Posterior Teeth Mesialization With Mini-implants In An Oligodontia Patient

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SUMMARY

A case report of a 16 year old male oligodontia patient who presented with a Class I malocclusion on a skeletal I base. He had multiple missing teeth of upper lateral incisors and all premolars except for lower right first premolar. Treatment involved fixed appliance with the aid of mini-implants to mesialize posterior teeth in order to reduce the number of prosthodontic replacement of the remaining missing teeth planned for the future. The application of the mini-implants in the sequence of treatment is presented.

Key words
orthodontic mini-implant, mesialize posterior teeth, oligodontia

INTRODUCTION

Definition

Hypodontia is a developmental absence of only a few teeth, while oligodontia denotes congenital absence of many teeth. It is the most common craniofacial malformation. If six or more permanent teeth are missing, the term oligodontia is used.

Prevalence and Etiology

Hypodontia involving four or more congenitally missing permanent teeth excluding third molars is relatively less common than that involving less number of teeth and reported to have a prevalence of 0.08 – 0.5%, and this has been found to be usually associated with some general systemic condition. The prevalence of hypodontia in the permanent dentition among a Chinese population has been reported to be 6.9%, frequently involving the lower incisor, representing 60% of all missing teeth, followed by maxillary second premolars at 10% and maxillary lateral incisors at 8%. The etiology is broad and includes environmental factors such as infection, trauma, drugs, chemotherapy or radiotherapy at young age, genetic factors and associated with conditions such as ectodermal dysplasia, cleft lip and palate, Down’s syndrome and hemifacial microsomia.

Features and Presenting Problems

Malocclusions related to absence of teeth are common, such as rotations, tilting, drifting and spaces. Microdontia is a frequent association, significantly in hypodontia involving six or more congenitally missing teeth. Other dental anomalies are transposition of permanent teeth, impaction of permanent teeth, taurodontism and ankylosis. A significant retroclination of incisors and an increased interincisal angle were also observed with increasing severity of hypodontia. Some studies have reported flat or concave facial profile, obtuse naso-labial angle, retrognathic maxilla, reduced anterior face height and mandibular plane angle in severe hypodontia with absence of six or more teeth.
Conventional Treatment Options

1. **Space Closure**
   
   Space closure enhanced by correct timing of extraction of the retained deciduous teeth to facilitate bodily movement of the still developing permanent teeth has been advocated as one measure\(^{24,25}\). Mesialization of posterior teeth forwards to close the edentulous space, either with conventional orthodontics, reverse headgear or with the help of mini-implants, such as the micro/miniscrew, onplant and miniplates.

2. **Orthodontic Space Redistribution for Prosthetic Replacement**
   
   In some hypodontia cases, orthodontic space redistribution is needed to facilitate prosthetic replacement. Orthodontic uprighting of mesially tilted molar is not uncommon to make it a more favourable abutment for prosthesis\(^{26}\). Restoration of edentulous spaces can then be carried out with prosthesis such as dental implants and dentures.

3. **Autotransplantation**
   
   Factors ensuring successful transplantation of teeth are the need for open apex to allow revascularization of the pulp and sufficient root length to allow continue development of the root\(^{27}\), status of root development\(^{28,29,30}\) and atraumatic surgical procedure\(^{31}\).

4. **Restorative treatment**
   
   Composite build up or veneers can address tooth-size discrepancy commonly associated with hypodontia\(^{32}\).

The following case report describes the use of orthodontic mini-implants to mesialize posterior teeth in order to reduce the number of prosthodontic replacement in the treatment of a patient with oligodontia where he had missing upper laterals and all premolars except for lower right first premolar.

**DIAGNOSIS**

A 15 year 7 month Chinese boy sought treatment for the gaps in his upper front teeth (Fig 1). He had convex lateral profile with a retrusive mandible (Fig 2). Permanent teeth that were not present in the mouth were #18, #15, #14, #12, #22, #24, #25, #28, #34, #35, #38, #45 and #48. Those present were as follows:

<table>
<thead>
<tr>
<th>Front Teeth</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Left</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Upper Right</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Teeth present includes #55, #64, #65, #75 and #85 and some were restored (Fig 3). The missing teeth had resulted in generalized spacing in both arches. Overjet was 3.5mm (Fig 4), overbite 2.5mm, left molars in Class I and right in ½ unit Class II relationship (Fig 5). Mandibular midline was shifted 3 mm left. Upper canines were unusually conical shaped, short and narrow (Fig 6). Upper central incisors were short, squarish and straight-sided. Dental panoramic tomogram showed presence of unerupted #28 and #38, bringing to a total of 11 missing teeth (Fig 7).

