

# DENTAL EDUCATION RESOURCES ON THE WORLD WIDE WEB

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## ABSTRACT

The existence of numerous World Wide Web (WWW) sites devoted to dental education is proof that dental educators have been utilizing the pedagogical potential of information technology. Despite the availability of an immense quantity of information on the Internet, performing a search is often a complex, uncoordinated and time-consuming procedure, thus the usefulness of a guide on a topic of interest. Forty WWW sites devoted to dental education have been located using search engines. They were evaluated and classified as follows: guides, electronic publications, databases, patient education and undergraduate education; and according to subjects such as oral biology, morphology, histology, microbiology oral pathology, oral and maxillofacial surgery, radiology, periodontology, dental materials, orthodontics and neuroscience. The extensiveness and quality of some of these sites make them useful resources and knowledge banks for the teacher and the student.

**Keywords:** Computer-assisted learning, dental education resources, information technology, Internet, on-line, web sites.

## INTRODUCTION

Information technology and computers are potentially effective teaching and learning aids. They are especially suited for independent learning, whereby a student may learn from reading material on a web-site or by utilizing software. In merely a few years, the Internet has revolutionized communication and education. Scarcely an area of human interest remains untouched by its influence. Electronic mail (or "e-mail") and "surfing" have become very much a part of the lives of many. However, in spite of the abundance of WWW sites, the user may find that there are relatively few sites that are useful. Indeed a key problem faced by the Internet user is that of trying to find relevant material among a mountain of data, bringing to mind the proverbial needle in the haystack.

Despite the fact that the WWW is a repository of much information, the search for information remains an uncoordinated, and often complex and time-consuming procedure. With the exception of those who understand the complexities of the Internet and search engines, the search for information is often a haphazard affair in which the user at times depends on luck to obtain useful material.

Search engines "crawl" or "spider" web sites, looking for words that are then compiled into an index. Although they may be used to locate web sites of interest, they are imperfect tools, as none are completely comprehensive or up-to-date. Furthermore, the size and frequency of updates of their indices may vary. As search engines are configured differently, using the same search term on different search engines may produce different results. Some search engines, such as

<sup>1</sup> Khoo Kong Soo and <sup>2</sup> Michael Ong Ah Hup

Lecturer

<sup>1</sup> Department of Oral Biology and

<sup>2</sup> Department of Oral and Maxillofacial Surgery

Faculty of Dentistry

University of Malaya

50603 Kuala Lumpur

Malaysia

Alta Vista and Lycos are very large. A search frequently yields a large number of "hits", and the user has to refine the search, for example, by adding additional search terms, or by including or excluding certain terms. The user frequently has to peruse a fairly large number of sites. In the process, time and effort are wasted in downloading and reading web sites that are of little or no value to the user.

The immense quantity of material available on the WWW, convenience and speed of accessing web sites, and the possibility of computer-assisted learning (CAL) make computers and information technology (IT) potentially beneficial to the teaching profession. A substantial quantity of instructional material for dental education in the form of lecture notes, histology slides, tests and quizzes molecular graphics, virtual dissections and laboratories, photographic images, video and movie clips, and essays are available on-line (1,2). In addition, some journals publish abstracts or full articles on the WWW. Educators in many academic fields have made teaching material available on-line. The dental teaching profession has taken steps in doing likewise (3,4).

In the health care professions, the lack of IT skills is a serious impediment towards independent learning. This is equally applicable to the dental student (5). The authors' Faculty was fully networked in 1997 and most members of the academic staff were supplied with a personal computer each, providing them with the means to tap the resources of the WWW for teaching and research (or for leisure and entertainment!). A compendium of WWW sites that contain dental education resources has been compiled. This digest should enable dental educators and students to gain access to various dentistry-related WWW sites without having to do a search themselves. Web sites often provides Hyper Text links to other sites, thus once a site of interest has been accessed, the user may move on to other sites. Regennitter et al (3) and Cotter (6) have compiled similar compendiums for orthodontic and histology sites, respectively.

In this list, the web sites listed are classified as guides (i.e. sites that are not databanks or repositories of information, but instead provide links to such sites), electronic publications or journals, databases, sites devoted to patient education, undergraduate education, and according to their subject matter. For each site, the following information is provided: (i) institution or organization that maintains the web-site, (ii) the Universal Resource Location (URL) address and (iii) features or highlights of that site. The sites that are in the author's

opinion, especially valuable are indicated by an asterisk (\*).

