In a young woman, aged 16 years, with upper anterior spacing and mesiopalatal rotation of upper central incisors, the right and left mandibular first molar extraction spaces were closed by protraction of the second and third molars without reciprocal retraction of the incisors and the premolars. The amounts of protraction for the second molars were 8 mm on the right side and 6 mm on the left side. Initial uprighting of lower second molars were done by T-loop on both sides. A titanium miniscrew was placed in the buccal alveolar bone between the first and second premolars on right side to provide direct anchorage for absolute protraction forces. On the left side uprighting and protraction was done simultaneously with the use of T-loop as uneven and less space was present on left side as compared to the right side. Careful biomechanical consideration was used to prevent tipping, rotation of posterior teeth. The treatment time was 20 months. Ideal overjet and overbite with good posterior occlusion was achieved.

Mandibular first permanent molar is the most common tooth to be lost due to caries according to Moyers [6]. Loss of permanent tooth results in undesirable consequences such as mesial tipping and rotation of adjacent teeth, supra-eruption of opposing tooth into the extraction space [1,2]. Previously prosthetic replacement of the edentulous spaces was considered as a sole treatment option as molar protraction was seldom attempted by clinicians due to increased anchorage demands and also prosthetic replacement was difficult due to mesial tipping of adjacent teeth.

Introduction

Mandibular first permanent molar is the most common tooth to be lost due to caries according to Moyers [6]. Loss of permanent tooth results in undesirable consequences such as mesial tipping and rotation of adjacent teeth, supra-eruption of opposing tooth into the extraction space [1,2]. Previously prosthetic replacement of the edentulous spaces was considered as a sole treatment option as molar protraction was seldom attempted by clinicians due to increased anchorage demands and also prosthetic replacement was difficult due to mesial tipping of adjacent teeth.

Orthodontic temporary anchorage devices (TADs) can provide skeletal anchorage for mandibular molar protraction, avoiding the problems often encountered with the use of dental anchorage.

Kyung., et al. [10] reported a 9-mm mesial movement of mandibular second molars, and Nagaraj., et al. [14] reported an 8-mm movement using miniscrews to close bilateral missing mandibular first molar spaces. Kavitz and Jolley [15] discussed problems, such as buccal proclination, during mandibular molar protraction with miniscrews.

Diagnosis and Etiology

A Young woman, aged 16 years, reported to our Department with the chief complaint of irregularly placed upper front teeth. She also wanted to close the space due to missing lower first molar on both sides. The right and left mandibular first molars had been extracted 2 years back, because of severe caries.

The patient had a straight profile with mesoprosoponic facial type. No remarkable facial asymmetry was seen.

Figure 1: Pretreatment Facial and Intraoral Photographs.

The dental casts showed that the lengths of the mandibular edentulous spaces were 8 mm on the right side and on the left side second premolar drifted back towards second molar creating spaces of 3 mm between first and second premolar as well as that between second premolar and second molar. The mandibular second molars were mesially tipped so initial uprighting of these molars were required before protraction. Prosthetic replacement was difficult in this particular case due to mesial tipping of mandibular second molars and uneven space on lower left side.

Intraorally she had mesiopalatally rotated upper right and left central incisors and midline diastema of 2 mm in the upper arch with overjet of 3 mm and overbite of 2 mm. Both the mandibular first molars were missing.

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The maxillary dental midline was coincident with the facial midline, and also coincident with the mandibular dental midline. Upper right canine was in cross bite and left canine exhibited class I relation.

A panoramic radiograph showed long edentulous spaces and mesial tilt of the second molars on both sides in the mandible.

The functional assessment showed no remarkable discrepancy between centric occlusion and centric relation, and no apparent signs and symptoms of temporomandibular joint dysfunction. There were no other medical or dental problems.

Treatment Objectives

We planned to maintain the anteroposterior position of the maxillary incisors, since there was no significant facial profile problem. The main treatment objectives consisted of initial uprighting and protraction of the mandibular second and third molars to close the missing first molar spaces and to correct the rotations of maxillary central incisors and to close the midline diastema maintaining the overjet and overbite.

Treatment Alternatives

Spaces caused by missing mandibular first molars can be corrected by prosthetic bridges, dental implants, autotransplantation of third molars, or mesial orthodontic movement of second and third molars. Prosthetic bridges offer the advantage of short treatment time but must be accompanied by significant tooth preparation.

Dental implants permit conservation of tooth structure but require surgery. Autotransplantation also requires surgery, and successful transplantation cannot be guaranteed.

Our patient finally chose orthodontic replacement, because she wanted to correct additional tooth position problems, including anterior spacing, rotations of maxillary central incisors and cross bite of right canine.

