CASE REPORT

Forced Eruption of an Impacted Third Molar Using a Bracket-Head Miniscrew

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The frequency of second-molar impaction is reportedly only .08% in the maxilla and .01% in the mandible.[1] When a second molar requires extraction because of ankylosis or unfavorable positioning, the third molar can replace it. The best timing for extraction of impacted second molars is during adolescence,[2] when the third molar roots are not yet completely formed and the apices remain open.[3] Early diagnosis of impaction can avoid occlusal problems such as inversion of neighboring teeth and extrusion of opposing teeth.[4] If the third molar fails to erupt after extraction of the second molar, however, orthodontic treatment will be required.

Although conventional orthodontic miniscrews have been used for skeletal anchorage in various types of treatment,[5-11] they permit only limited force vectors and ranges of tooth movement. The bracket-head miniscrew, which can be engaged with an archwire, has been used effectively in treatment involving maxillary second molars.[12] This case report describes the use of a bracket-head screw to force the eruption of an impacted mandibular third molar after extraction of an impacted mandibular second molar.

Diagnosis and Treatment Plan

A 23-year-old female presented with the chief complaint of an unerupted mandibular left sec-


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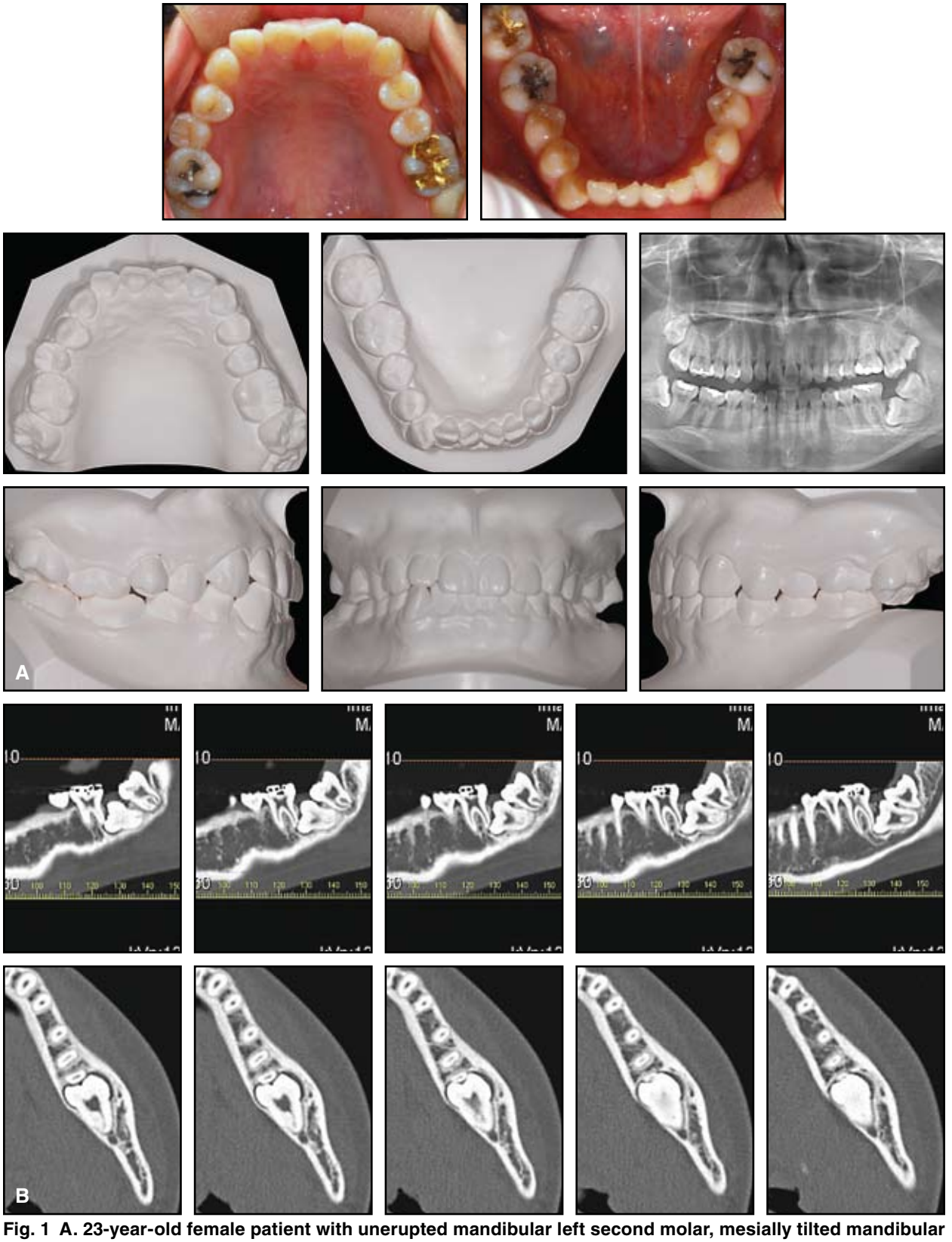

