

# Mandibular Incisor Intrusion: An Adjunct to Restoring Short, Abraded Anterior Teeth

**Vincent G. Kokich, DDS, MSD**  
Professor  
Department of Orthodontics  
School of Dentistry  
University of Washington  
Seattle, Washington

**Frank M. Spear, DDS, MSD**  
Founder and Director  
Seattle Institute for Advanced Dental  
Education  
Seattle, Washington  
Affiliate Assistant Professor  
University of Washington  
School of Dentistry  
Seattle, Washington  
Private Practice  
Seattle, Washington

**David P. Mathews, DDS**  
Affiliate Assistant Professor  
Department of Periodontics  
School of Dentistry  
University of Washington  
Seattle, Washington

A common challenge for dentists is to restore the dentition of an adult who has a history of bruxism and anterior tooth wear. Some individuals have a lateral bruxing habit, which results primarily in posterior tooth wear. Other individuals may have a circumferential or circular bruxing pattern, which produces wear on both the anterior and posterior teeth. However, there are some patients who only brux in an antero-posterior direction. These individuals cause attrition of the maxillary anterior teeth, the mandibular anterior teeth, or both. When anterior teeth abrade gradually over a long period of time, they continue to erupt to maintain occlusal contact. So after years of protrusive bruxing, when your patient wants their short, stubby teeth to look more esthetic, how do you manage this perplexing situation? Do you restore all of the teeth in order to open the bite? Do you recommend endodontics and crown lengthening of both the maxillary and mandibular incisors to permit preparation and restoration? Or are there other solutions for this anterior restorative dilemma? In many of these cases, orthodontic intrusion of the worn and abraded teeth can provide the key to the conservative management of these types of patients. This article will describe and discuss the steps involved in the orthodontic-restorative management of patients with significant wear and overeruption of their anterior teeth.

## Description of the Problem

This 48 year-old woman wanted to improve the esthetics of her smile. Her maxillary incisors had been previously restored, and the right central and lateral incisors had received root canal therapy (Figure 1A through Figure 1E). She had a long history of protrusive bruxism. As a result, she had abraded the lingual surfaces of the maxillary anterior teeth

and had lost nearly half the length of her mandibular incisors. Her resulting overbite was deep with the mandibular incisors over-erupting and impinging near the lingual gingival margins of the maxillary incisors. She was missing her mandibular right second premolar and second molar as well as the maxillary left second and third molars. Her maxillary dental midline was coincident with her facial midline; however, the mandibular dental midline deviated slightly to the right. Her periodontal health was good with no significant bone loss in any areas. The primary problems facing the restorative dentist were the deep anterior overbite, extensive wear of the mandibular incisors, and poor infrastructure of the previously restored maxillary incisors.

## Treatment Objectives

The following treatment objectives were established to satisfy this patient's concerns.

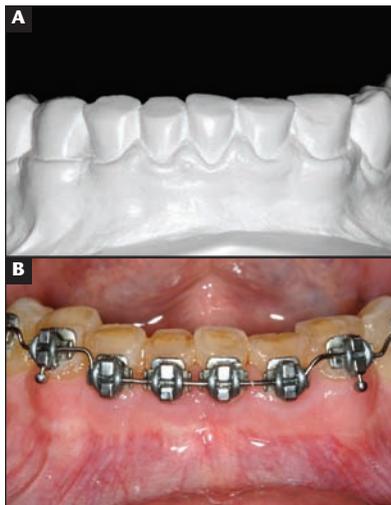
- Improve the esthetic appearance of the maxillary anterior teeth
- Lengthen the mandibular incisors
- Reduce the anterior overbite
- Maintain the posterior occlusion
- Maintain periodontal health
- Replace the failing anterior and posterior restorations

## Treatment Alternatives

There are several treatment alternatives that would satisfy the aforementioned objectives. One of the primary concerns was how to overcome the mandibular incisor abrasion and overeruption. First of all, to "open the bite," all of the posterior teeth could be restored at a greater vertical dimension. However, the long-term prognosis of opening the vertical dimension in adults is unpredictable, with most retrospective studies<sup>1-3</sup> showing that the patient returns to the original vertical dimension with time.



