Management of the Immature Apex Tooth: An Online Study Guide

Abstract
The Editorial Board of the Journal of Endodontics has developed a literature-based study guide of topical areas related to endodontics. This study guide is intended to give the reader a focused review of the essential endodontic literature and does not cite all possible articles related to each topic. Although citing all articles would be comprehensive, it would defeat the idea of a study guide. This section will cover apexogenesis, revascularization/regeneration, apexitication, and artificial apical barriers. (J Endod 2008;34:e79–e85)

Introduction
The delivery of high quality clinical care requires a thorough understanding of the endodontic literature. The Editorial Board of the Journal of Endodontics has developed this online study guide for endodontists and fellow clinicians interested in endodontics.

There are several potential applications for an online study guide. First, an online study guide permits clinicians to focus in on particular areas of endodontics where they can quickly review key papers devoted to one particular topic. For example, this particular study guide provides a summary of key papers in the area of apexogenesis, revascularization/regeneration, apexitication, and artificial apical barriers.

Second, a study guide permits speakers to efficiently review background material in preparation for future courses, lectures, or continuing educational events. Third, an online study guide permits students to review key papers in preparation for future examinations or for development of residency seminars. Fourth, an online study guide permits readers to quickly and efficiently access either the abstract or the entire paper cited in the Tables (see Discussion for details).

Methods
One potential problem in developing an online study guide was to provide a summary of major papers that contributed to a given topic area. The inclusion of all possible papers on a given topic would lead to an unwieldy collection that failed to clearly identify key papers in the area. Of course, exclusion of key papers is also problematic. To address this issue, the JOE Editorial Board developed the overall list of topics to be covered and then for each topic generated an initial tabulation of key historical and contemporary papers on that topic. This list was then sent to two outside reviewers who were both experienced educators and Diplomates of the American Board of Endodontics. These reviewers then recommended additions and deletions of papers to the proposed topic list.

To maintain currency, the JOE Editorial Board proposes to periodically update each topical study guide by using the same peer-reviewed process as described above.

Results
The results of the study guide (1–52) provide an overview of selected literature that will cover apexogenesis, revascularization/regeneration, apexitication, and artificial apical barriers. This information is organized into Tables 1–4.

Discussion
The journey to clinical excellence requires not only outstanding clinical skills, but also that special knowledge that accrues from a study of the endodontic literature. The purpose of the JOE online study guide is to serve as one source for efficiently reviewing key papers that are organized by topic area and presented with the advantages of online Internet technology.

Although JOE readers are undoubtedly familiar with many aspects of the Internet, there are special features available at JOE online that provide particular advantages in their application for a study guide. For example, if this particular study guide is downloaded as a pdf, it provides a useful but static listing of the cited articles. On the other hand, if the reader navigates to the Table of Contents page for the Online Study Guide and then clicks on “Full Text” (Fig. 1), they will be taken to an HTML version of the Study Guide. This online version of the study guide has special capabilities including the fact that the references are hyperlinked. Thus, the
reader can quickly obtain abstracts of nearly all cited papers and can review the entire paper of many of the cited papers with only a few clicks of their mouse (Fig. 2). Thus, combining a study guide with online capabilities provides particular benefits for efficiently reviewing key papers in the endodontic literature.

We hope that this Study Guide will prove useful to you as one source for developing a focused and special base of endodontic knowledge. As always, we are interested in your thoughts on this initiative and how the JOE can better serve you, our readers. Feel free to email us at: JEndodontics@UTHSCSA.edu.

### TABLE 1. Apexogenesis

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| 1.    | Tronstad L.  
Reaction of the exposed pulp to Dycal treatment.  
| 2.    | Krakow AA, Berk H, Gron P.  
Therapeutic induction of root formation in the exposed incompletely formed tooth with vital pulp.  
| 3.    | Tenca JI, Tsamtsouris A.  
Continued root end development: apexogenesis and apexification.  
| 4.    | Cvek M.  
A clinical report on partial pulpotomy and capping with calcium hydroxide in permanent incisors with complicated crown fracture.  
| 5.    | Gutmann JL, Heaton JF.  
Management of the open (immature) apex: 1—vital teeth.  
| 6.    | Cvek M, Cleaton-Jones PE, Austin JC, Andreasen JO.  
Pulp reactions to exposure after experimental crown fractures grinding in adult monkeys.  
| 7.    | Cvek M, Lundberg M.  
Histological appearance of pulps after exposure by a crown fracture, partial pulpotomy, and clinical diagnosis of healing.  
| 8.    | Goldberg F, Massone EJ, Spielberg C.  
Evaluation of the dentinal bridge after pulpotomy and calcium hydroxide dressing.  
Partial pulpotomy as a treatment alternative for exposed pulps in crown-fractured permanent incisors.  
| 10.   | Mejare I, Cvek M.  
Partial pulpotomy in young permanent teeth with deep carious lesions.  
| 11.   | Bakland LK.  
Management of traumatically injured pulps in immature teeth using MTA.  
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Sterilization of infected root-canal dentine by topical application of a mixture of ciprofloxacin, metronidazole and minocycline *in situ*.  
In–vitro antibacterial susceptibility of bacteria taken from infected root dentine to a mixture of ciprofloxacin, metronidazole and minocycline.  
| 14.   | Yanpiset K, Trope M.  
Pulp revascularization of replanted immature dog teeth after different treatment methods.  
| 15.   | Iwaya S, Ikawa M, Kubota M.  
Revascularization of an immature permanent tooth with apical periodontitis and sinus tract.  
| 16.   | Ritter AL, Ritter AV, Murrah V, Sigurdsson A, Trope M.  
Pulp revascularization in replanted immature dog teeth after treatment with minocycline and doxycycline assessed by laser Doppler flowmetry, radiography, and histology.  
| 17.   | Banchs F, Trope M.  
Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol?  
| 18.   | Saito T, Ogawa M, Hata Y, Bessho K.  
Acceleration effect of human recombinant bone morphogentic protein-2 on differentiation of human pulp cells into odontoblasts.  
| 19.   | Murray PE, Garcia-Godoy F.  
Stem cell responses in tooth regeneration.  
| 20.   | Windley W, Teixeira F, Levin L, Sigurdsson A, Trope M.  
Disinfection of immature teeth with a triple antibiotic paste.  
| 21.   | Nakashima M, Akamine A.  
The application of tissue engineering to regeneration of pulp and dentin in endodontics.  
| 22.   | Chueh LH, Huang GT.  
Immature teeth with periradicular periodontitis or abscess undergoing apexogenesis: a paradigm shift.  
| 23.   | Murray PE, Garcia-Godoy F, Hargreaves KM.  
Regenerative endodontics: a review of current status and a call for action.  
| 24.   | Thibodeau B, Teixeira F, Yamauchi M, Caplan DJ, Trope M.  
Pulp revascularization of immature dog teeth with apical periodontitis.  
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<td>43.</td>
<td>Steinig TH, Regan JD, Gutmann JL. The use and predictable placement of Mineral Trioxide Aggregate® in one-visit apexification cases. Aust Endo J 2003;29:34–42.</td>
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References