broad geographic spectrum. The School's influence is manifest in our world-leading research and our strong links with the three global bodies concerned with oral health affairs: the IADR, the FDI World Dental Federation and the World Health Organisation (WHO), with Dundee hosting a WHO collaborating centre for craniofacial congenital anomalies from 2004–2018. Dundee has an established international reputation for teaching and research. Our taught postgraduate programmes are highly popular with students from across the world and we have developed innovative partnerships with international institutions which will only build on this.

Conclusions

The well-established international structures, the global excellence scholarships, the affordability of living in Dundee and the favourable staff-to-student ratio founded on a true team-working ethos among the Hospital and School staff are attractive features. These, combined with an impressive alumni programme with Dental Alumni Ambassadors distributed worldwide, make Dundee a very popular location for students from many parts of the world.

Ethics declaration

Philip M. Preshaw is on the British Dental Journal Editorial Board. The authors declare no other conflicts of interest.

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Author contributions

Philip M. Preshaw, R. Graham Chadwick, Kevin Davey, Andrew Mason, Grant McIntyre, Peter A. Mossey, Kerry Richardson, Lorraine Robertson, Clement Seeballuck and Fiona Stewart conceived and designed the paper, wrote and edited the paper, and gave final approval of the manuscript.

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Correction to: Sustainability in dentistry gathers momentum

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When initially published, there was an error in the author's affiliation. This should have read:

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The journal apologises for any inconvenience caused.