Cephalometric analysis suggested a retrognathic maxilla and mandible (Table 1). The ANB angle suggested a skeletal Class I relationship. Anterior face height was proportionate and the upper incisors were retroinclined.
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Fig 3 Pre-treatment orthopantomogram

Fig 4 Treatment progress records taken on Jan 2005

Fig 5 Post-treatment intra-oral views

Variable  | Pretreatment | Posttreatment | Normal
---|---|---|---
SNA | 74.2° | 76.4° | 82° ± 3.5
SNB | 71.1° | 74.2° | 79° ± 3.0
ANB | 3.1° | 2.3° | 3.0° ± 2.0
Wits appraisal | 0.0 mm | -2.7 mm | -4.5 mm ± 3.0
Upper incisor to maxillary plane angle | 111° | 110.7° | 118° ± 6
Lower incisor to mandibular plane angle | 95° | 95.2° | 97° ± 7
Interincisal angle | 129.6° | 128.9° | 115° ± 8
Maxillary mandibular planes angle | 24.4° | 25.4° | 26° ± 5
Upper anterior face height | 64.8 mm | 64.9 mm | 54.0 mm
Lower anterior face height | 78.4 mm | 81.0 mm | 64.0 mm
Face height ratio | 55% | 56% | 55%
Lower incisor to APo line | 5.4 mm | 4.4 mm | 5.5 mm ± 2.5
Lower lip to Ricketts E Plane | 1.9 mm | 0.7 mm | 4.0 mm ± 2.5


Table 1: Pre- and post- treatment cephalometric analysis

PROBLEM LIST

1. Oligodontia with missing upper laterals, all premolars except lower right first premolar and right third molars.
2. Spacing of upper and lower arches.
3. Lower midline shifted left.
4. Upper centrals and lower incisors were short and straight-sided, and upper canines were short, conical and narrow.

TREATMENT AIMS/OBJECTIVES

1. Redistribute permanent teeth
2. Utilise and eliminate residual spaces
3. Reduce the number of prosthodontic replacement for missing teeth
4. Resize deciduous teeth in preparation for future prosthodontic replacement
5. Maintain bone volume and space for prosthodontic replacement by delaying removal of remaining deciduous teeth till appropriate maturity age
6. Correct midline discrepancy
7. Improve dental aesthetics especially of anterior teeth
8. Retention with intermediate term replacement of missing teeth

RATIONALE FOR TREATMENT

Autotransplantation was discarded after consultation with oral surgeons because of the immature root formation of the third molars. As the patient’s incisors were upright, there were too few teeth remaining and his unfavourable profile, mini-implant was used for added anchorage to mesialize all first and second molars by one premolar space. This allowed for the number of prosthetic replacements to be reduced from nine to five involving upper lateral incisors, upper first premolars and lower left premolar. Retention was planned with a retainer incorporating
passive anterior bite plane in order to maintain vertical space required for future prosthodontic replacements. Removal of the remaining deciduous teeth was to be postponed until patient is ready for more permanent prosthetic replacements. Resizing of deciduous teeth was planned together with the prosthodontist for temporary composite build-up of upper canines during treatment, assessment of space required interocclusally and mesiodistally for prosthetic replacement of missing teeth and periodontist for possibility of crown lengthening procedure on short clinical crowns.

TREATMENT PROGRESS

Treatment started at 15 year 9 month and ended 18 years of age. Orthodontic treatment started with referral to the oral surgeon for removal of #85, placement of fixed appliances with initial levelling and alignment wires.