Fig. 1 A. 23-year-old female patient with unerupted mandibular left second molar, mesially tilted mandibular third molar, and extruded maxillary left second molar. B. Computed tomography shows crown of mandibular left second molar impacted horizontally under distal root of first molar, with distal root of first molar positioned between buccal and lingual cusps of second molar.

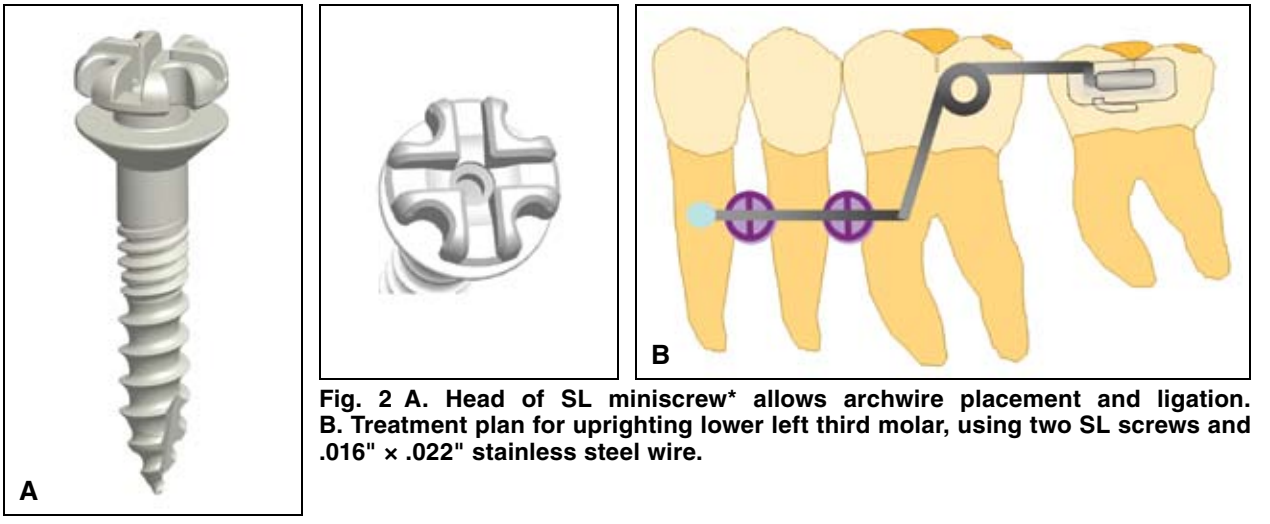

Fig. 2 A. Head of SL miniscrew* allows archwire placement and ligation. B. Treatment plan for uprighting lower left third molar, using two SL screws and .016" × .022" stainless steel wire.

ond molar (Fig. 1). She had a Class I malocclusion on the right and a Class II relationship on the left, and the dental midline was deviated about 1.5mm to the left. There was 3.7mm of crowding in the upper arch and 5.2mm in the lower.