The browser used for this study was Netscape Communicator 4.04 (Standard Edition) while the search engines of choice were Lycos (<http://www.lycos.com>) and Alta Vista (<http://altavista.digital.com>) The browser used for this study was Netscape Communicator 4.04 (Standard Edition) while the search engines of choice were Lycos (<http://www.lycos.com>) and Alta Vista (<http://altavista.digital.com>).

## COMPENDIUM OF DENTAL EDUCATION SITES

### Guides

1. The "Virtual" Dental Center, Martindale's Health Science Guide\*.

URL: <http://www-sci.lib.uci.edu/HSG/Dental.html>

Features: This award-winning site is maintained by Jim Martindale, the only one the authors have come across that is the product of a single individual's efforts. This is a well-planned site, yet it is not graphic-intensive and thus easily downloaded. It is of very high quality, and is comprehensive yet extensive. This site provides links to teaching files, dental cases, multimedia courses, tutorials, databases, and movies. The fields which are covered include: anaesthesiology, biomaterials, dentition, drugs, ethics' histology, microbiology, immunology, oral biology, dental neuroscience, pathology, physiology, thaumatology, dentures, dental implants, oral health, orofacial pain, pediatric dentistry, periodontology and oral surgery. In addition, links are provided for dental literature and patent searches, on-line journals, dental and interactive anatomy browsers, and complete curricula of several dental schools.

2. Dentistry Internet Resources, University of Hong Kong\*.

URL: <http://www.hku.hk/lib/DenLib/den.html>

Features: The user should not be misled by the unimpressive facade and white background of this no-frills site. It is a very good guide, providing links to dental education resources, electronic libraries and journals, and associations. The dental resources are listed according to subject, such as cariology, cleft lip and palate, dental implants, dental materials, endodontics, forensic dentistry, HIV and dental care, oral and maxillofacial radiology, oral and maxillofacial surgery, oral cancer, orthodontics, pediatric dentistry, periodontics, prosthodontics, and temporomandibular joint disease.

3. MedWeb at Emory University, Educational Resources: Dentistry.

URL: [http://www.gen.emory.edu/MEDWEB/keyword/educational\\_resources/dentistry.ht ml](http://www.gen.emory.edu/MEDWEB/keyword/educational_resources/dentistry.ht ml)

Features: This site is not very extensive, providing links to only 17 dentists related sites. Perhaps more useful are the links are given to general scientific and health sciences sites, including sites dealing with biology, chemistry and genetics.

4. American Academy of Pediatric Dentistry.

URL: <http://aapd.org/Links.html>

Features: This site provides links to many international dental schools, and US medical and health associations.

However, it lists only a few dental education databases.

5. Dentistry Resources at the University of Alberta.

URL: <http://www.ualberta.ca/~cbidwell/hsms/hsresdnt.htm>

Features: This site provides links to professional organizations, companies, educational, research and social sites.

6. Dental Related Internet Resources.

URL: <http://www.dental-resources.com>

This is a site with a commercial orientations providing, for example, links to dental suppliers and laboratories, although it provides links to dental education, continuing education sites and associations as well. It includes a search engine.

7. Webdental.

URL: <http://www.webdental.com>

Features: Webdental is a web-site with a commercial orientation, with links to manufacturers, suppliers, professional organizations and laboratories. However, it has links to educational sites.

8. Dentistry Sites, Medical Center Library, University of Kentucky.

URL: <http://www.uky.edu/MedicalCenter/MedLibrary/dentistry.html>

Features: This site provides links to educational institutions, databases, electronic publications, other guides, associations and agencies, and continuing education sites.

9. The Clinical Dentistry Page, Harvard School of Dental Medicine.

URL: <http://www.hsdm.med.harvard.edu/pages/clindent.htm>

Features: This site provides links to educational sites which provide tutorials on topics including periodontology, systemic antibiotic therapy in oral surgery, odontogenic tumours, oral anatomy, temporomandibular joint, facial and mandibular fractures, and oral health. In addition, it provides links to sites with case studies, including cases in diagnosis and treatment planning, periodontology, oral and maxillofacial radiology, and oral and maxillofacial surgery.

10. Internet Resource, Dentistry, University of Pittsburgh.

URL: <http://www.hsls.pitt.edu/intres/health/dental.html>

Features: This site provides numerous links to dental schools, sites for dental education, associations and information for the lay person.

### Databases

11. Project DENTAL, University of Connecticut School of Dental Medicine, Columbia University School of Dental and Oral Surgery and the University of Iowa College of Dentistry.