**Figure 1** This 48-year-old woman wanted to improve the esthetic appearance of her maxillary anterior teeth. All four maxillary incisors had been restored previously (**A**). Periapical radiographs showed that the right central and lateral incisors had received root canal therapy (**B**), and all four incisors were not structurally sound beneath the restorations (**B,C**). The lingual surfaces of the maxillary incisors were abraded (**D**), and the anterior overbite was deep, with the mandibular incisors impinging near the lingual gingival margins of the maxillary incisors (**E**).



**Figure 2** The incisal edges of the mandibular incisors had been severely abraded from a protrusive bruxing habit, and these teeth had overerupted (**A**). To facilitate restoration of the mandibular incisors without further incisal preparation, the mandibular incisors were intruded (**B**). This created restorative space and moved the bone and gingival margins apically.

A second treatment alternative would be to perform crown-lengthening surgery on the mandibular incisors, prepare the teeth for crowns, and restore the incisors with porcelain crowns. However, this alternative would require further reduction of these already severely abraded teeth, which could necessitate endodontic therapy and post and core build-ups of the mandibular incisors. A third alternative would involve orthognathic surgery to rotate the mandible downward, open the anterior vertical dimension, and allow the incisors to be restored at an increased crown length. However, this alternative could result in lip incompetence, and the patient already had normal vertical facial proportions. The fourth option would be to intrude the abraded and overerupted mandibular incisors and then restore them with porcelain veneers. This alternative would not require periodontal surgery, endodontic therapy, or orthognathic surgery. This plan would treat the real problem, ie, the over-eruption of the abraded teeth, by placing them back where they started. This would allow the dentist to replace the teeth without further tooth preparation.

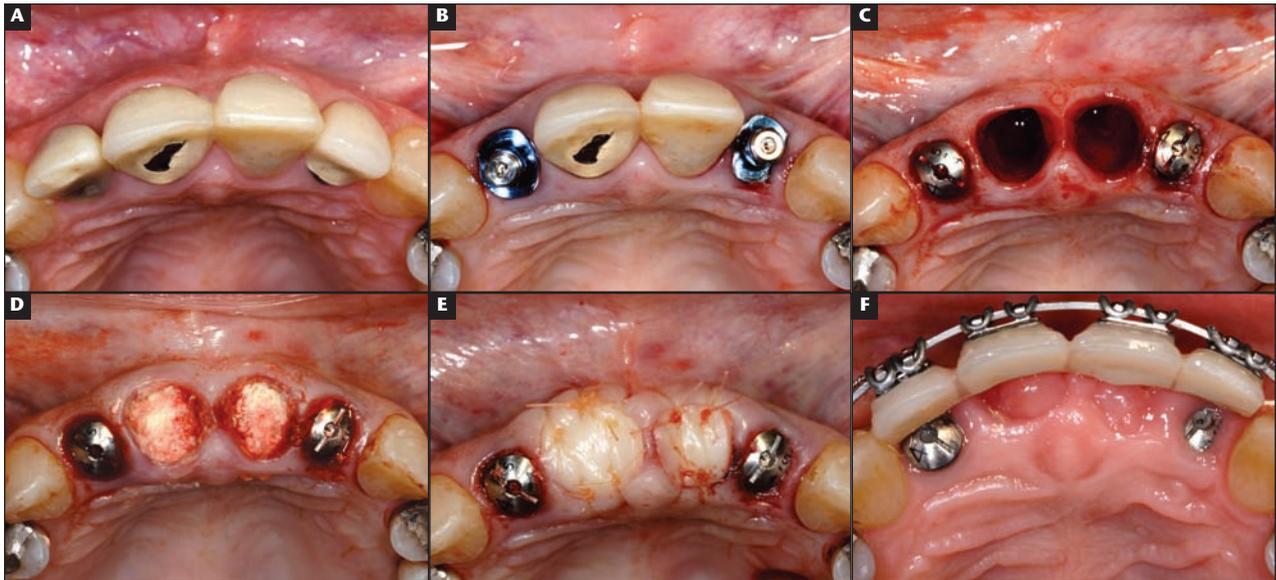
The second major issue involved the choice of restoration for the previously restored maxillary incisors. The infrastructure of these teeth was poor, and restoration of the existing teeth would

