Restoration of an Intruded Maxillary Central Incisor with a Uniquely Designed Dowel and Core Restoration: A Case Report

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ABSTRACT

This article describes the restoration of an intruded root using a custom-made metal dowel and metal-ceramic veneer core restoration. The treatment plan for this patient consisted of restoring the missing esthetics and eliminating psychological trauma by utilizing the root of the intruded maxillary left central incisor to replace both missing central incisor crowns. This treatment will preserve space and bone until the patient is old enough for another prosthodontic restoration to be considered.

CLINICAL SIGNIFICANCE

As the lost fragments were not recovered, we considered this restoration of the intruded root to be the best therapeutic option, considering the effect on the patient's psyche. The patient was satisfied with the final result.

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INTRODUCTION

The intrusion of permanent teeth is rare. By definition, an intrusion is the axial displacement of the tooth into the alveolar socket,[1] an uncommon event constituting only 3% of all injuries to the permanent dentition.[2] In the pathogenesis of this type of injury, the impact has to come from an axial direction.[1] One can envision an impact hitting the incisal edge and driving the tooth in an axial direction. With strict axial dislocation, the tooth is displaced axially. If the force is in an axial-labial or axial-lingual direction, the tooth may be displaced in the apical-labial or apical-lingual direction, respectively. The former results in crown fracture and labial bone plate fracture.[1] Crown fractures associated with intrusions are important for treatment and prognosis. The exposed dentin may allow bacterial invasion and the subsequent development of pulp necrosis.[3–5] Complications include inflammatory root resorption, dentoalveolar ankylosis, the loss of marginal bone support, calcification of the pulp tissue, paralysis or disturbance of root development, and gingival recession.[6,7]

Given its rarity, little epidemiological data is available on the intrusion of permanent teeth and few clinical radiographs exist of this injury.[1] Furthermore, very few clinical reports have documented the prognosis of these injuries and the effect of treatment.[8–15]

CASE REPORT

A 14-year-old female patient was seen at the Prosthetic Dentistry Clinic of the Faculty of Dentistry,

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University of Dicle, Turkey, 12 months after she was in a traffic accident and injured her maxillary central incisors. On examination, the patient had good periodontal health, with a stable intercuspal position, normal vertical and horizontal overlap, and canine-protected guidance. Following the trauma, the maxillary right central incisor was avulsed, and the coronal tooth structure of the maxillary left central incisor and mandibular right central incisor was fractured. The maxillary left central incisor was intruded and displaced into the alveolar socket in an apical-mesial direction. The fracture line was below the gingival margin on the palatal side, and the anterior harmony of the maxillary anterior tissues was compromised. No periapical pathology was observed of the intruded roots of the maxillary left central incisor and mandibular right central incisor. The periodontal spaces around the root were reduced, but no root or bone fractures were detected (Figures 1 and 2). Based on the clinical and radiographic findings, a definitive treatment plan was developed. The first stage of treatment involved endodontic treatment of the root and clinical and radiographic follow-up of the root. The second stage of treatment aimed to restore the smile and eliminate the psychological trauma with the help of prosthodontic rehabilitation.

The root canal of the intruded maxillary left central incisor was debrided and obturated using gutta-percha points (Dia Dent Gutta-Percha Points, Dia Dent, Seoul, Korea). Prosthodontic rehabilitation was started 3 months after the endodontic treatment to allow bone healing in the periapical region.

To begin the prosthodontic rehabilitation, the gutta-percha was removed from the root canal with a reamer (Peso Reamer, Dentsply-Maillefer, Ballaigues, Switzerland). The preparations were then completed for a custom-made metal post and metal-ceramic veneer restoration, with great attention to conserving the remaining tooth structure (Figure 3).