URL: <http://sdm.uchc.edu/ProjectD.html>

Features: This is the one of the most ambitious project involving the use of IT in dental education thus far. As it is an ongoing project, available information is at the moment sparse, fragmented and far from complete. However, there are plans to add new material, and contributions are welcome. An

outline of the database has been drafted, and the information available is classified as texts, images, videos, devices, records, and documentation. This promises to be the foremost and most extensive database for dental education.

#### 12. MedNets Dental Database.

*URL: <http://www.internets.com/mednets/dental.htm#chid>*

Features: This is a searchable database, i.e. one with a search engine that enables the user to locate material in its repository. The extensive database contains abstracts of books, pamphlets, brochures, fact sheets and journal articles, many of which are written by top researchers in their respective fields. In addition, links to other searchable dental databases are provided.

#### 13. Dental Study Club Online Archives.

*URL: <http://www.tambed.edu/DentalCE/dsc/ARCHIVES/search.html>*

Features: This is a searchable database that provides structured abstracts of journal articles. The structured abstracts contain summaries of research objectives, results and conclusions. Suggested reading lists and self-assessment tests are also given.

### Electronic publications

14. Teledentistry Network Newsletter, School of Dentistry, University of North Carolina, Chapel Hill. Teledentistry Network Newsletter, School of Dentistry, University of North Carolina, Chapel Hill.

*URL: <http://www.dent.unc.edu/depts/diag/newslett.htm>*

Features: This is an on-line newsletter that presents a few new cases, without diagnoses, are presented in every issue. The reader is invited to submit her diagnosis, and answers are given in the subsequent issue of the journal.

15. Dentistry On-Line, Priory Lodge Education Ltd.

*URL: <http://www.priory.com/dent.htm>*

Features: This is a reviewed electronic journal, one of the few on the WWW related to dentistry that does not require a subscription. It contains patient pages, professional pages and links to other dental sites.

16. Den-Tel-Net

*URL: <http://biz.onramp.net/Den-Tel-Net>*

Features: Den-Tel-Net is an electronic newsletter, distributed monthly with dental articles pertaining to fields including periodontics, endodontics, orthodontics, prosthodontics, oral surgery, paedodontics, dental public health and oral pathology.

### Patient education

17. The Interactive Dental Office, by Drs. R.K. Boyden and K.A. Loos

*URL: <http://www.parentsplace.com/readroom/dentist-images/office>*

This site offers a multimedia interactive software which was developed by these California-based dental practitioners. This software, which is distributed as freeware, requires approximately 1.8 Mb of disc space. It is colourful and

entertaining, and should serve as an interesting and entertaining method of emphasizing dental care to children (although the authors claim that the software is suitable for all between the ages of 3 and 123!). The software also contains a useful glossary of dental terms, and a game called "Plaque Attack", a version of "Space Invaders" in which microorganisms attempting to invade a virtual mouth may be destroyed using dental floss or gobs of tooth paste emanating from a tooth brush.

18. Ask an Oral and Maxillofacial Surgeon by Dr. Kim E. Goldman

*URL: <http://www.calweb.com/~goldman/askomfs.html>*

Features: This is an interactive question/answer page intended for the lay person. The topics covered include the following: third molars, temporomandibular joint, mandibular fractures, chin and orthognathics.

### Undergraduate education

19. Dental Education Resources on the Web (DERWeb), University of Sheffield \*

*URL: <http://www.derweb.ac.uk/index.html>*

Features: This is by far the best dental education resource the authors have come across. In addition to an extensive database of images, it provides web conferencing, a virtual bookshop and links to professional organizations. DERWeb features case studies, a CAL program on dental caries, revision notes on periodontology, immediate dentures, and removal of foreign objects from root canals, a history of occlusal concepts and the dental articulator, and a quiz on root canals (with hints, if required), and patient education pages. The extensive image library, which has over 2,000 colour photographs of high quality in its database, covers paedodontics, oral and maxillofacial surgery, oral medicine, preventive dentistry, restorative dentistry, periodontology, orthodontics, radiology and cross infection control. A search engine enables to user to look for images of interest.

20. Dr Burn-Murdoch's "Major Points" series, United Medical and Dental Schools, Guy's and St. Thomas' Hospitals, London, U.K.

*URL: <http://www.umds.ac.uk/physiology/rbm/cvmenu.htm>*

Features: This site contains detailed, well-written essays on cardiovascular and respiratory physiology for First Year BDS students. The essays include topics such as the physics of blood flow, cardiac muscles, haemorrhage, lung mechanics, carriage of oxygen and carbon dioxide, and hypoxia.

