Coronectomy in Patients With High Risk of Inferior Alveolar Nerve Injury Diagnosed by Computed Tomography

Ulkem Cilasun, DDS, PhD, Tulin Yildirim, MD,†*
Esra Guzeldemir, DDS, PhD,‡ and
Zafer Ozgur Pektas, DDS, PhD§

Purpose: Previous studies have suggested coronectomy as an alternative procedure to decrease the risk of inferior alveolar nerve (IAN) injury when there are high-risk findings observed on panoramic radiographs. However, the exact relation between the inferior alveolar canal and the roots is not obvious on 2-dimensional imaging. The aim of this study was to evaluate the success of coronectomy by comparing it with conventional extraction for the treatment of the patients who had clear IAN injury risks that were determined on 3 dimensions by computed tomography.

Patients and Methods: Two hundred and sixteen teeth of 124 patients were evaluated by computed tomography and 175 teeth of 120 patients were enrolled in the study. Teeth were divided into an extraction group (n = 87) and a coronectomy group (n = 88) according to the operations planned.

Results: The mean follow-up time of the study was 17.29 months. There were 2 patients in the extraction group who had moderate IAN injuries that resolved in 1 month. Also 1 case of dry socket was observed in the extraction group and 1 patient in the coronectomy group had minor infection 1 month postoperatively, which was treated with antibiotics and subgingival irrigations. There were 2 failed coronectomies and neither had any postoperative complications. No cases of lingual nerve injury were noted in this study.

Conclusions: Coronectomy appears to be a preferable alternative with a low incidence of complications and therefore a suggested technique for the treatment of impacted mandibular molars when there is a high risk of IAN injury.

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Injury to the inferior alveolar nerve (IAN) is a rare but serious complication of mandibular third molar extraction and the incidence is 0.5% to 8%,[1] whereas the incidence of persistent injury is approximately 1%.[1-4]

*Assistant Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Kocaeli, Kocaeli, Turkey.

†Associate Professor, Department of Radiology, Faculty of Medicine, Baskent University, Ankara, Turkey.

‡Assistant Professor, Department of Periodontology, Faculty of Dentistry, University of Kocaeli, Kocaeli, Turkey.

§Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Baskent University, Ankara, Turkey.

Address correspondence and reprint requests to Dr Cilasun: Department of Oral and Maxillofacial Surgery, University of Kocaeli, Yuvacik Yerleskesi, Dis Hekimligi Fakultesi, 41190, Yuvacik, Basiskele, Kocaeli, Turkey; e-mail: ulkem.cilasun@kocaeli.edu.tr

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The relation between the third molar and IAN can be evaluated with panoramic radiographs. Certain radiographic signs such as darkening of the root, deflection of the roots, narrowing of the root, dark and bifid apex of the root, interruption of white lines of the canal, diversion of the inferior alveolar canal, and narrowing of the inferior alveolar canal indicate proximity of the mandibular molars and the inferior alveolar canal.[5-10]

Diversion of the canal, darkening of the root, and interruption of the white line are significantly related to nerve injury, and narrowing or deflection of the root is also clinically important.[11,12]

Although the risk of IAN can be decreased with a careful technique, it cannot be totally eliminated. Knutsson et al[13] published the first series of coronectomy, or "intentional root retention," as an alternative to extraction to avoid IAN injury. Since then, a few studies have been conducted to evaluate coronectomy.[14-20] Pogrel et al[15] defined the technique in more detail and proposed some basic rules for carry-

ing out the procedure. In a subsequent article, Pogrel[21] refined the method and presented the results of longer follow-ups.

Recently, numerous studies have shown the value of computed tomography (CT) for assessing the spatial relation between the mandibular molars and the IAN.[22-27] In the presence of the earlier described high-risk findings on panoramic radiographs, CT is better able to evaluate the relation further.[21]

This study was designed to assess the success of coronectomy for third molars, which have close proximity to the inferior alveolar canal determined with CT, compared with conventional extraction.

Patients and Methods

The research is approved by the local ethical board. The study was undertaken from February 2006 to August 2008. Medically compromised patients and teeth with premature roots, profound dental caries, acute infection, or periodontally compromised were excluded. CT scans of 216 teeth of 124 patients with at least 1 high-risk finding on panoramic radiograph according to the criteria of Howe and Poyton[5] were examined. The absence of cortical bone between the root and the IAN was evaluated as eligible for coronectomy (n = 121). Teeth that were deeply impacted and horizontally positioned along the course of the IAN (n = 15) were excluded as suggested by Pogrel et al.[15] The study design is shown in Figure 1.