have been difficult and unpredictable. One option would have been to replace the incisors with a six-unit maxillary anterior bridge, using the maxillary canines for abutments. However, with this patient's parafunctional occlusal habits as well as her history of failing anterior restorations, this plan seemed injudicious. A second option would have been to place four implants to replace each of the incisors, but it would have been difficult to maintain normal papilla heights in the maxillary anterior region with this plan. A third possibility would have been to replace the central incisors with implants and the lateral incisors with cantilevered pontics. The problem with this option was that it would be difficult to maintain a normal papilla height between the central incisors. A fourth alternative would be to replace the maxillary lateral incisors with implants and to place a four-unit, implant-supported bridge with pontics replacing the central incisors. This plan would create natural-looking papilla heights between the centrals and lateral incisors. This plan seemed more predictable and ultimately was the one chosen by the team.

## Treatment Sequence and Results

One of the keys to treating this patient was the sequence of steps involved in her overall treatment plan. This patient lived nearly 800 miles away, but wanted our team to choreograph her treatment. So, she flew in for her appointments about every 10 weeks, and on several occasions needed to be seen by each of us during her visit. The first step in the treatment plan was to place orthodontic brackets on the mandibular teeth and intrude the mandibular incisors (Figure 2A and Figure 2B). This process involved placing vertical steps in the mandibular archwire and progressively intruding the teeth over an 8-month period.

The next step involved extraction of the maxillary lateral incisors and immediate placement of implants into the extraction sockets (Figure 3A and Figure 3B). At the same appointment, the maxillary central incisors were extracted and bovine bone was placed into the sockets



**Figure 3** The maxillary right and left lateral incisors were extracted, and implants were immediately placed into the extraction sockets without elevating a flap (A,B). Cover screws were placed over the implants and the maxillary central incisors were extracted and bovine bone was placed into the extraction sockets (C,D). Gingival grafts were placed over the bone grafts (E), and a segment of four plastic teeth with orthodontic brackets was used to provide a temporary prosthesis without placing pressure on the surgical site (F).

to help preserve the labiolingual thickness of the alveolar ridge (Figure 3C and Figure 3D). A flapless procedure was used to minimize alveolar resorption. Gingival grafts were placed over the extraction sockets to prevent loss of the graft material (Figure 3E). A four-tooth segment of plastic teeth was created and secured with orthodontic brackets and the maxillary archwire (Figure 3F). This temporary prosthesis provided the patient with an esthetic replacement for her missing incisors and kept pressure off the anterior alveolar ridge during healing.

Figure 4A through Figure 4F show the progress of the treatment 6 months after implant placement; at this time point the provisional restoration of the implants and the intruded mandibular incisors was completed, and the implants were restored with a four-unit acrylic provisional bridge while the mandibular incisors were restored temporarily with composite. The orthodontic brackets were replaced on these restorations to retain the intrusion of the mandibular anterior teeth and to facilitate orthodontic finishing of the occlusion.

After orthodontic treatment the patient was restored with a four-unit porcelain-fused-to-metal bridge replacing the maxillary incisors, porcelain veneers on the mandibular anterior teeth, and

full-coverage porcelain restorations on the maxillary and mandibular posterior teeth. The final restorations provided this patient with improved esthetics and function (Figure 5A through Figure 5F).