Treatment Progress

The patient was bonded with 0.022" MBT appliance using metal brackets and initial alignment was done using 0.016" NiTi wires in both arches followed by 0.018" NiTi. The mandibular second molars were tilted mesially so after initial alignment the molar uprighting was done first on the right side using T-loop made of 0.017" x 0.025" TMA wire with base arch wire 0.019" x 0.025" stainless steel wire. T-loop was selected as segmental uprighting arch wires with T-loops are easy to fabricate and use; T-looped uprighting springs can be engaged immediately and used efficiently in instances in which helical spring or box-loop uprighting appliances are contraindicated; T-looped uprighting springs offer excellent controlled movements of teeth in three planes of space; acceptance by the patient is favorable; and treatment time, depending on the amount of tooth movement required, is rapid and varies between 8 to 16 weeks as discussed by Burstone [5].

Following uprighting, 0.016" x 0.022" NiTi wire was ligated, followed by 0.017" x 0.025" SS and finally 0.019" x 0.025" SS wires were ligated in both arches. Upper anterior space consolidation was done on 0.019" x 0.025" stainless steel wire using elastomeric...
Updighting and Proracton of Mandibular Second and Third Molars into Missing First Molar Spaces for a Patient with T-Loop and Temporary Anchorage Device: A Case Report


chain. On the mandibular left side space consolidation was done mesial to second premolar and then there was 6 mm space left between second premolar and second molar. Molar uprighting as well as protraction was done using T-loop made of 0.017” x 0.025” TMA wire on the left side as there was comparatively less space on the left side than on the right side. On the mandibular right side molar uprighting was completed in around 2 months using T-loop.

A miniscrew of dimensions 1.5 x 8 mm was inserted with respect to 44 and 45 and a protraction force was applied using a NiTi closed-coil spring from the miniscrew to 47. Then space was created between second and third molars on right side as well as on the left side. So after the protraction of mandibular second molars, elastics in Class II pattern was advised to use on both sides from lower 3rd molars to upper intermaxillary hook for protraction of 3rd molars as well as overjet correction. The third molars extrusion were prevented as closed coil spring was attached from third molar to miniscrew on right side and T-loop was continued on the left side. Finishing and detailing was continued for another 3 months. The total treatment time was 20 months. A 0.0175-in twisted-wire fixed retainer was attached onto the lingual surfaces of the anterior teeth in both arches immediately after debonding.

Treatment Results

The maxillary and mandibular arches were well aligned and coordinated without midline deviations. Normal overbite and overjet were achieved. The final models showed normal Class I molar and canine relationships and good intercuspation. The edentulous spaces in the mandibular arch were completely closed by protraction of the second and third molars. The mesially tipped mandibular second molars were uprighted. The posttreatment panoramic radiograph showed good root parallelism. There was no remarkable root resorption. All teeth showed good alveolar bone height. Post treatment cephalogram and superimposed tracing shows the mesial movement of the second and third molars. There was no significant change in the facial profile with no increase in facial height. The changes in the upper lip and chin were minimal during treatment. Wire fixed retainers were attached to the lingual aspect of each tooth from the right to the left canines in both arches.

Discussion

The mandibular first molar is the most frequently lost tooth in adults [6]. Molar protraction can be an alternative to restoration with posterior dental implants or fixed partial dentures. Recently, there have been more reports about orthodontic protraction of the second and third molars into missing first molar spaces [10,14,15]. Compared with other cases previously reported, our patient is different in several ways. First, the edentulous span
was uneven on lower left side. Second, the edentulous spaces were closed entirely by protraction of the second and third molars as very minimal space was required to establish normal overjet and overbite. A miniscrew was placed in between the roots of first and second premolars on lower right side to provide direct anchorage for efficient molar protraction. During the movement of a tooth over a long distance, tipping is a big concern. To prevent mesial tipping, a heat-treated 0.016” x 0.022” stainless steel wire was inserted and changed at every visit. Long buccal hook attached to the lower right second molar bracket was also used to protract the teeth through the center of resistance. Stepovich [3] also demonstrated that posterior mandibular edentulous spaces could be closed without tipping. In our patient, this problem was minimized by placing an anti-rotation bend in the posterior portion of the arch wire. Despite our efforts, a slight mesial rotation occurred on the right second molar during protraction. Therefore, we removed the bands and bonded the brackets toward the mesial sides of the teeth. At debonding, there were no rotations or crossbites of the second and third molars. Molar protraction often requires a phase of uprighting due to the tipping of molar into the extraction site. A T-loop was used in the present case to allow distal crown moment and mesial root moment of the molar on the right side. On the left side T-loop was used to upright as well as protract second molar [16-19].

**Conclusion**

Mandibular molar protraction with orthodontic TADs has become the standard of care for closing posterior edentulous spaces without retracting the anterior teeth as miniscrews provide a source of skeletal anchorage. The use of miniscrews for mandibular molar protraction can be used as a routine procedure in orthodontic practice as prosthetic replacement cannot be always used as treatment alternative.

**Conflict of Interest**

None.

**Bibliography**