Clinical examination revealed that the mandibular left second molar was unerupted. The maxillary left second molar was buccally extruded due to the lack of opposition. The panoramic x-ray indicated that the mandibular left second and third molars were impacted, with the second molar lying horizontally under the third, which was tilted mesially. Both of the right third molars were also impacted. Computed tomography showed that the crown of the mandibular left second molar was horizontally impacted under the distal root of the first, with the distal root of the first molar positioned between the buccal and lingual cusps of the second (Fig. 1B). The shape and the size of the second molar crown were similar to those of the third molar, but the root of the third molar was slightly shorter than that of the second.

Although extraction of all impacted molars and full-arch orthodontic treatment were recommended, the patient insisted that treatment be limited to the left upper and lower molars. Therefore, the treatment objectives were to establish proper occlusion of the left molars by extraction of the lower second molar, forced eruption of the impacted lower third molar, and intrusion and lingual movement of the upper second molar, using minimal orthodontic appliances. We considered extraction of the third molar followed by forced eruption of the second, but the third molar impaction appeared more difficult to manage than that of the second.

Skeletal anchorage was required if we were to move only the left upper second and lower third molars. We planned to insert conventional orthodontic miniscrews on the lingual side for intrusion and lingual tipping of the upper molar, along with two bracket-head miniscrews on the lower buccal side for forced eruption and protraction of the lower molar (Fig. 2).

Treatment

After the lower left second molar was surgically extracted, a button was bonded to the occlusal surface of the third molar for forced eruption. Using the self-drilling method,[13] we inserted two bracket-head SL miniscrews* (6.5mm long, 1.5mm in diameter) mesial and distal to the lower left second premolar, on the buccal side, for eruption and protraction of the impacted lower left third molar. The SL screw has two .022" slots on the head for archwire placement and four notches for ligatures.

We used an .016" × .022" TMA** wire with a helix for exposure and initial leveling of the third molar. Elastic thread was connected between the occlusal button on the third molar and the looped end of the TMA wire for eruption (Fig. 3).

During this phase, a conventional Miangang* miniscrew

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Fig. 3 After extraction of lower left second molar, conventional miniscrew* placed in upper arch for intrusion and tipping. Two bracket-head SL screws placed in lower arch, with occlusal button bonded to lower left third molar to initiate uprighting with .016" × .022" TMA wire.**

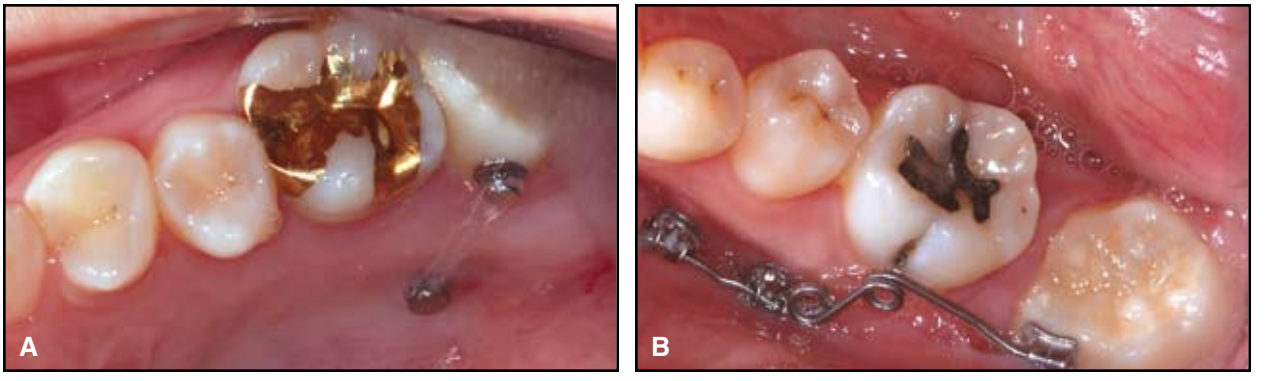

Fig. 4 A. Power chain applied to lingual button on upper left second molar to begin lingual tipping. B. Button on lower left third molar replaced with buccal tube; .016" × .022" stainless steel archwire and power chain placed to continue uprighting and protraction.

