Case Report

Molar Protraction Using Miniscrews (Temporary Anchorage Device) with Simultaneous Correction of Lateral Crossbite: An Orthodontic Case Report

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Early loss of permanent teeth, congenitally missing lateral incisors or second premolars, extremely displaced or impacted canines, all result in a reduced upper dentition. That leads to the development of crossbite in the maxillary dentition. Partial denture prosthesis, dental implants, and space closure by fixed orthodontics are the various means of treating the edentulous spaces. Protraction of molars is time taking and challenging. Temporary anchorage device (TAD) helps to protract molars without anchorage loss. This case report describes the orthodontic treatment of a 25-year-old female with lateral dental crossbite using posterior bite plane appliance with fixed orthodontic appliance. Missing upper second molar was protracted mesially to the first molar extraction space by TAD to avoid prosthetic replacement.

Keywords: Correction of lateral crossbite, miniscrews, molar protraction, orthodontic

The two most common treatment approaches after correcting the crossbite are space closure or space opening to allow prosthodontic replacement with either a fixed prosthesis or single-tooth implants. Both of these approaches involve compromises in terms of esthetics, periodontal health, and function. The orthodontist must make the proper decision at the appropriate time, regarding management of the edentulous space. In many cases, space closure by means of mesial tooth movement seems to be the most desirable option, since treatment can be finished as soon as the dentition is complete. Protraction of posterior teeth requires a high anterior dental anchorage to avoid reciprocal retraction of the incisors or movement of the dental midline. The rate of molar protraction is inversely related to the radiographic density or cortical thickness of the resisting alveolar bone.

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Intraoral skeletal anchorage such as temporary anchorage device (TAD) miniplates, screws provide absolute anchorage for various tooth movements without requiring patient cooperation and anchorage preparation and gets predictable treatment results more rapidly.[13]

This case report documents a case in which lateral dental crossbite was successfully corrected using fixed orthodontic appliance with posterior bite plane and missing upper first molar space was closed by protracting second molar mesially by orthodontic miniscrews.

**CASE REPORT**

A 25-year-old female patient was referred by her prosthodontist for an orthodontic consultation regarding her anterior bite. The patient was having chief complaints of multiple missing teeth and unesthetic smile. Extraorally, she had slight concave profile, and on intraoral clinical examination, right lateral dental crossbite and palatal tipping of 12 and 13 were noticed. The maxillary dental midline was coincident with the facial midline; however, the mandibular dental midline deviated approximately 2 mm to the left. Teeth 14, 16, 24, 36, 46 and 47 were missing, 24 and 44 were rotated and spacing between 42 and 43 present [Figure 1]. Early loss of upper right first premolar and first molar could be the reason for this lateral crossbite.

Pretreatment face photograph showed a slight concave facial profile and normal vertical facial heights. Cephalometric analysis [Figure 2] shows the maxilla and the mandible were normally positioned to the cranial base (Sella-Nasion to A Point Angle SNA 81° and Sella-Nasion to B Point Angle SNB 80°). The ANB angle (1°) showed the patient had Class I skeletal pattern and normal mandibular plane angle. The mandibular plane was normally related to Sella and Nasion (SN) plane (MPA-33). Maxillary and mandibular incisors were slightly uprighted (U1-NA-21/1 mm: L1-NB-21/2 mm). Maxillary and mandibular arch forms are asymmetric and are not coordinated. Oral hygiene was adequate. The patient did not have pain in temporomandibular joint.

A panoramic radiograph [Figure 3] showed symmetric condylar shapes and positions bilaterally and there is no evidence of bone or dental pathology; it shows impacted 24, missing 14, 16, 36, 46, and 47. Mesially tipped 37 was seen.

The treatment objectives for the patient were to correct the lateral crossbite, to establish normal overbite and overjet, to align the anterior teeth for ideal inclination, and to improve the patient’s facial and dental esthetics for prosthetic replacement. Protraction of 17 into 16 space was planned. The patient was informed of the planned procedures and a consent of the treatment plan obtained.

**TREATMENT PROGRESS**

Fixed orthodontic treatment was started by placement of preadjusted edgewise appliance (MBT 0.022-inch slot). Arch alignment with 0.014-inch NiTi wires was carried out. To align the maxillary anterior teeth and correct
the crossbite, a removable acrylic posterior bite plane appliance was used to raise the bite to unlock pathway of movement of upper incisors. The acrylic covered the entire maxillary posterior teeth palatal and occlusal surfaces and extended for 2–3 mm onto the buccal surfaces [Figure 4].

The leveling and aligning were done with 0.014, 0.016, 0.020, and 16 × 22 NITI wires and followed by 16 × 22 stainless steel wire; finally 19 × 25 stainless steel wire was given. Crossbite and rotation correction were corrected in the first stage [Figure 5]. The first phase of orthodontic treatment took 6 months.

There was no opponent tooth for 17 since teeth 46 and 47 were missing. Hence, it was decided to mesialize second molar into first molar space. After the first stage, the miniscrews were placed in the first premolar area to mesialize the right upper second molar into 16 space [Figure 6]. After infiltration local anesthesia, a 6-mm length and 2-mm diameter miniscrew (TAD) was inserted into the alveolar process of first premolar area with the help of self-tapping screwdriver. The recommended insertion technique for mini implants placement is at an angle (30°) relative to the long axis of teeth, positioning the screw to reach the uppermost portion of the alveolar crest, while avoiding the proximity of the dental roots. This method allows more bone contact of implants due to the conical shape of dental roots and reduces stress and improve stability. Protraction force was given by elastic chain because it provides constant and continuous force. Bondable button was placed in the palatal surface of 15 and 17 for the bilateral force to counteract the molar rotation [Figure 7], and molar protraction was done on 0.019” × 0.025” stainless steel wire. To upright the upper right second molar, another miniscrew was placed distal to upper right second molar. Mesialization of the second molar leads to crossbite because of moving a molar anteriorly into the narrower arch area. The archwire was expanded posteriorly in every visit to compensate for the crossbite effect.