All patients were informed about conventional extraction and coronectomy and the potential risks of both procedures. After receiving informed consent, 1 patient did not agree to any of the procedures. Some patients agreed to 1 of the procedures (extraction or coronectomy) only for the side of complaint. Eventually, 26 teeth were excluded from the study. Six teeth from the coronectomy group were extracted by patients' requests and these were included in the extraction group.

All operations were performed under local anesthesia by the first author. In the extraction (n = 87) and coronectomy (n = 88) groups, a conventional mucoperiosteal flap with a buccal releasing incision was raised and retained with a retractor. During the coronectomy procedures, the crowns were transected by a fissure bur 2 to 3 mm below the cementoenamel junctions. Transections were carried out two thirds of the way across, toward the lingual side, at an angle of approximately 45° and then fractured off with an elevator with equal force to the roots and the crowns. All transections were performed under saline irrigation. After removal of the crowns, the remaining roots were reduced with a fissure bur, so that they were at least 2 to 3 mm below the crest of the lingual and the buccal plates in all dimensions. The socket was then irrigated with saline and tightly closed with 3-0 silk sutures. Antibiotics (amoxicillin clavulanate 625 mg, 2 × 1) and oral rinses (benzydamine HCL plus chlorhexidine gluconate, 2 × 1) were prescribed for 5 days postoperatively. Panoramic radiographs were taken immediately after the operation from all patients who had undergone coronectomy. All patients were invited to return for appointments at 1 week and the first, third, and sixth months for clinical and, when needed, radiographic evaluations. After the first 6 months, patients were advised to visit annually unless they became symptomatic.

In 2 patients, the root remnants were mobilized during the removal of the crown. Thus, the coronectomy was abandoned and the roots were removed simultaneously. These patients were assigned to a subgroup of "failed coronectomies" and followed with the rest of the coronectomy group.

No attempts were made to treat the pulps of the retained roots in this study because it has been shown that the pulps survive in vital retention of the roots.[28-31]

Results

Teeth that had at least 1 high-risk finding on panoramic radiograph were included in the study and examined by CT. These CT examinations showed a close relation to the IAN for 121 of the 216 teeth. Fifteen teeth that were deeply impacted or horizontally positioned along the course of the IAN and teeth of patients who did not accept any procedure for the 2 sides or 1 side were only followed (n = 26).

One hundred seventy-five teeth of 120 patients (55 bilateral, 65 unilateral) were assigned to 2 main groups, namely the coronectomy and extraction groups, according to the planned surgical procedure. Mean ages were 27.19 years for the coronectomy group and 27.36 years for the extraction group.

In the coronectomy group, 6 teeth were extracted at the patients' request and these were assigned to a higher-risk subgroup of the extraction group, the "extraction-with-consent" group. Coronectomy was planned for 88 and extraction for 87 teeth. Two teeth were mobilized during the coronectomy procedure and these had to be extracted; these were classified as failed coronectomy. These subgroups were followed with the rest of the main groups.

The mean follow-up periods were 17.62 months (6 to 30 months) in the extraction group and 16.97 months (6 to 29 months) in the coronectomy group. For the total of 175 operated teeth (87 extractions, 88 coronectomies) the mean follow-up period was 17.29 months (6 to 30 months).