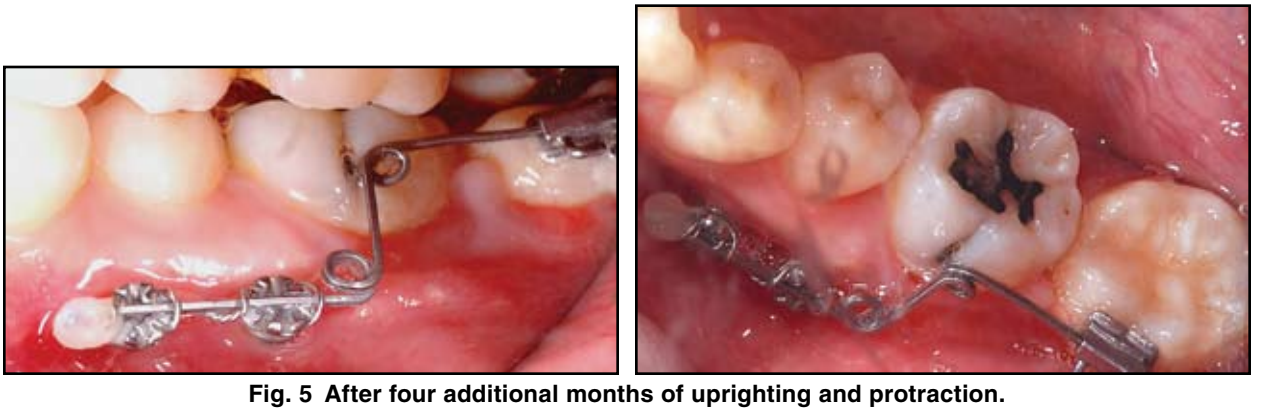

Fig. 5 After four additional months of uprighting and protraction.

(8mm long, 1.2mm in diameter) was placed mesial to the upper left second molar on the lingual side. A button was bonded to the lingual surface of the second molar, and power chain was applied from the button to the lingual miniscrew for intrusion and lingual tipping (Fig. 4A). The upper left third molar was extracted during this stage to avoid interference with movement of the second molar.

After four months of protraction, the lower left third molar had erupted. The occlusal button was then removed, and a tube was bonded to the buccal surface of the molar (Fig. 4B). An .016" × .022" stainless steel wire and power chain were used to protract the third molar with sliding mechanics (Fig. 5). Another four months later, brackets were bond-