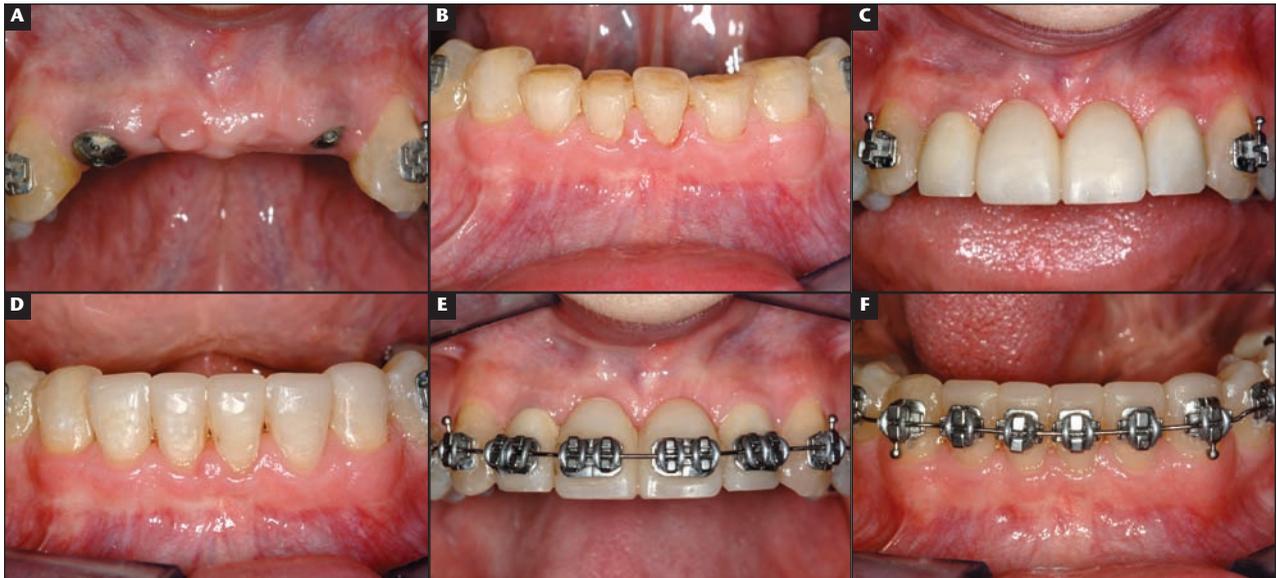
## Discussion

Planning restorative rehabilitation for a patient with significant mandibular anterior tooth wear is a challenging and often confusing task for the restorative dentist. The logical thought process would suggest that the vertical dimension should be increased by restoratively “opening the bite,” thereby permitting space to lengthen the abraded teeth. However, if the tooth wear were limited to the mandibular incisors, then many nonabraded posterior teeth would have to be restored to open the patient’s vertical dimension. In these situations, the restorative dentist must realize that when teeth wear as a result of a protrusive bruxing habit, they continue to erupt to maintain occlusal contact. As they erupt, they bring the gingiva and bone with them. Therefore, the most logical method of correcting this problem is to re-intrude the abraded teeth so that the crowns can be restored to their original length without further tooth preparation. Of course, this would require

adjunctive orthodontics to accomplish the intrusion.

In some patients with severe attrition of the mandibular anterior teeth, there is either insufficient crown length to place orthodontic brackets or insufficient crown length remaining to permit adequate ferrule for tooth preparation, or both. In these situations, some periodontal surgery and crown lengthening may be appropriate before orthodontic intrusion.<sup>4</sup> The key is to carefully assess the existing crown length of the abraded teeth. Is there sufficient interproximal and labio-lingual tooth length to provide a minimum of 1.5 mm to 2 mm of ferrule? If there is, then orthodontic intrusion can be used to create the inter-occlusal space, and the tooth preparation requirements will be acceptable.<sup>5-10</sup> However, if the existing crown length will not permit adequate ferrule, crown-lengthening surgery should be performed first to establish adequate ferrule,<sup>11</sup> then the teeth should be intruded orthodontically to create the correct vertical position before restoration.

What happens to the alveolar bone adjacent to a tooth when the root is intruded orthodontically? Although some have proposed that intruding a tooth will create new attachment,<sup>12</sup> there is little evidence to support this



**Figure 4** After 6 months, the implants had integrated (A), and the orthodontic brackets were removed to facilitate temporary restoration of the mandibular incisors (B). A provisional bridge was constructed and attached to the maxillary lateral incisor implants (C), and composite was added to the incisal edges of the intruded mandibular incisors (D). Brackets were replaced on the maxillary and mandibular teeth and archwires were used to stabilize the position of the intruded mandibular incisors and allow for completion of the orthodontic therapy (E,F).

theory. When teeth are intruded or extruded, the alveolar bone moves with the tooth, thus maintaining the distance between the alveolar crest and the cemento-enamel junction on the tooth. In other words, the patient's biologic width stays about the same as the tooth is intruded or extruded.<sup>13</sup>

