CASE REPORT

Molar Intrusion Using Miniscrew Palatal Anchorage

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The hyperdivergent profile that typically leads to anterior open bites is one of the most complex malocclusions facing orthodontists. It is often characterized by excessive maxillary posterior dentoalveolar height and, consequently, a steep mandibular plane. This case shows the effective use of palatal skeletal anchorage in treating an adult patient with a Class II, division 1 malocclusion and anterior open bite.

Diagnosis and Treatment Plan

A 17-year-old female presented with the chief complaint of inability to bite properly. Clinical examination revealed a Class II, division 1 malocclusion with an anterior open bite and mild maxillary and mandibular tooth-size-arch-length discrepancies (Fig. 1, Table 1). The patient’s initial contact upon closure was between the maxillary and mandibular first molars, leading to a complex open bite involving the premolars and all the anterior teeth. In addition, there was a maxillary transverse deficiency resulting in bilateral posterior crossbites, as well as a severely rotated mandibular left second premolar. Profile analysis indicated an excessive lower anterior facial height and mandibular plane angle.

Two options were discussed with the patient: comprehensive surgical-orthodontic treatment, including orthognathic surgery to impact the posterior maxilla and expand the posterior segments through a three-piece Le Fort I procedure; and orthodontic treatment involving slow maxillary expansion and correction of the anterior open bite by intrusion of the maxillary posterior segments, using palatal miniscrew anchor-

### TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Pretreatment</th>
<th>Post-Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>82.0°</td>
<td>85.4°</td>
<td>81.9°</td>
</tr>
<tr>
<td>SNB</td>
<td>80.9°</td>
<td>80.4°</td>
<td>77.9°</td>
</tr>
<tr>
<td>ANB</td>
<td>1.6°</td>
<td>5.0°</td>
<td>3.9°</td>
</tr>
<tr>
<td>SN-GoGn</td>
<td>32.9°</td>
<td>33.9°</td>
<td>31.9°</td>
</tr>
<tr>
<td>FMA (MP-FH)</td>
<td>23.9°</td>
<td>29.0°</td>
<td>27.3°</td>
</tr>
<tr>
<td>U1-NA</td>
<td>4.3mm</td>
<td>5.3mm</td>
<td>2.3mm</td>
</tr>
<tr>
<td>U1-SN</td>
<td>102.8°</td>
<td>109.0°</td>
<td>101.4°</td>
</tr>
<tr>
<td>L1-NB</td>
<td>4.0mm</td>
<td>6.8mm</td>
<td>5.0mm</td>
</tr>
<tr>
<td>L1-GoGn</td>
<td>93.0°</td>
<td>97.2°</td>
<td>89.7°</td>
</tr>
<tr>
<td>Upper lip to E-plane</td>
<td>−6.0mm</td>
<td>−4.7mm</td>
<td>−7.5mm</td>
</tr>
<tr>
<td>Lower lip to E-plane</td>
<td>−2.0mm</td>
<td>−1.8mm</td>
<td>−2.3mm</td>
</tr>
</tbody>
</table>

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Fig. 1 17-year-old female patient with Class II, division 1 malocclusion, anterior open bite, and maxillary transverse deficiency before treatment.
The patient chose the orthodontic option.

Treatment Progress

A Hyrax palatal expander was fabricated, and slow expansion was initiated at a rate of two turns per week to facilitate uprighting of the maxillary premolars rather than skeletal movement. After seven weeks of expansion, the anterior open bite had increased from 1mm to 5mm (Fig. 2). The Hyrax was activated for a total of 20 turns; meanwhile, .022" × .028" SmartClip® self-ligating brackets were bonded, and leveling and alignment was initiated. Archwires were sequentially increased to .019" × .025” beta titanium.

Five months after final activation of the maxillary expander, the Hyrax was replaced with a modified transpalatal arch (TPA) as described by Cope, with soldered distal arms extending to the second molars2 (Fig. 3). Ideally, the TPA should be positioned 5mm away from the depth of the palate and 3mm from the palatal walls. Prior to cementation of the TPA, a 6mm Unitek TAD System® miniscrew implant was inserted under local anesthesia at the level of the first molars, 1mm lateral to the midpalatal suture. The miniscrew was angled about 15-20° toward the anterior to resist the vertical forces applied during molar intrusion. Two 3mm Nitinol coils were attached to the head of the miniscrew using .010” stainless steel ligature wire, and the other ends of the springs were tied to the distal extensions of the TPA (Fig. 4).