Active orthodontic treatment was completed in 18 months. The crossbite of 12 and 13 was corrected, and molar protraction was done with miniscrew [Figure 8]. After debonding, the patient was sent to prosthodontist for missing teeth replacement. Missing 14, 36, and 46 were replaced with prosthetic removable appliance [Figure 9].

Figure 5: (a) After leveling, aligning, and crossbite correction. (b) After leveling, aligning, and crossbite correction
Patient cooperation in the maintenance of oral hygiene was excellent, and the examination after active orthodontic treatment revealed that the clinical status and radiographic results observed at the completion of the treatment were excellent [Figures 10]. The cephalometric superimposition was done based on SN reference plane to see the overall changes. The patient was completely satisfied with the results of the fixed and removable orthodontic treatment. More than a year after debonding, the results were well maintained. The patient is still under regular follow-up. Follow-up clinical status showed satisfactory maintenance of accomplished treatments.

**DISCUSSION**

The orthodontist plays a key role in achieving specific space requirements by positioning teeth in an ideal restorative position. Two treatment options for patients with missing teeth are opening space or closing space. The treatment of choice in treating edentulous patient should be the least invasive option that satisfies the expected esthetic and functional objectives. Substitution of natural tooth can be an excellent, esthetic treatment option for replacing missing teeth.\(^{16}\)

Orthodontic treatment can protract second molar into missing first molar space as it is better than conventional prosthesis in terms of alveolar bone support and oral hygiene. There is also evidence that orthodontic movement is an excellent way to reclaim new alveolar bone and soft tissue when closing spaces and avoids crestal bone damage mesial to the second molars after treatment.\(^{17}\) Although corticotomy assisted molar protraction is a possibility, limited duration of the corticotomy effect on the rate of tooth movement, if considered within the context of a prolonged treatment time observed with molar protractions appears to be unjustified.\(^{18}\) Molar protraction needs high anchorage, and tipping of the molars and root resorption can happen if anchorage is inadequate.\(^{19}\) Molar protraction with the help of TAD controls anchorage loss which is frequently used in molar protraction cases.\(^{20}\) Today in orthodontics, all kinds of tooth movements such as protraction, retraction, expansion, intrusion, and extrusion are achieved easily with the help of miniimplants.\(^{21}\)

In this case, miniscrew was placed in the anterior maxillary region to protract the maxillary second molar. The protraction force was given from the second molar to TAD immediately after placement of miniscrew. In an animal study, markedly decreased bone remodeling was noticed adjacent to 1.6-mm diameter miniscrews under a typical (2N) orthodontic load. This may indicate that 2-mm diameter and wider screws are better supported by monocortical alveolar bone to withstand orthodontic forces from a biologic perspective.\(^{22}\) The duration of the treatment was 18 months, 7 mm of molar protraction was done, and lower midline shift was corrected with sliding mechanics. Good root paralleling and minimal root resorption was achieved, as seen on the post-treatment panoramic radiograph and lateral cephalogram. TADs can provide skeletal anchorage for molar protraction, avoiding the problems often encountered with the use of dental anchorage. The failure rate of TADs is greater in the mandible than in the maxilla.\(^{23,24}\) We did not experience any kind of miniscrew failure, breakage, or patient discomfort in this case. The primary biological factors that determine miniscrew stability are bone density (or bone quality),\(^{23}\) peri-implant soft-tissue health,\(^{18}\) adequacy of peri-implant bone stock, and operator technique.\(^{25}\) Screws placed through the
nonkeratinized gingiva or movable gingiva stimulate the surrounding soft tissue and sometimes evoke the peri-implantitis, which we have avoided. Root contact with miniscrews during mesial movement of the molar is a concern during mesialization. Four cases of root damage due to miniscrew contact during tooth movement were reported, and there were no signs or symptoms of pain, discoloration, devitalization, or ankylosis. The contact between the screw and tooth root did not disturb the movement of the tooth or provoke screw loosening.

In our study, miniscrew was placed distal to canine root to avoid this complication.

The treatment of lateral crossbite has been regarded as the correction of buccolingual tipping of a single or group of teeth and re-establishing the balance between the upper and lower arch. The use of posterior bite plane in crossbite correction provided satisfactory results, restoring the functional contact with the antagonist. GIC bite blocks are also preferred by some clinicians, but it wears off easily, and it causes supra eruption and intrusion of the molars. Posterior bite plane with fixed orthodontic appliance was very effective in correcting lateral crossbite.

**Conclusion**

Protraction of molars with TAD’s in case of missing first molars is a cost-effective treatment when compared with missing tooth replacement with implant systems, especially when the patient has already committed to undergo fixed orthodontic treatment. It also saves the patient from having additional surgeries, complications, or other restorative procedures. TADs are technically easy to place and can achieve all kinds of tooth movement without loss of anchorage. It will able to withstand multidirectional heavy forces required for any kind of orthodontic treatment. Posterior bite plane is a very useful appliance to correct lateral crossbite. It helps to reduce intercuspation of the opposing teeth, thus enhancing labial tooth movement to correct the crossbite. A predictable, successful outcome was achieved using posterior bite plane and miniscrew anchorage system.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patients understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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