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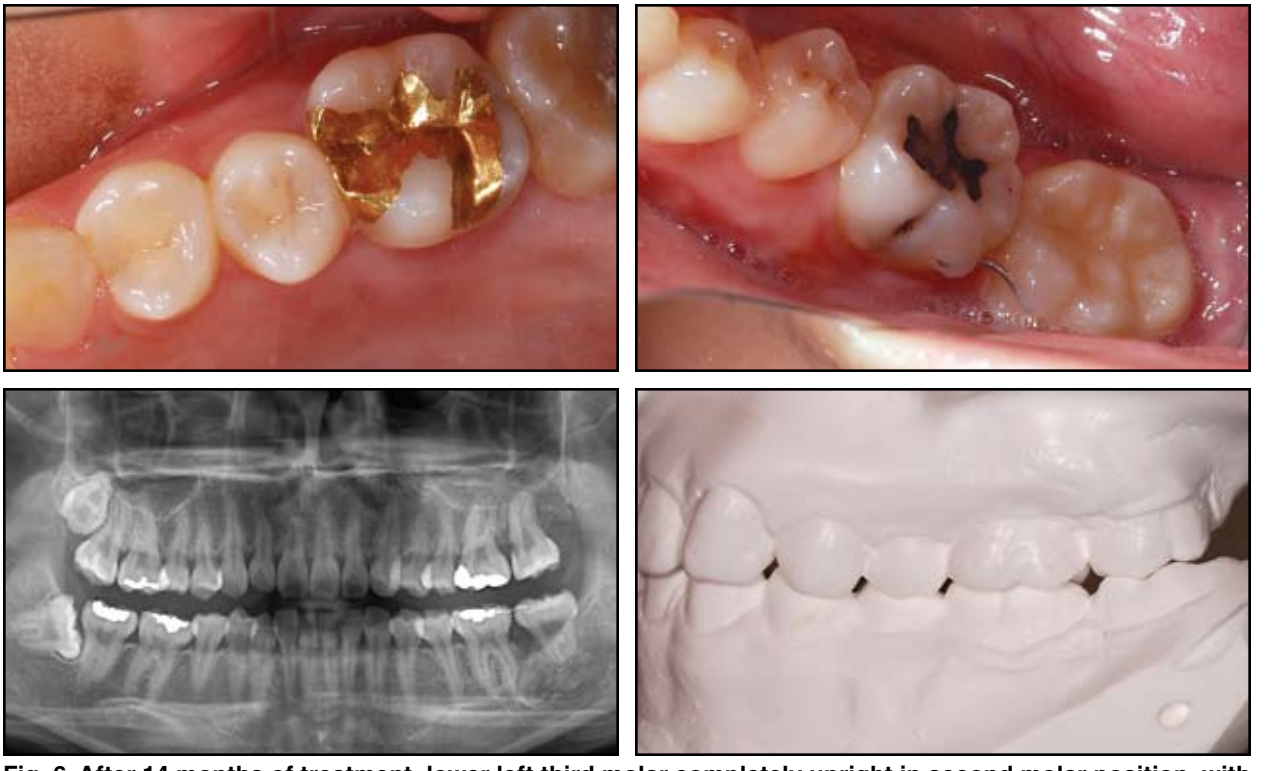

Fig. 6 After 14 months of treatment, lower left third molar completely upright in second molar position, with upper left second molar tipped lingually and intruded.

Fig. 7 Cast shows stable result six months after completion of treatment.

ed to the upper first and second molars for leveling with an L-loop .016" × .022" TMA wire.

After 14 months of treatment, the lower left third molar had been uprighted into the second molar position with no anterior tipping or extrusion (Fig. 6). The long axis of the third molar was parallel to that of the first molar, and the occlusal levels of the two molars were even. The shape and size of the third molar crown were acceptable for replacement of the second molar; as expected, the root of the third molar was slightly short. The upper left second molar had been intruded about 3mm, level with the first molar, with no reduction in the depth of the gingival sulcus. No significant movement of other teeth was observed during treatment.

A fixed retainer wire was bonded to the buccal side of the lower left first and third molars. Six months later, the position and occlusion of the treated teeth were well maintained (Fig. 7).

Discussion

As reported by other authors,[14,15] skeletal anchorage was used to effectively correct the left molar positions in this patient, who had requested only limited orthodontic treatment. We used a conventional miniscrew for the upper second molar because its simple, direct vector was sufficient to produce intrusion and lingual movement.[16,17] Forced eruption is difficult to achieve with these miniscrews, however, because elastics and springs cannot control the three-dimensional force vectors required for such movements. Therefore, we used bracket-head miniscrews to erupt and protract the impacted lower third molar, allowing archwire engagement for the application of more complex force vectors.

Roberts and colleagues[18] recommended the use of endosseous implant anchorage to protract second and third molars into the space of a missing first molar, without movement of other teeth or rotation or tipping of the second and third molars, but this type of implant requires surgical procedures for insertion and removal. Although some clinicians have used indirect anchorage for such treatment,[19] the indirect attachment makes it difficult to detect screw loosening and bond failures that may result in unexpected movement of the anchorage tooth, the target tooth, or both.

Direct anchorage from bracket-head miniscrews with engaged archwires can resolve these problems.[12] In cases where limited tooth movement is required, the technique presented here can simplify treatment and permit the application of three-dimensional forces without adversely affecting other teeth.