Molar intrusion was maintained for 21 weeks. Upon deactivation of the appliance, a bilateral posterior open bite was noted, but the anterior open bite had been overcorrected to a 3mm overbite (Fig. 5). The miniscrew was removed, and a panoramic radiograph was used to assess root parallelism.

Posterior box elastics were then used to close the posterior open bite and settle the occlusion. After 16 appointments over 22 months of treatment, the brackets were removed, and fixed maxillary and mandibular lingual retainers were bonded.

Fig. 2 Increased open bite after seven weeks of slow palatal expansion, at time of bracket placement.

Fig. 3 Modified transpalatal arch (TPA) with soldered arms extending distally for attachment of closed-coil springs.

Fig. 4 Palatal miniscrew and modified TPA placed for maxillary molar intrusion.

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Treatment Results

Post-treatment records showed a Class I molar relationship with ideal overjet and overbite (Fig. 6A). Cephalometric superimposition indicated an improved anteroposterior projection of the mandible and a reduction in the mandibular plane angle due to autorotation of the mandible. Regional superimpositions confirmed a 2 mm intrusion of the maxillary molars, with the extrusion of the mandibular molars compensated for by a modest amount of late mandibular growth (Fig. 6B, Table 1).

Discussion

Various treatment modalities have been introduced for posterior dental intrusion, including posterior bite blocks, magnets, high-pull headgear, and fixed appliances combined with anterior vertical elastics. In 1967, Kuhn recommended altering the outer bow of a headgear to produce molar intrusion and close the anterior open bite through clockwise rotation of the mandible. Early treatment of patients using posterior bite blocks to prevent eruption of the molars has also been recommended, since this allows growth modification to increase the ratio of posterior to anterior facial height, thus inducing forward autorotation of the mandible.

Although such techniques have been successful in intruding the maxillary posterior segments, the open-bite correction was mainly achieved through prevention of eruption of the posterior teeth and incisor extrusion—effects that have proven to be rather unstable and prone to relapse. Orthognathic surgery can be used to impact the maxillary posterior segment and close the anterior open bite by mandibular plane reduction, but recent trends in declining insurance reimbursement, as well as patients’ reluctance to accept surgery, have made it more difficult to recommend this option in open-bite cases.

In recent years, temporary anchorage devices have provided orthodontists with numerous treatment alternatives. In patients with excessive maxillary posterior growth and anterior open bite, the posterior teeth can be intruded using nickel titanium coil springs attached to molar brackets and titanium plates fixed bilaterally to the zygomatic buttress. This technique, however, requires an oral surgeon to insert and remove the plates.

Miniscrew implants have the advantages of lower cost, simpler placement, and a far less invasive means of achieving molar intrusion. They are typically inserted bilaterally into the infrazygomatic crest and loaded with nickel titanium coil springs attached to the molars. Un fortunately, the difficulty of maintaining oral hygiene in the mucobuccal fold and the lack of keratinized attached gingiva can result in significant tissue irritation and even infection around the collar of the miniscrew. Placing miniscrews interdentally in the attached mucosa introduces a new set of limitations, including minimal interradicular bone, unreliable placement angles, impingement of the periodontal ligament space, and potential cementum contact. Other sites, such as the posterior maxilla and maxillary tuberosity, provide minimal cortical bone thickness and low bone density, thus reducing primary stability and success rates for miniscrew implants.

The palate has been shown...
Fig. 6  A. Patient after 22 months of treatment.  B. Superimposition of pre- and post-treatment cephalometric tracings.
to be an effective site for mini-
screw implants supporting antero-
posterior tooth movement. The
dense cortical bone provides ex-
ceptional screw retention, and the
ample keratinized tissue is resis-
tant to irritation and inflamma-
tion. Except in the area of the
incisive foramen, the palate also
has little potential for nerve or
blood-vessel damage from mini-
screw placement.15 Xun and col-
leagues, using a palatal miniscrew
for maxillary molar intrusion and
two miniscrews in the mandibular
cortical bone for mandibular
molar intrusion, reduced the man-
dibular plane angle by an average
2.3°, leading to a 1.8mm reduc-
tion in anterior facial height.10

In the case shown here, the
palatal miniscrew allowed light,
constant force application to the
maxillary posterior segments for
molar intrusion and anterior bite
closure. The palatal application of
the intrusive force prevented buc-
cal tipping and hanging palatal
cusps of the maxillary molars—a
problem often observed when
intrusive force is delivered from
the buccal.