21. BDS1 Course 2: Endocrinology and Nutrition, United Medical and Dental Schools, Guy's and St. Thomas' Hospitals, London, U.K.

*URL: <http://www.umds.ac.uk/physiology/banks/endonut.htm>*

Features: This site provides some excellent essays on endocrinology and nutrition for BDS students. The topics include: thyroid hormones, endocrinological response to stress, adrenal glands, sex hormones, menstrual cycle and pregnancy.

**Oral Biology**

22. Oral Biology 510: Development, Structure and Function of Oral Tissue, Department of Oral Biology, School of Dentistry, University of Washington .  
URL: <http://www.dental.washington.edu/syllabi/ob510/index.html>\*

This is an excellent web-site composed by staff members of one of the foremost Oral Biology departments in the world. This site contains lecture notes, micrographs, a glossary, and references. The topics include the following: early orofacial development, face and palatogenesis, branchial arches, odontogenesis, amelogenesis and enamel, dentin and root formation, dental pulp and innervation, tooth eruption, cranio-skeletal development, periodontium temporomandibular joint, specialized mucosa and salivary glands.

23. Oral Biology 520: Molecular Microbiology and Oral Diseases, Department of Oral Biology, School of Dentistry, University of Washington.  
URL: <http://128.95.5.53/lamont/index2.htm>

Features: This site contains lecture notes for an advanced oral biology course dealing with the microbiological, biochemical and pathological aspects of dental plaque, and molecular biology.

**Tooth morphology**

24. Quicktime Database of the Human Dentition, Dental Anthropology Association at the University of California, Santa Barbara.  
URL: <http://alishaw.sscf.ucsb.edu/~walker/dentition/HumanDentition.html>

Features: Movie clips of the human dentition are available from this site, making it invaluable for teaching dental morphology. When the clips are played, the black-and-white images are rotated. A plug-in such as Apple's QuickTime (URL: <http://www.apple.com/quicktime>) is required.

**Dental Histology**

25. Histology Lessons, Informatics Center, Vanderbilt University Medical Center\*.  
URL: <http://www.me.vanderbilt.edu/histo>

Features: This elegant site provides well-written and concise notes, together with micrographs of histological samples, including salivary glands and exocrine pancreas. Notes are also available on the following: blood, epithelium and peripheral nervous tissues.

**Dental Microbiology**

26. Dental Microbiology, Immunology and Parasitology Laboratory Syllabus, Department of Microbiology, immunology and Parasitology, Louisiana State University Medical Center\*.  
URL: <http://www.lsume.edu/campus/micr/dmlab.htm>

Features: This is an excellent and extensive site. It provides 20 exercises, which include notes and experimental procedures. Some of the experimental results are shown using photographic images. These exercises cover topics such as non-specific host defense, cell-mediated immunity, general

microbiological techniques, gram negative pyogens, antibiotic sensitivity testing, gram positive pyogenic cocci, oral anaerobes, and streptococci, oral and pulmonary actinomycetales, toxigenic gram positive bacilli, yeast and fungi, and viral research techniques.

**Oral Pathology**

27. Oral Pathology Image Database College of Dentistry, University of Iowa.  
URL: <http://www.uiowa.edu/~opr/AtlasHome.html>

Features: This site provides an atlas of some of the most common lesions of the oral cavity. The coloured images are displayed in a "frames" format alongside concise and well-written notes.

**Oral and Maxillofacial Surgery**

28. Oral and Maxillofacial Surgery Online.  
URL: <http://www.omfs.org>

Features: This is an on-line journal featuring articles on new techniques and cases in oral and maxillofacial surgery. In addition, information on conferences, discussion forums, patients' health, oral cancer, and links to associations are included.

29. Anatomy Modules: TMJ tutorials, University of Washington Department of Radiology.  
URL: <http://www.rad.washington.edu/Anatomy/TMJ/TMJ.html>

Features: This excellent site features tutorials on the temporomandibular (TMJ) joint. The topics covered include the following: TMJ anatomy, TMJ arthrography, TMJ computed tomography, and TMJ magnetic resonance image. The notes provided are interesting and concise, while the graphics and QuickTime movie clips are of high quality

30. Case Studies in Oral and Maxillofacial, Surgery Division of Oral and Maxillofacial Surgery, Dalhousie University.  
URL: <http://bpass.dentistry.dal.ca/oscasestudies.htm>

Features: This site features poster presentations of 2 case studies on cleft lip and plate repair using functional cheilorhinoplasty and alveolar bone grafts.

