The Use of Guided Tissue Regeneration Techniques among Endodontists: A Web-based Survey

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Abstract

Introduction: The purpose of this study was to determine factors and clinical situations that influence an endodontist's decision to use guided tissue regeneration (GTR) techniques during endodontic root-end surgery. **Methods:** An invitation to participate in a web-based survey was e-mailed to 3,750 members of the American Association of Endodontists. Data were collected from 1,129 participants, representing a 30.1% completion rate. The number of questions varied from 3 to 11 depending on individual responses. **Results:** 40.7% of respondents who perform root-end surgeries also use GTR techniques. The clinical situation in which GTR techniques are used most often is for transosseous lesions. Barrier membranes and bone replacement grafts are each used by more than 85% of respondents using GTR techniques. Insufficient training and insufficient evidence in support of its use were selected as the predominant reasons for not using GTR techniques at 42.4% and 32%, respectively. **Conclusions:** Although over 40% of respondents are currently using GTR techniques in conjunction with their root-end surgeries, a majority of those who do not use GTR indicated they would consider using these techniques with better evidence and available training. *(J Endod 2011;37: 1495–1498)*

Key Words

Endodontic surgery, guided tissue regeneration, root-end surgery

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Endodontic surgery involves the removal of cortical bone to gain access to the periapical area and subsequent primary closure of the surgical site with healthy soft tissue. The healing defect can either regain its original function through regeneration or regain health through repair (1). The determination of which healing process occurs is dependent on which cells proliferate the wound (2).

One criterion used to assess healing after surgery is the radiographic resolution of the osseous defect. If no decrease is noticed in relation to lesion size, further treatment may be initiated to include additional endodontic surgery or extraction. A periapical scar is one form of healing that can occur after surgery. Andreasen and Rud (3) attributed this to connective tissue ingrowth during healing. Although not pathologic, the radiolucent nature of the entrapped tissue may be misdiagnosed as disease and prompt unnecessary treatment. True regeneration requires mesenchymal cells native to the area, a matrix to permit accumulation of stem cells, and cellular signals to initiate differentiation of these cells.

Guided tissue regeneration (GTR) is a technique that delays apical migration of gingival epithelium by excluding gingival connective tissue and allowing tissue derived from the periodontal ligament and alveolar bone to repopulate the space adjacent to the denuded root surface. The need to guide the regenerative process for purely endodontic lesions has yet to be definitively established although there are studies to recommend its use with large (>1 cm) periapical lesions (4) and transosseous lesions (4, 5). There are circumstances when a periodontal component complicates treatment and the use of GTR is more widely accepted. These situations include communication of the lesion with periodontal pockets (6–9) and furcation or root perforation with crestal bone loss (2, 10).

GTR involves the use of bone replacement grafts, barrier membranes, and/or cellular modulating factors. Additional time is required to place these materials exposing the surgical site to the oral environment and dehydrating reflected tissues for an extended time. Success rates for endodontic surgery have been reported to range from 72% to 78% (11, 12) and as high as 94% using microsurgical techniques (13). Given the success of microsurgery, the added costs for materials, and the lack of persuading evidence, the benefit gained from GTR with endodontic surgery is debatable. The purpose of this study was to determine the factors and clinical situations that influence an endodontist's decision to use GTR techniques during endodontic surgery.

Materials and Methods

In August 2010, an invitation for a survey (Table 1) was e-mailed to 3,750 members of the American Association of Endodontists. The e-mail included a link to the survey created on the QuestionPro website (Survey Analytics, LLC, Seattle, WA). All respondents were kept anonymous to encourage accurate responses.

The number of questions encountered ranged from 3 to 11. If the participant answered that he/she did not perform root-end surgeries in question 3, the survey was ended. Those that continued but answered that they did not use any GTR techniques in question 5 were branched to 2 final questions inquiring further details. If participants answered "yes" to question 5, they were prompted to answer questions 6 through 11. All responses were recorded on the QuestionPro website.

Results

Of the members invited to participate, 1,238 (33%) opened the link to start the survey. Although 109 members failed to answer all associated questions (8.8%