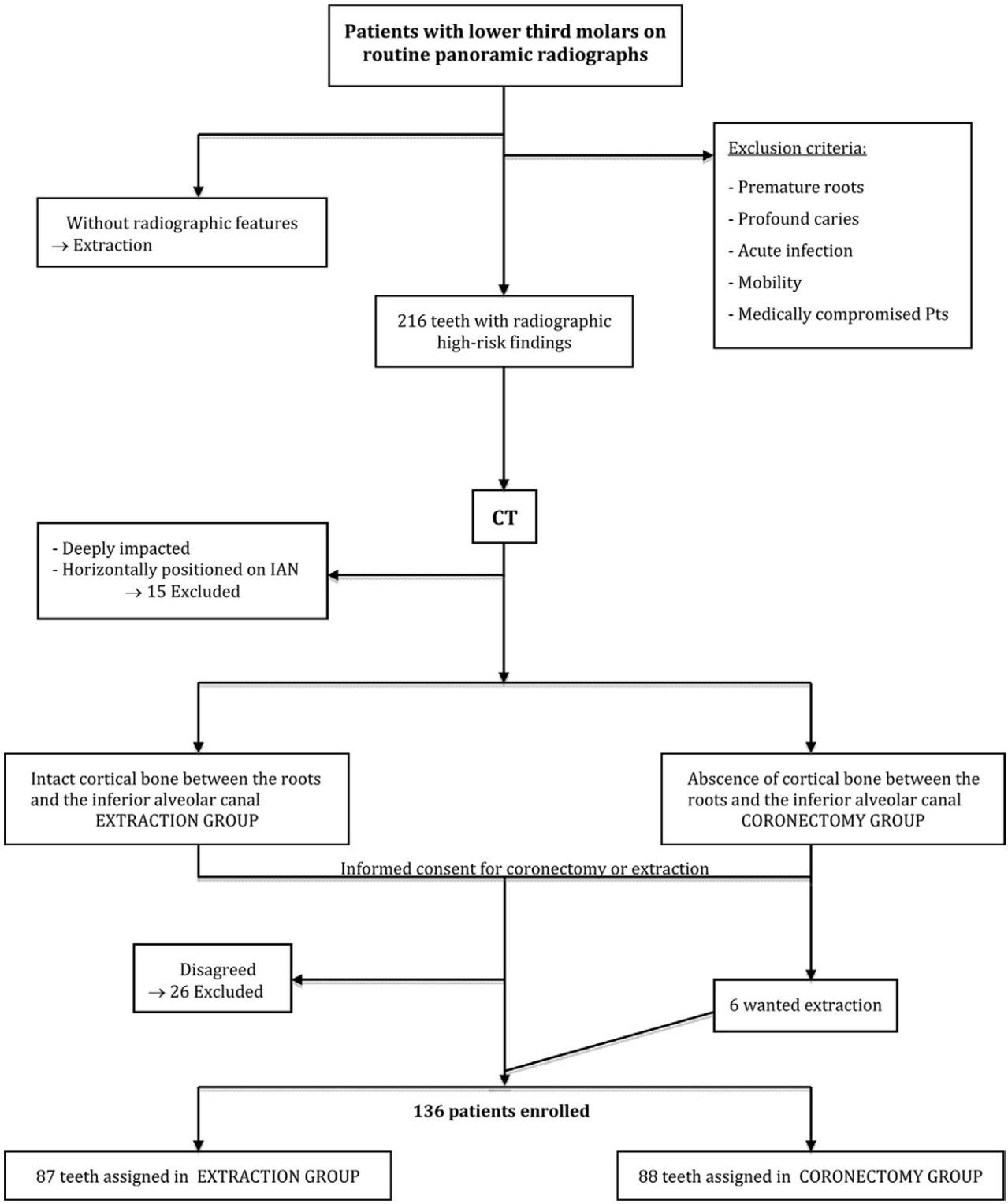

FIGURE 1. Study design.

Cilasun et al. Coronectomy in High Risk of IAN Injury. J Oral Maxillofac Surg 2011.

In the extraction group, 1 patient had dry socket and 2 patients had postoperative paresthesia of the lower lip and chin area. One of these patients was in the extraction-with-consent subgroup. Also, in 1 patient a root tip fracture occurred during the operation; no postoperative complications were seen in this patient.

In the coronectomy group, 1 patient complained of pain on the 10th postoperative day, and 1 patient had

a minor infection after 3 to 4 weeks postoperatively. There were 2 failed coronectomies and neither developed postoperative complications.

Overall complication rates were 4.6% (4/87) in the extraction group and 4.5% (4/88) in the coronectomy group.

The outcomes and characteristics of the 2 groups were similar.

In the extraction group, dry socket was treated by irrigation and dressing with Alvogyl (Septodont, France). The 2 postoperative paresthesias lasted for 3 to 4 weeks and both recovered totally in 1 month. The fragment (<3 mm) of the root tip fracture was left with the consent of the patient due to the risk of IAN injury. In the coronectomy group, the patient who had pain on the 10th postoperative day requested to have a second operation for the removal of the retained root. Minor infection was treated with antibiotic therapy and subgingival irrigations with antiseptics and resolved in 1 week.