What happens to the gingival margin as teeth are intruded? Do the clinical crowns become shorter as the root is pushed back into the bone or does the gingival margin move with the tooth? In our experience, when a tooth is intruded, the bone and gingival margin move about the same amount as the tooth intrusion.<sup>14</sup> Again, this indicates that the patient's biologic width is maintained in spite of extrusive or intrusive movements of the teeth. The exception to this rule, again in our experience, has been when we have intruded teeth with existing porcelain or gold crowns. In some of these situations, it appears that the bone moves to match the amount of root intrusion; however, the gingival margin does not respond in the same way. In these patients, it appears that the crown is being pushed into the gingival tissue. In this patient's case, the gingival margin moved apically as the mandibular incisors were intruded, thus maintaining the clinical crown length.

Does an intrusive force on the roots produce or exacerbate root shortening through root resorption? Previous research in monkeys<sup>15</sup> shows that significant intrusive force causes extensive root resorption. However, this side effect of tooth movement does not apply to all humans. The incidence of moderate to severe root resorption in adults<sup>16,17</sup> is about 4%. If a person is susceptible to root resorption, eg, has the genetic predisposition that causes root shortening during orthodontics, then intrusive forces on the teeth would exacerbate that resorptive response. However, if the patient is not susceptible to root resorption, then significant root shortening will not occur, despite the amount of tooth intrusion.

Is root resorption progressive? Does it continue after orthodontics in a susceptible patient? This question was answered in a study that evaluated root length in 100 patients who had moderate to severe root resorption during orthodontics.<sup>18</sup> This retrospective assessment 14 years after orthodontic treatment clearly showed that root shortening stops when the orthodontic force is terminated, and no further root resorption occurred long term in their sample. Why do the posterior teeth not extrude as the mandibular incisors are intruded? Is it easier

to intrude a tooth than to erupt it? Actually it is much easier to extrude a tooth compared to intrusion. However, the mandibular posterior teeth in an adult are prevented from erupting by the muscles of mastication, primarily the masseter, temporalis, and medial pterygoid. In an adult, it is difficult if not impossible to permanently stretch these muscle fibers beyond their natural length. So, the patient's vertical dimension stays the same, in spite of the extrusive force on the posterior teeth during incisor intrusion. In the patient reported in this article, the vertical dimension did not change, and the posterior teeth did not erupt, even though the incisors were intruded 3 mm during the orthodontic treatment.

Is the intrusion of anterior teeth stable long term? Yes, if the teeth are stabilized or retained in the intruded position for a sufficient period of time. Experimental studies in laboratory animals<sup>19,20</sup> have shown that the principal fibers of the periodontium (subcrestal collagen fibers connecting the root to the alveolar socket) stretch and become obliquely oriented as a tooth is intruded or extruded. However, if the tooth is held in the extruded or intruded position, the collagen fibers eventually reorient themselves perpendicular to the tooth root and



**Figure 5** The final restoration of the maxillary and mandibular arches consisted of a four-unit, implant-supported maxillary anterior bridge (A) and veneers on the intruded mandibular anterior teeth (B). The posterior teeth in both arches were restored with full-coverage porcelain restorations to replace her old failing restorations (C,D). By intruding the mandibular incisors, the resulting anterior overbite could be reduced (E). The esthetics of the patient's smile was improved through coordinated orthodontic, periodontal, and restorative treatment (F).

socket wall. In animal studies<sup>19,20</sup> this retention period was 28 days. However, in a human it would probably take a minimum of 6 months of stabilization to produce a similar reorientation of the principal fibers of the periodontium.

How do you retain this type of tooth correction? After the orthodontist intrudes the teeth, the restorative dentist should provisionalize the teeth with either bonded composite or temporary acrylic crowns. Then the orthodontic brackets are replaced to maintain the intruded tooth position for at least 6 months, preferably longer. After orthodontic bracket removal, we recommend using a nightguard (either maxillary or mandibular), to prevent further tooth wear and to maintain the vertical position of the mandibular incisors long term.

## Conclusion

This article has discussed the advantages of using adjunctive orthodontics to assist the dentist in restoring the dentition of adult patients with severe wear and over-eruption of the mandibular anterior teeth. Hopefully the guidelines and discussion provided here will help your team provide the sequence of interdisciplinary treatment that is necessary to successfully treat these challenging situations.