A retraction cord was placed and delicately deepened to the degree necessary to expose the subgingival finish line that extended facially and proximally below the tissue level, except the palatal side of the tooth. The pattern for the repair was fabricated with an autopolymerizing resin (Pattern Resin, GC, Tokyo, Japan). The resin was mixed according to the powder/liquid ratio specified by the manufacturer and was injected into the base of

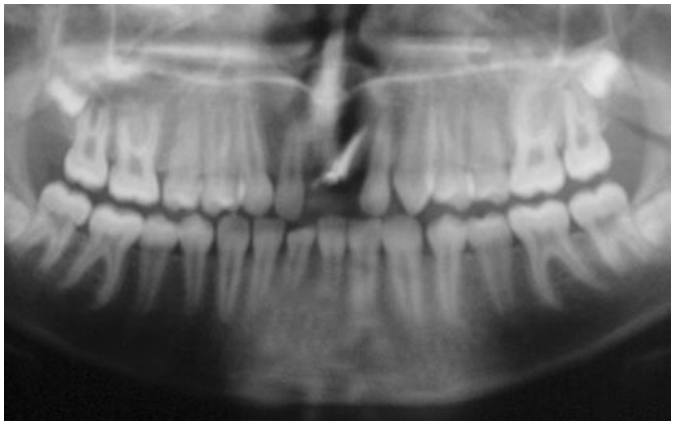

Figure 1. The radiographic view of the patient before treatment.

Figure 2. The intraoral view of the patient before treatment.

Figure 3. The intraoral view of the patient, after preparing the canal for the custom-made metal post restoration.

Figure 4. The intraoral labial view of the patient, after applying the custom-made metal post restoration.

the preparation immediately. To minimize the effects of polymerization shrinkage, the resin was applied in small volumes. After polymerization of the first resin mix, a new mix was prepared and applied with a syringe along the entire gingival and proximal finish lines. The resin patterns were then refined with new mixes of the autopolymerizing resin until the pattern of the entire restoration was accomplished. The accurate fit of the resin pattern was checked under magnification. The resin pattern for the coronal post was modeled in the mouth directly. For the coronal post, two post heads were designed for the central incisors. An impression for the restoration was made with silicone material (Speedex, Coltène/Whaldent, Cuyahoga Falls, OH, USA). A custom-made metal dowel restoration was fabricated from a porcelain metal alloy (Wiron 99, Bego, Bremen, Germany) according to the manufacturer's directions. After completion, the custom-made metal dowel restoration was evaluated for fit in the root canal (Figures 4 and 5). It was then luted with an adhesive resin luting agent (Rely X ARC, 3M ESPE Dental Products, St. Paul, MN, USA). The root canal was conditioned with 35% phosphoric acid gel (3M Scotchbond, 3M ESPE Dental Products) for 15 seconds. Care was taken to remove the etchant gel by rinsing thoroughly for 10 seconds, and the root canal was air-dried. The root canal was conditioned and primed using a

Figure 5. The intraoral lingual view of the patient, after applying the custom-made metal post restoration.

self-etching adhesive (Adper PROMPT L-Pop Self-Etching, 3M ESPE Dental Products), then air-dried for 5 seconds, and polymerized for 20 seconds with a polymerizing unit (Polofil Lux halogen light, VOCO, Cuxhaven, Germany). The custom-made metal dowel restoration was conditioned with ceramic primer (Rely X Ceramic Primer, 3M ESPE Dental Products) and air-dried for 5 seconds. Adhesive resin cement paste (Rely X ARC) was mixed and then introduced into the root canal. The custom-made metal dowel restoration was coated with adhesive resin cement and seated slowly using finger pressure. The excess cement was removed, and the remainder was polymerized for at least 40 seconds with the polymerization unit (Polofil Lux).