Prior to placement of AbsoAnchor® mini-implants, all repositioning of permanent teeth are done on 017” x 025” SS. Gradual stripping of deciduous teeth to resize to permanent replacement and to allow mesialization of posterior teeth was carried out (Fig 8). 1.4mm x 8mm and 1.5mm x 6mm mini-implants were first placed by the orthodontist in the first and fourth quadrants respectively, distal to permanent canines. Location was determined with the help of periapical radiographs and with consideration of amount of movement required. Mesialization of #13 and #46 was done immediately using the mini-implant with aid of extended steel hooks on 019” x 025” SS with the aid of extended steel hooks on molar bands (Fig 9). After placement of mini-implants on the second and third quadrants, mesialization of posterior teeth was commenced on the related quadrants, in conjunction with gradual stripping of deciduous teeth (Fig 10).

COMPLICATIONS ENCOUNTERED DURING TREATMENT

Overall, the patient was compliant with oral hygiene and tolerant with all aspects of treatment. Anchorage control after placement of the mini-screws was better and treatment progressed much faster and more predictably. However, two out of the four mini-implants loosened and dislodged midway of treatment and had to be replaced. During movement of upper right canine mesially, frequent dislodgement of the bracket on lower right first premolar occurred due to the biting of the upper canine, and it was decided to rebracket it after the upper canine has been mesialized.

TREATMENT RESULTS

Post-treatment record shows that lateral profile has been maintained with no overt flattening (Fig 11). Extraoral appearance is pleasing and the smile greatly improved with redistribution of teeth and acrylic teeth replacement of upper lateral incisors. Class I molar relationship was achieved (Fig 12). Post-treatment overjet and overbite are within normal limits. Overbite stability is good as long as patient wear upper removable retainer. Dental midlines coincide with facial midline. Composite build-up of upper canines and central incisors has been placed as intermediate plan prior to definitive prosthodontic treatment.

Lateral cephalogram analysis showed slight retroclination of upper and small retraction of lower incisors and lips (Table 2). Individual superimposition on maxilla (Fig 13) and mandible (Fig 14) showed molar mesialization. Panoramic radiographs reveal adequate root parallelism except for #44, with some blunting of lower right first molar root tips (Fig 15). Bodily mesialization of first permanent had been successfully carried out. Roots adjacent to planned future implants have been positioned with sufficient bone space vertically and mesiodistally. The position of the developing #28 and #38 needs to be reviewed. Although interincisal angle was reduced from pre-treatment value, post-treatment angle is still more than the norms, therefore long-term retention of overbite involving a removable retainer with anterior bite plate was planned.

DISCUSSION

The pattern of oligodontia presented by this case report conforms to the findings in a study conducted on the pattern of severe hypodontia affecting at least 5 teeth excluding the third molars where it was reported to be affecting mainly maxillary lateral incisors (16%), followed by mandibular second premolar (11%), mandibular central incisor and maxillary second premolar (10% each)31.

Different methods of mesialization

Mesialization of posterior teeth by means of conventional orthodontics to close spaces often tax the anchorage from remaining teeth and unwanted tooth movement can still happen, therefore in hypodontia patients with an already retusive profile as in this patient, conventional orthodontic space closure would be detrimental to the facial profile34,35. Therefore various other types of posterior teeth mesialization have been advocated, such as extra-oral traction with chin cup35 and gradual self-mesialization via hemisection34. Reverse headgear was also one of the ways recommended to provide anchorage for moving upper posterior teeth forward to close the edentulous space or to advance the hypoplastic maxilla in hypodontia patients36,37, however this method requires a higher level of patient’s co-operation.

The introduction of “absolute” anchorage system helps reduce anchorage control problem and thus have been documented for this purpose35,36,39,40. Sliding jigs were applied on the buccal for distalization of the lower posterior teeth41. Costa et al.42 placed screws in the mandible for mesial movement of the molars. Loading protocols for screws involve immediate loading or a waiting period of 2 weeks to apply forces43 and only a short waiting period was required before loading44,45. This advantage reduces the
treatment period and, thus, increases patient acceptability.

**Success rate**

Bernhart et al. placed 21 mini-implants on the paramedian region of the palate for protraction of posterior teeth, among various other purposes and presented an 86% success rate after 11.6 months of use.

**CONCLUSIONS**

As a conclusion, mesialization of posterior teeth with mini-implants is a worthwhile treatment option especially in a severe hypodontia patient in order to reduce cost of prosthetic replacement without overt flattening of patient’s profile.

**REFERENCES**


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