Discussion

The success rates were 95.4% in the extraction group (n = 87) and 95.5% in the coronectomy group (n = 88). All were followed for approximately 17 months. This result is higher than the reported rates in some previous studies.[16,17,19,20]

IAN damage is not frequent but is a well-known complication that can be seen after removal of mandibular third molars. Known risk factors for this nerve injury include radiographic proximity, patient's age, pre-existing disease, surgical procedures, and a surgeon's experience.[32] However, the exact relation between the roots and the IAN cannot be observed on panoramic radiographs. Appropriate sections on a CT scan can show this spatial relation in greater detail than panoramic radiographs and display the positions of the roots and the IAN in 3-dimensional view. However, even with CT, there are some cases where it is not possible to orient the slices exactly as wished and nerve injuries can still occur.[32] In this study, more than half the teeth evaluated with CT showed a direct relation with the IAN by the absence of cortical bone between roots and the inferior alveolar canal. Therefore, when a high-risk finding is observed on panoramic radiograph, CT imaging would be appropriate before deciding the treatment. Two-year follow-up after coronectomy is sufficient to evaluate the incidence of symptomatic complications such as nerve injury, dry socket, and early eruption.[17] According to Pogrel et al,[15] asymptomatic patients did not have to be followed up after 6 months. Therefore, the patients in this series were informed that the long follow-up was only for research purposes, and after the first month they were seen at 3-month intervals for the first 6 months and then followed annually.

It has been reported that late eruption or root migrations can occur in up to 10 years after coronectomy.[17,33] Because the maximum follow-up period was planned as 2.5 years in this study, complications after this period were not assessed.

In 2 patients in the extraction group, moderate paresthesias were observed postoperatively and the 2 patients recovered within 1 month. These probably resulted from the pressure transmitted to the nerve during extraction. None of the patients in the coronectomy group had any postoperative neurologic symptoms in this study, whereas some neurologic complications have been reported in previous studies.[13,16,17,19,20] Because the 2 paresthesias in the extraction group completely resolved within weeks, this technique could be preferred for cases in which the nerve actually traverses the root itself.

Leung and Cheung[20] reported similar postoperative infection rates, 5.8% in the coronectomy and 6.7% in the control group, as those in the present study. Similarly, in a randomized controlled trial by Renton et al,[17] a 3.19% infection rate was reported after coronectomy. The incidence of dry socket was higher than 10% in the study by Renton et al. However, in this study, the postoperative infection rates were 1% in the coronectomy group and 0% in the extraction group and rates for dry socket were 1% in the extraction group and 0% in the coronectomy group. These rates are lower than those reported previously.[17,20] In contrast, these 2 studies concluded that the infection rates were similar in both groups, which corresponds to the present study.

Failure in coronectomy was reported as 38% in a study by Renton et al.[17] This failure rate was attributed to the conically rooted teeth in women by the investigators[17] or to the technique used to section the roots.[21] Although the same technique was used and the percentage of women was higher, the failure rate was 2.3% in the present study and no correlation was found between any apparent factors and failure of the technique.

Except for 1 patient who underwent reoperation at her own decision, none of the patients required a subsequent root removal. Hence, the rate for a need of a second operation is assessed as 0% in this study, which is comparable with previously reported rates.[17,18]

Results of the present study are consistent with those of recent studies that used 2-dimensional radiographs at enrollment.[15-18,20] This study design is similar to the case-control study reported by Hatano et al,[19] who reported similar results in a shorter follow-up period.

This study supports the results of some previous studies[14-20,34] and indicates that coronectomy can be a successful alternative to extraction with a low complication rate.

A randomized controlled trial with longer follow-up period and a larger number of cases should be the next step to add to and improve the increasing evidence being gathered for the effectiveness of coronectomy as a feasible alternative to extraction.

In conclusion, with a success rate of 96.5% in 87 cases, coronectomy can be suggested as an efficient alternative technique for the management of mandibular wisdom teeth when there is a high risk of IAN injury.