TABLE 1. GTR Survey

1. What is your age group?
   A. <35
   B. 35–45
   C. 46–55
   D. 56–65
   E. >65
2. How many years has it been since you completed your residency training?
   A. 0–5
   B. 6–10
   C. 11–15
   D. 16–20
   E. >20
3. How many surgeries do you perform each month?
   A. None
   B. 1–3
   C. 4–6
   D. 7–10
   E. >10
4. Do you perform combined endodontic-periodontic surgeries?
   A. Yes
   B. No
5. Do you use any GTR techniques in conjunction with your surgeries?
   A. Yes
   B. No
6. Which clinical situations do you use GTR techniques? (select all that apply)
   A. Small periapical lesions (<1 cm)
   B. Large periapical lesions (>1 cm)
   C. Through-and-through (transosseous) lesions
   D. Furcation or root perforation repairs
7. Which GTR techniques do you use? (select all that apply)
   A. Barrier membrane
   B. Bone replacement graft
   C. Cellular modulating factors
8. Which type of membrane materials do you use? (select all that apply)
   A. Nonresorbable
   B. Resorbable
   C. I do not use a barrier membrane
9. Which type of bone replacement graft materials do you use? (select all that apply)
   A. Autogenous
   B. Demineralized freeze-dried bone allograft (DFDBA)
   C. Freeze-dried bone allograft (FDBA)
   D. Xenograft
   E. Alloplast
   F. I do not use a graft material
10. Which type of suture material do you use?
    A. Chromic gut
    B. Polyglycolid acid (PLGA; Vicryl)
    C. Silk
    D. Polytetrafluoroethylene (PTFE; Gortex)
11. When do you typically remove sutures?
    A. <5 days
    B. 5–7 days
    C. 1–2 weeks
    D. >2 weeks
12. Why do you choose not to use GTR techniques?
    A. Insufficient training
    B. Insufficient evidence
    C. Expense
    D. Time
    E. Other
13. Which factor would most likely encourage your use of GTR techniques in the future?
    A. Available CE training
    B. Better evidence
    C. Reduced expense
    D. Reduced treatment time
    E. Nothing would encourage my use of GTR

dropout), data were collected from 1,129 participants, representing a 30.1% completion rate. The average time to complete the survey was less than 1 minute.

Most respondents were 35 to 45 years of age (30.3%), 46 to 55 years of age (24.1%), and 56 to 65 years of age (23.1%). About a quarter were younger than 35 years of age (14.4%) or older than 65 years of age (8.2%). More than half completed residency training over 20 years ago (33.5%) or less than 5 years ago (23.9%). Those 6 to 10 years of age (16.7%), 11 to 15 years of age (15.4%), and 16 to 20 years of age (10.5%) removed from their residencies comprised less than half of the participants. There were no correlations with age or time since specialty training and the use of GTR techniques.

A majority (55.4%) perform 1 to 3 root-end surgeries each month. Sixteen percent perform 4 to 6, 7% perform 7 to 9, and 7.4% are completing more than 10 surgeries each month. The remaining 14.1% do not perform root-end surgeries and were not asked further questions. Of those performing surgery, 38.4% are treating combined endodontic-periodontic defects, and 40.7% are using GTR techniques. There was no correlation between the number of surgeries performed and the use of GTR techniques.

When asked which clinical situations GTR techniques would be used in, 88.7% selected transosseous lesions, 63.9% furcation or root perforation repairs, 62.9% periapical lesions larger than 1 cm, and 10.1% lesions smaller than 1 cm (Fig. 1). Barrier membranes were the most used technique (88.7%). Resorbable-type membrane materials were the most popular, used by 92.5% of respondents, whereas 7.7% used nonresorbable membranes. Bone replacement grafts were used almost as often as indicated by 85.6% of the participants. Demineralized freeze-dried bone allograft was the most popular graft material used by 67.3% of respondents, freeze-dried bone allografts were used by 29.9%, alloplast bone grafts were used by 22.2%,

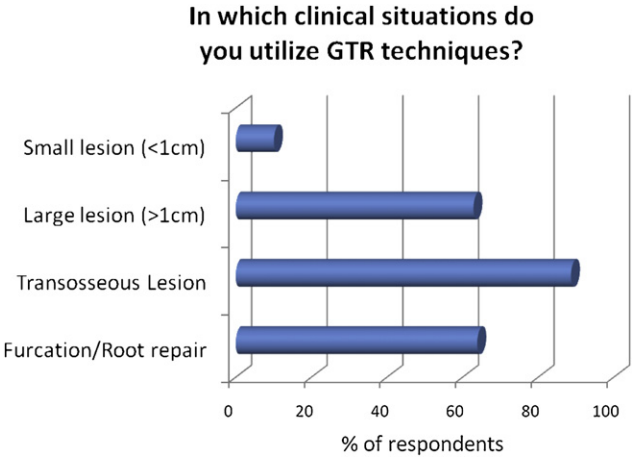

Figure 1. Survey question 6.

xenografts were used by 15.7%, and autogenous grafts were used by 11.1%. Cellular modulating factors were used by 9.5% of respondents.

For those performing surgery but not using GTR techniques (59.3%), 2 questions were asked to ascertain the reason. Insufficient training (42.4%) and insufficient evidence (32%) were the most common reasons followed by expense (6.2%), time (1.2%), and other unstated reasons (18.2%). When asked which factors, if any, would encourage the use of GTR techniques in the future, better evidence (42.3%) and available continuing education training (35.2%) were cited most often followed by reduced expense (7.4%) and reduced treatment time (3.2%). Some participants (11.9%) selected that nothing would encourage their use of GTR techniques.