**Radiology**

31. Division of Oral and Maxillofacial Radiology, Dalhousie University, Halifax, Nova Scotia, Canada.  
URL: <http://bpass.dentistry.dal.ca>

Features: This site provides numerous links to radiology resources, radiation dosimetry and health physics resources, medical imaging research sites and magnetic resonance imaging resources. In addition it provides radiology case studies.

32. Oral and Maxillofacial Radiology Teaching File, Department of Radiology, Nagasaki University Hospital of Dentistry (4).  
URL: <http://w3.dh.nagasaki-u.ac.jp/tff/index.html>

Features: This is a very extensive databank of radiological images. Two classification systems are used for the images,

i.e. anatomical region and disease. The wealth of material available on this site compensates for the charmingly imperfect English!

### **Periodontology**

33. Periodontics Information Center at the School of Dentistry, University of California, Los Angeles.

*URL: <http://www.dent/ucla.edu/pic>*

Features: The user can find lecture notes on periodontal scaling instruments, dental caries and case studies in this site. Dental news is available, as are links to continuing education and product information sites.

34. Virtual Periodontology at the Faculty of Odontology, Lund University, Sweden\*.

*URL: <http://www.odont.lu.se/depts/par/virtual.html>*

Features: This excellent site provides lecture notes on: basic periodontology, scaling and rootplaning, periodontal abscess, and video clips on the treatment of moderate periodontitis, periodontal flap surgery at a single tooth and periodontal flap surgery in an upper jaw quadrant. The video clips are in the Motion Pictures Experts Group (MPEG) format, and require a browser plug-in such as QuickTime ([http://www/apple.com/quicktime](http://www.apple.com/quicktime)) or InterVU ([http://www/intervu.net/installer/eyeq.html](http://www.intervu.net/installer/eyeq.html)) in order to be played.

35. W3 Site of Periodontology and Oral Implantology\*.

*URL: <http://www.paro.org/indenglix.html>*

Features: This is an elegant site, containing articles on periodontological concepts, clinical procedures and their consequences on the other odontological fields. More than 50 clinical cases, presented using high-quality colour images, and abstracts of their journal articles are available.

36. Periodontium, New Jersey Dental School, University of Medicine and Dentistry New Jersey.

*URL: <http://www.umdnj.edu:80/~khochtah/periodontium.html>*

Features: This site provides lecture notes, together with photographic images, on the periodontium. The notes are interestingly written, and the images are of high quality. These should be particularly valuable as an introduction to the subject.

### **Dental Materials**

37. Biomaterials Properties Database, University of Michigan.

*URL: [http://www.lib.umich.edu/libhome/Dentistry.lib/Dental\\_tables.toc.htm](http://www.lib.umich.edu/libhome/Dentistry.lib/Dental_tables.toc.htm)*

Features: This site provides data on the physical properties of biomaterials. It is perhaps more useful to the researcher than the student or teacher, as only physical data is provided.

38. Dental Materials School of Dentistry, University of North Carolina at Chapel Hill.

*URL: <http://www.dent.unc.edu/bayne/dentmtls/dm-lectures.htm>*

Features: This site provides lecture notes on dental materials. The topics include resin modified glass ionomers, filling

materials, gold casting alloys, the mercury controversy, and dental cements.

### **Orthodontics**

39. Orthodontic splints in dental traumatology, Virtual Journal of Clinical Orthodontics.

*URL: <http://vjco.it/splint.htm>*

Features: This site provides notes, photographic images and 2 case studies on the use of orthodontic splints.

### **Neuroscience**

40. Dental Neuroscience Online, United Medical and Dental Schools, Guy's and St. Thomas' Hospitals, London, U.K.

*URL: <http://www.umds.ac.uk/physiology/banks/neurosci.html>*

Features: This site provides clear, interesting and extensive articles on topics including: neuroscience; neurophysiology; oral reflexes, sensory receptors of the tooth and periodontal membrane; swallowing and vomiting; effects of nerve lesions, consciousness, emotion, appetite and memory; sensation and central processing, sensory physiology; and physiology of acute pain.

### **Conclusion**

Although the quality, format, extensiveness and content of the web sites that have been listed and reviewed in this compendium vary rather widely, it is clear that dental educators and researchers have not lagged behind other health science professions in the use of information technology. This augurs well for the education of dental students and the dissemination of dental information to the public. However, it is evident that very few Asian institutes of higher learning, and even fewer South East Asian ones, have web sites providing dental and scientific information. In the field of dental education, dental schools in Hong Kong and Japan have taken the lead in this direction.

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