References

1. Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C: Inferior alveolar nerve damage after lower third molar surgical extraction: A prospective study of 1117 surgical extractions. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 92:377, 2001
2. Schultze-Mosgau S, Reich RH: Assessment of inferior alveolar and lingual nerve disturbances after dentoalveolar surgery, and of recovery of sensitivity. Int J Oral Maxillofac Surg 22:214, 1993
3. Gülicher D, Gerlach KL: Sensory impairment of the lingual and inferior alveolar nerves following removal of impacted mandibular third molars. Int J Oral Maxillofac Surg 30:306, 2001
4. Queral-Godoy E, Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C: Incidence and evolution of inferior alveolar nerve lesions following lower third molar extraction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 99:259, 2005
5. Howe GL, Poyton HG: Prevention of damage to the inferior dental nerve during the extraction of mandibular third molars. Br Dent J 109:353, 1960
6. Kipp DP, Goldstein BH, Weiss WW Jr: Dysesthesia after mandibular third molar surgery: A retrospective study and analysis of 1,377 surgical procedures. J Am Dent Assoc 100:185, 1980
7. Main LR: Further roentgenographic study of mandibular third molars. J Am Dent Assoc 25:1993, 1938
8. Stockdale CR: The relationship of the roots of mandibular third molars to the inferior dental canal. Oral Surg Oral Med Oral Pathol 12:1061, 1959
9. Waggener DT: Relationships of third molar roots to the mandibular canal. Oral Surg Oral Med Oral Pathol 12:853, 1959
10. Seward GR: Radiology in general dental practice. VIII. Assessment of lower third molars. Br Dent J 115:45, 1963
11. Rood JP, Shehab BA: The radiological prediction of inferior alveolar nerve injury during third molar surgery. Br J Oral Maxillofac Surg 28:20, 1990
12. Sedaghatfar M, August MA, Dodson TB: Panoramic radiographic findings as predictors of inferior alveolar nerve exposure following third molar extraction. J Oral Maxillofac Surg 63:3, 2005
13. Knutsson K, Lysell L, Rohlin M: Postoperative status after partial removal of the mandibular third molar. Swed Dent J 13:15, 1989
14. Freedman GL: Intentional partial odontectomy: Review of cases. J Oral Maxillofac Surg 55:524, 1997
15. Pogrel MA, Lee JS, Muff DF: Coronectomy: A technique to protect the inferior alveolar nerve. J Oral Maxillofac Surg 62: 1447, 2004
16. O'Riordan BC: Coronectomy (intentional partial odontectomy of lower third molars). Oral Surg Oral Med Oral Pathol Oral Radiol Endod 98:274, 2004
17. Renton T, Hankins M, Sproate C, McGurk M: A randomised controlled clinical trial to compare the incidence of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars. Br J Oral Maxillofac Surg 43:7, 2005
18. Dolanmaz D, Yildirim G, Isik K, et al: A preferable technique for protecting the inferior alveolar nerve: Coronectomy. J Oral Maxillofac Surg 67:1234, 2009
19. Hatano Y, Kurita K, Kuroiwa Y, et al: Clinical evaluations of coronectomy (intentional partial odontectomy) for mandibular third molars using dental computed tomography: A case-control study. J Oral Maxillofac Surg 67:1806, 2009
20. Leung YY, Cheung LK: Safety of coronectomy versus excision of wisdom teeth: A randomized controlled trial. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 108:821, 2009
21. Pogrel MA: Partial odontectomy. Oral Maxillofac Surg Clin North Am 19:85, 2007
22. Nakagawa Y, Ishii H, Nomura Y, et al: Third molar position: Reliability of panoramic radiography. J Oral Maxillofac Surg 65:1303, 2007
23. Monaco G, Montevecchi M, Bonetti GA, et al: Reliability of panoramic radiography in evaluating the topographic relationship between the mandibular canal and impacted third molars. J Am Dent Assoc 135:312, 2004
24. Maegawa H, Sano K, Kitagawa Y, et al: Preoperative assessment of the relationship between the mandibular third molar and the mandibular canal by axial computed tomography with coronal and sagittal reconstruction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 96:639, 2003
25. Ohman A, Kivijärvi K, Blombäck U, Flygare L: Pre-operative radiographic evaluation of lower third molars with computed tomography. Dentomaxillofac Radiol 35:30, 2006
26. Tantanapornkul W, Okouchi K, Fujiwara Y, et al: A comparative study of cone-beam computed tomography and conventional panoramic radiography in assessing the topographic relationship between the mandibular canal and impacted third molars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 103:253, 2007
27. Bell GW: Use of dental panoramic tomographs to predict the relation between mandibular third molar teeth and the inferior alveolar nerve. Radiological and surgical findings, and clinical outcome. Br J Oral Maxillofac Surg 42:21, 2004
28. Johnson DL, Kelly JF, Flinton RJ, Cornell MT: Histologic evaluation of vital root retention. J Oral Surg 32:829, 1974
29. Whitaker DD, Shankle RJ: A study of the histologic reaction of submerged root segments. Oral Surg Oral Med Oral Pathol 37:919, 1974
30. Plata RL, Kelln EE, Linda L: Intentional retention of vital submerged roots in dogs. Oral Surg Oral Med Oral Pathol 42:100, 1976
31. Cook RT, Hutchens LH, Burkes EJ: Periodontal osseous defects associated with vitally submerged roots. J Periodontol 48:249, 1977
32. Assael LA: Coronectomy: A time to ponder or a time to act? J Oral Maxillofac Surg 62:1445, 2004
33. Zola MB: Avoiding anesthesia by root retention. J Oral Maxillofac Surg 51:954, 1993
34. Pogrel MA: Coronectomy to prevent damage to the inferior alveolar nerve. Alpha Omegan 102:61, 2009