After cementing the dowel with the prepared abutments, full maxillary and mandibular arch impressions were made with vinyl polysiloxane (Speedex) in stock trays. From these impressions, casts were made and mounted in an articulator to produce metal-ceramic crowns. The metal frameworks were evaluated intraorally to determine the marginal fit. The crowns were then completed in the laboratory. The patient's natural occlusal scheme (canine-protected occlusion) and anterior guidance were controlled in the definitive restoration to decrease the lateral forces acting on the posterior dentition. The interdental papillae were fabricated from pink porcelain for esthetic reasons (Figure 6). The restoration was evaluated for esthetics and function, then glazed and polished. The final restoration was checked for accuracy of fit in the mouth, then cemented with a resin luting agent (Rely X ARC) (Figures 7 and 8). In addition, the mandibular left central incisor was restored using direct resin composite laminate veneer restoration.

The patient was satisfied with the final result and was recalled at 2-month intervals. After 6 months, the patient returned for a review examination. After 1 year, at the next annual checkup, no major changes were detected (Figures 9 and 10).

DISCUSSION

Losing and replacing a permanent front tooth is psychologically traumatic, time consuming, and expensive.[16–18] The treatment of young patients with missing maxillary incisors is a challenge for prosthodontists and orthodontists. Two principal approaches are used for resolving this problem. The first is aimed at maintaining the space for future autotransplantation, artificial implant therapy, or

Figure 6. The intraoral view of the patient, after evaluating the crown restoration for fit.

Figure 7. The intraoral labial view of the final restoration.

Figure 8. The intraoral lingual view of the final restoration.

Figure 9. The radiographic view of the patient 1 year after the treatment.

Figure 10. The intraoral view of the patient 1 year after the treatment.

conventional prosthetic restoration of the missing teeth. An alternative approach consists of total orthodontic space closure, followed by prosthodontic alteration of the shape of the lateral incisors to simulate the central incisors. Each of these approaches has its advantages and disadvantages, but the prevailing conditions usually influence the selection of one approach over the other. Decisions about the direction of treatment are usually based on several major factors: type of occlusion, space conditions, lateral incisor width and root length, and shape and shade of the canines.[19,20]

Close collaboration between the prosthodontist and orthodontist is mandatory in the early orthodontic treatment period, while space closure is under way, in the immediate prosthodontic period, when the initial composite restorations are needed, and in the long term, when the placement of final, more durable metal-ceramic restorations must be coordinated with the requirements of orthodontic retention.[19,20]

If space maintenance is chosen, space must be maintained until skeletal growth is complete for the artificial implant restoration to be successful.[21–24] In addition, a resin-bonded appliance with a metal substructure (Maryland bridges) must be maintained until skeletal growth is complete.

The treatment plan for our patient consisted of replacing the missing esthetics and eliminating the

psychological trauma by restoring the root of the intruded maxillary left central incisor. This treatment will preserve space and bone until the patient is old enough for another prosthodontics/implant restoration to be considered.

The restoration of fractured teeth depends on the amount of the coronal tooth structure fractured. If only the enamel and dentin are fractured, they can be restored using a simple composite or porcelain laminate. If more than half of the coronal part is missing, then a dowel and crown may be required.[25] Given suitable conditions, restoring the intruded root with the help of different custom-made metal post and core restorations has the advantage of limiting the prosthodontic intervention to the insertion of artificial crowns, based on the conservative reduction of the other dental hard tissue. Moreover, this approach eliminates the need for artificial teeth and the extensive removal of tooth structure or complicated implant technology. The most difficult part of the procedure is to assess the space needed for the maxillary central incisors with two post heads and to maintain it esthetically in the final restoration. Therefore, custom-made metal posts were used, and the resin patterns of the coronal post were modeled directly in the mouth. The final restoration was checked for accuracy of fit in the mouth, and premature contacts were eliminated. Fabricating the interdental papillae in pink porcelain proved particularly useful and esthetic. The advantages of this type of treatment are the lower cost compared with complicated treatments and the reversible nature of this procedure, which allows for other treatment approaches in the future.

SUMMARY

This clinical report describes the treatment of a patient with intruded and avulsed teeth that were restored with a custom-made metal dowel and core restoration. These simple procedures are a cost-effective treatment alternative for renewing the esthetics of these teeth and may prove particularly useful before more definitive restorations are needed.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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