## References

1. De Mol van Otterloo JJ, Tuinzing DB, Kostense P. Inferior positioning of the maxilla by a Le Fort I osteotomy: A review of 25 patients with vertical maxillary deficiency. *J Craniomaxillofac Surg.* 1996;24:69-77.
2. Major PW, Phillippon GE, Glover KE, Grace MG. Stability of maxilla downgrafting after rigid or wire fixation. *J Oral Maxillofac Surg.* 1996;54:1287-1291.
3. Costa F, Robiony M, Zerman N, et al. Bone biological plate for stabilization of maxillary inferior repositioning. *Minerva Stomatol.* 2005;54:227-236.
4. Spear F, Kokich VG, Mathews D. Interdisciplinary management of anterior dental esthetics. *J Am Dent Assoc.* 2006;137:160-169.
5. Kokich VG. Esthetics: The ortho-perio-restorative connection. *Semin Orthod Dentofac Orthop.* 1996;2:21-30.
6. Kokich VG, Kokich VO. Orthodontic therapy for the periodontal-restorative patient. In: *Periodontics: Medicine, Surgery, and Implants.* Rose L, Mealey B, Genco R, Cohen D, eds. Mosby-Elsevier, St. Louis, Missouri, 2004; 718-744.
7. Kokich VG. Anterior dental esthetics: An orthodontic perspective I. Crown length. *J Esthet Dent.* 1993;5:19-23.
8. Kokich VG. Esthetics and vertical tooth position: The orthodontic possibilities. *Compend Cont Ed Dent.* 1997;18:1225-1231.
9. Kokich VG. Managing orthodontic-restorative treatment for the adolescent patient. In: *Orthodontics and Dentofacial Orthopedics.* McNamara JA Jr, ed. Needham Press, Inc, Ann Arbor, Michigan, 2001;395-422.
10. Kokich VG, Kokich VO. Interrelationship of orthodontics with periodontics and restorative dentistry. In: *Biomechanics and Esthetic Strategies in Clinical Orthodontics.* Nanda R, ed. Elsevier Press, St. Louis, Missouri, 2005;348-373.
11. Kokich V, Spear F, Mathews D. Inheriting the unhappy patient: An interdisciplinary case report. *Advanced Esthetics and Interdisciplinary Dentistry.* 2005;1(3):12-22.
12. Melsen B, Agerbaeck N, Markenstam G. Intrusion of incisors in adult patients with marginal bone loss. *Am J Orthod Dentofac Orthop.* 1989;96:232-241.
13. Kokich VG, Spear FM, Kokich VO. Maximizing anterior esthetics: An interdisciplinary approach. In: *Frontiers in Dental and Facial Esthetics.* McNamara JA Jr, ed. Craniofacial Growth Series, Center for Human Growth and Development, Needham Press, University of Michigan, Ann Arbor, Michigan, 2001;1-18.
14. Kokich VG, Spear F. Guidelines for treating the orthodontic-restorative patient. *Semin Orthod Dentofac Orthop.* 1999;3:3-20.
15. Dellinger EL. A histologic and cephalometric investigation of premolar intrusion in the *Macaca speciosa* monkey. *Am J Orthod.* 1967;53:325-355.
16. Mirabella AD, Artun J. Prevalence and severity of apical root resorption of maxillary anterior teeth in adult orthodontic patients. *Eur J Orthod.* 1995;17:93-99.
17. Mirabella AD, Artun J. Risk factors for apical root resorption of maxillary anterior teeth in adult orthodontic patients. *Am J Orthod Dentofac Orthop.* 1995;108:48-55.
18. Remington DN, Joondeph DR, Artun J, et al. Long-term evaluation of root resorption occurring during orthodontic treatment. *Am J Orthod Dentofac Orthop.* 1989;96:43-46.
19. Reitan K. Clinical and histologic observations on tooth movement during and after orthodontic treatment. *Am J Orthod.* 1967;53:721-745.
20. Reitan K. Principles of retention and avoidance of posttreatment relapse. *Am J Orthod.* 1969;55:776-790.