REFERENCES

1. Buschang, P.H.; Sankey, W.; and
English, J.D.: Early treatment of hyper-
divergent open-bite malocclusions,
2. Cope, J.B.: OrthoTADS: The Clinical
Guide and Atlas, Under Dog Media,
Dallas, 2007, p. 361.
3. Iscan, H.N. and Sarisoy, L.: Comparison
of the effects of passive posterior bite-
blocks with different construction bites
on the craniofacial and dentoalveolar
structures, Am. J. Orthod. 112:171-178,
1997.
4. Kiliaridis, S.; Egermark, I.; and Thi-
lander, B.: Anterior open bite treatment
with magnets, Eur. J. Orthod. 12:447-
5. Rinchuse, D.J.: Vertical elastics for cor-
6. Kuhn, R.J.: Control of anterior vertical
dimension and proper selection of extra-
oral anchorage, Angle Orthod. 38:340-
349, 1968.
7. English, J.D.: Early treatment of skele-
tal open bite malocclusions, Am. J.
8. Worms, F.W.; Speidel, M.T.; Bevis,
R.R.; and Waite, D.E.: Post-treatment sta-
bility and esthetics of orthognathic
surgery, Angle Orthod. 50:251-273,
1980.
use of skeletal anchorage in open bite
treatment: A cephalometric evalua-
10. Xun, C.; Zeng, X.; and Wang, X.: Microscrew anchorage in skeletal ante-
rior open-bite treatment, Angle Orthod.
11. Liou, E.J.; Chen, P.H.; Wang, Y.C.; and
Lin, C.Y.: A computed tomographic
image study on the thickness of the
infrazygomatic crest of the maxilla and
its clinical implications for miniscrew
insertion, Am. J. Orthod. 131:352-356,
2007.
12. Baumgaertel, S.; Razavi, M.R.; and
Hans, M.G.: Mini-implant anchorage
for the orthodontic practitioner, Am. J.
Park, Y.C.; and Yu, H.S.: Computed
tomographic analysis of tooth-bearing
alveolar bone for orthodontic mini-
14. Park, H.S.; Lee, Y.J.; Jeong, S.H.; and
Kwon, T.G.: Density of the alveolar and
basal bones of the maxilla and the man-
15. Kang, S.; Lee, S.J.; Ahn, S.J.; Heo,
M.S.; and Kim, T.W.: Bone thickness of
the palate for orthodontic mini-implant
the palate: A unique application of the
Unitek temporary anchorage device,
17. Razavi, M.: Applications and benefits
of fixed anchorage in the palate, Orthod.
Perspect. 16:15-17, 2009.
18. Razavi, M.: MSIs, TPAs, and SLBs:
Combining appliance systems can short-
en treatment time and lengthen appoint-
ment intervals, Orthod. Prod., Sept. 2011,
pp. 30-36.
Many orthodontists today use low-friction brackets designed for sliding mechanics.\textsuperscript{1-5} Although chain elastic is often applied for canine and anterior tooth retraction, it produces relatively high friction.\textsuperscript{6} To avoid this problem, we have developed a multipurpose retraction clip that can be used with chain elastic, coil springs, or intermaxillary elastics without generating any archwire friction.

Retraction Clip Application

The multipurpose retraction clip, fabricated from .016” round stainless steel wire, is a C-shaped auxiliary with a hook and a slightly protruding notch for grasping with a fine-tip elastics plier (Fig. 1A). The clip encircles the base of the bracket and is usually inserted behind the tie wings before the archwire is placed. Alternatively, if the archwire is already ligated, the clip can be carefully inserted behind the bracket and archwire (Fig. 1B).

The retraction clip can be placed in four different ways, depending on its intended purpose, with the hook positioned either cervically or occlusally and oriented either mesially or distally (Fig. 1B).