Discussion

Regeneration is the biologic means of restoring form and function of injured or diseased tissue. It has been well documented that certain requirements must be fulfilled for regeneration to occur, and periodontal tissues are no exception (1). Mesenchymal cells with the ability to differentiate into specific tissue-forming cells are necessary to repopulate the periradicular area after surgery. These stem cells must be directed to divide into osteoblastic, cementoblastic, and periodontal ligament lineages by the appropriate morphogenic factors. Once signaled, these cells must have a matrix within which to develop and mature. If this favorable environment can be established, the body can regenerate lost tissue to its original form (14). The goal of endodontic surgery should be to remove the microbial etiology of the periradicular disease and also to establish an environment conducive to regeneration. This includes the thorough curettage of the osseous defect and primary closure of the surgical wound.

Melcher (15) noted that oral epithelial progenitor cells have a greater migratory rate than those of the periodontal ligament. He attributed this as the reason for long junctional epithelium formation after periodontal surgery rather than re-establishment of the periodontal attachment apparatus. Nyman et al (16) successfully applied guided techniques using a membrane barrier in the first clinical trials to show GTR. The clinical practice of guiding the regeneration process has since become well established with periodontal intrabony and furcation defects (17). Trope (18) used varying migratory rates to explain healing after traumatic dental injuries and reported that the critical factor in healing of the damaged root surface was the type of cells that migrate to and repopulate the affected area. Others have extrapolated this concept to the healing of periapical defects after endodontic root-end surgery and have applied GTR techniques in an attempt to more predictably regenerate lost tissues (4, 5, 14).

Limited studies and reviews of literature have been published assessing the use of GTR with endodontic surgeries. Those that have addressed lesions communicating with the alveolar crest and combined endodontic-periodontic lesions have shown the most promising and consistent results (14). Our data indicate that 38.4% of respondents are treating combined apicomarginal defects and that 63.9% are using GTR with furcation or root perforation repairs. The evidence for using GTR with purely endodontic lesions is not as convincing. Conclusions from these studies are mixed, and our study reflects this as only 40.7% of respondents are using these techniques. However, the effectiveness and significance of GTR in certain clinical situations do appear to have some credence when considered independently.

The strongest evidence in support of GTR is associated with transosseous lesions, which was the situation when these techniques were most used by our respondents (88.7%). High-level randomized clinical trials have found that GTR significantly improves the healing of transosseous lesions when compared with surgery not using GTR (4, 5, 19). These lesions are associated more often with scar formation (3), which may make their healing more amenable to GTR. Taschieri et al (5) evaluated the healing of large (>1 cm) lesions and found that GTR was not useful when at least 1 cortex was intact (5). This is in contrast to Pecora et al (4) who found that large lesions did benefit from membrane placement. Despite contrasting evidence, 62.9% of our respondents indicated using GTR techniques with large lesions.

Techniques include barrier membranes, bone graft materials, and morphogenic factors. Tobon et al (2) clinically compared the use of a barrier membrane alone and a barrier membrane in conjunction with a bone graft. They found that healing with barrier alone was better than the control but not as good as the combination of a graft and membrane. Similar conclusions were made by Britain et al (7) in a laboratory study using foxhounds. Our respondents indicated that barrier membranes are used by 88.7% and bone graft materials by 85.6%, which is in accord with the literature. Morphogenic signaling factors are vital in directing the differentiation and growth of the involved cells (1). The importance of adding modulating factors during treatment rather than relying on the natural factors local to the area has yet to be determined. Their use in cats was not shown to improve healing (20), and only 9.5% of our respondents are currently using them.

Lin et al (14) questioned the efficacy of GTR and stated that these techniques might even prevent regeneration. They argued that fibroblasts derived from the periodontal ligament could proliferate the defect to form scar tissue because they are not excluded with GTR and that osteoprogenitor cells from the periosteum are excluded. More than half (59.3%) of respondents choose not to use GTR techniques with their root-end surgeries. A lack of evidence was cited by 32% as the primary reason, whereas 42.4% do not use GTR because of a lack of training. This suggests that a significant number of endodontists would use GTR techniques if they had received the appropriate training.

Regeneration of lost periapical tissues is the ultimate goal of endodontic treatment. Root-end surgeries are typically in areas with otherwise healthy tissue. With microsurgical techniques, adequate curettage, and primary closure, healing is very predictable. Results of studies that evaluated healing using GTR have varied, and this is reflected in the results of this survey. Further studies should be conducted to determine which clinical situations would benefit from GTR and which techniques are most effective.

Acknowledgments

The authors deny any conflicts of interest related to this study.

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