REFERENCES

1. Grover, P.S. and Lorton, L.: The incidence of unerupted permanent teeth and related clinical cases, Oral Surg. Oral Med. Oral Pathol. 59:420-425, 1985.
2. Owen, A.H.: Early surgical management of impacted mandibular second molars, J. Clin. Orthod. 32:446-450, 1998.
3. Johnson, J.V. and Quirk, G.P.: Surgical repositioning of impacted mandibular second molar teeth, Am. J. Orthod. 91:242-251, 1987.
4. Valmaseda-Castellón, E.; De-la-Rosa-Gay, C.; and Gay-Escoda, C.: Eruption disturbances of the first and second permanent molars: Results of treatment in 43 cases, Am. J. Orthod. 116:651-658, 1999.
5. Park, H.S.: The skeletal cortical anchorage using titanium microscrew implants, Kor. J. Orthod. 29:699-706, 1999.
6. Im, D.H.; Park, H.J.; Park, J.W.; Kim, J.I.; and Chang, Y.I.: Surgical orthodontic treatment of skeletal Class III malocclusion using mini-implant: Correction of horizontal and vertical dental compensation, Kor. J. Orthod. 36:388-396, 2006.
7. Kyung, S.H.: A study on the treatment of anterior open bite with midpalatal miniscrews, Kor. J. Orthod. 34:13-21, 2004.
8. Kim, J.W.; Baek, S.H.; Kim, T.W.; and Chang, Y.I.: Comparison of stability between cylindrical and conical type mini-implants, Angle Orthod. 78:692-698, 2008.
9. Kim, T.W.; Baek, S.H.; Kim, J.W.; and Chang, Y.I.: Effects of microgrooves on the success rate and soft tissue adaptation of orthodontic miniscrews, Angle Orthod. 78:692-698, 2008.
10. Park, Y.C.; Lee, S.Y.; Kim, D.H.; and Jee, S.H.: Intrusion of posterior teeth using mini-screw implants, Am. J. Orthod. 123:690-694, 2003.
11. Kim, T.W.; Kim, H.; and Lee, S.J.: Correction of deep overbite and gummy smile by using a mini-implant with a segmented wire in a growing Class II Division 2 patient, Am. J. Orthod. 130:676-685, 2006.
12. Godtfredsen Laursen, M. and Melsen, B.: Multipurpose use of a single mini-implant for anchorage in an adult patient, J. Clin. Orthod. 43:193-199, 2009.
13. Kim, J.W.; Ahn, S.J.; and Chang, Y.I.: Histomorphometric and mechanical analyses of the drill-free screw as orthodontic anchorage, Am. J. Orthod. 128:190-194, 2005.
14. Umemori, M.; Sugawara, J.; Mitani, H.; Nagasaka, H.; and Kawamura, H.: Skeletal anchorage system for open-bite correction, Am. J. Orthod. 115:166-174, 1999.
15. Sugawara, J.; Kanzaki, R.; Takahashi, I.; Nagasaka, H.; and Nanda, R.: Distal movement of maxillary molars in nongrowing patients with the skeletal anchorage system, Am. J. Orthod. 129:723-733, 2006.
16. Tamamura, N.; Kuroda, S.; Sugawara, Y.; Takano-Yamamoto, T.; and Yamashiro, T.: Use of palatal miniscrew anchorage and lingual multi-bracket appliances to enhance efficiency of molar scissors-bite correction, Angle Orthod. 79:577-584, 2009.
17. Nagaraj, K.; Upadhyay, M.; and Yadav, S.: Titanium screw anchorage for protraction of mandibular second molars into first molar extraction sites, Am. J. Orthod. 134:583-591, 2008.
18. Roberts, W.E.; Marshall, K.J.; and Mozsary, P.G.: Rigid endosseous implant utilized as anchorage to protract molars and close an atrophic extraction site, Angle Orthod. 60:135-152, 1990.
19. Yun, S.W.; Lim, W.H.; Chong, D.R.; and Chun, Y.S.: Scissors-bite correction on second molar with a dragon helix appliance, Angle Orthod. 132:842-847, 2007.