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The Use of Implants at an Increased Vertical Dimension of Occlusion to Correct a Scissor Bite: A Case Report

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Abstract - *Traditional methods of achieving anchorage for orthodontic treatment are dependant on the presence of a sufficient number of teeth with adequate root support. With the success and predictability of osseo-integration, dental implants are being used frequently to obtain absolute anchorage. This case report illustrates the successful use of implants with a combined orthodontic-restorative approach to obtain anchorage in a partially dentate patient to correct a transverse cross-bite (scissor bite) relationship. The implants were subsequently restored to replace missing posterior teeth. The importance of a multi-disciplinary approach to planning and close liaison between the orthodontist, surgeon and restorative dentist during the treatment phase are discussed.*

KEY WORDS: Scissor bite, transverse cross bite, Implants, Orthodontic anchorage

INTRODUCTION

The advent and successful use of osseointegrated implants has revolutionized the dental management of many complex restorative problems [1,2,3]. Long-term (10 year) success rates for implant treatment in partially edentulous cases are in the region of 90.2% for the maxilla and 93.7% for the mandible, thus making it an essential tool in the dental armamentarium [3]. More recently implants have been used with increasing frequency for achieving absolute anchorage during orthodontic treatment [4-9]. Traditional methods of achieving anchorage are dependant on the presence of a sufficient number of teeth with adequate root support, as well as a high degree of compliance where extra-oral support with headgear is employed.

A substantial number of cases reported in the literature involve the use of implants specifically designed and placed for a limited period to facilitate orthodontic treatment [4,7,8]. Block and Hoffman described the use of a hydroxyapatite coated sub-periosteal implant called an 'Onplant' [10]. This is a wide flat circular disc shaped implant placed in the mid-palatal region and connected with a trans-palatal arch to the teeth. Other examples include the 'Orthosystem' by Straumann® which is an endosseous implant designed specifically for orthodontic anchorage; and mini implants such as the 'provisional implant' (Nobel Biocare), and the 'mini implant' as described by Kanomi in 1997 [11]. The mini implants are usually between 1.5-2.4mm in diameter and are easy to place in the inter-dental and inter-radicular areas especially when used to intrude teeth. Once placed, they can often be loaded immediately, but as osseointegration may not take place there is the possibility of minor movement of the implant with loss of anchorage.

There are two means by which implants may be used to obtain orthodontic anchorage. *Direct anchorage* is achieved when an implant is located in place of a missing tooth and orthodontic forces are pitted against it by directly connecting an arch wire to the implant or crown. These implants are subsequently used to replace the missing teeth. On the other hand, *indirect anchorage* is obtained when an implant is used to stabilize specific dental units, to which orthodontic forces are applied. Examples of the latter include mid-palatal and mini implants which are placed solely for orthodontic purposes and are removed once the objective is fulfilled.

This case report involves the use of implants to obtain direct anchorage in a partially dentate patient to correct a transverse cross-bite relationship. The implants served the dual purpose of providing anchorage during orthodontic treatment and were subsequently used to restore posterior support in the mandible, thereby providing the patient with a well aligned and functional dentition.

CASE REPORT

Clinical Findings: A 41 year old lady presented with a class II div I malocclusion and a unilateral mandibular lingual crossbite (scissor bite) of dental origin associated with overeruption of UR 5,6 and 7 (fig I a, b c and 2). A previous attempt at orthodontic correction of the same had failed. She complained of missing teeth on the lower left side and difficulty in chewing on the right side. She presented with a removable cobalt chrome onlay appliance which was constructed 15 years previous in an attempt to provide bilateral occlusal contacts to aid function. The appliance was loose, generally unsatisfactory and unaesthetic in appearance (fig 3 a and b). The vertical dimension of occlusion was reduced. All teeth distal to the lower left second premolar tooth were missing. Teeth present were:

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1a. *Labial*

1b . *Upper occlusal*

1c. *Lower occlusal*

Figure 1. *Pre-operative views*

Figure 2. *Scissor bite right buccal view*

3a. *Occlusal view*

3b. *left buccal view*

Figure 3. *Onlay appliance in situ*

7654321	1234 67
765 321	12345

Occlusal contacts were detected with the use of shim-stock® on the following teeth:

7 21	123
7 21	123

The upper anterior teeth displayed Grade II-III mobility according to Millers Classification [10], with no pathological periodontal pocketing associated with the teeth. The lower anterior teeth had tooth wear (mainly attrition) resulting in a 40-50% reduction in crown height. Overall she presented with a heavily restored dentition with multiple amalgam restorations, crowns and porcelain laminate veneers on the upper incisor teeth (fig 1 a, b, c).

A joint consultation with the Restorative dentist and Orthodontist was arranged, and the following treatment plan was formulated:

Treatment plan:

1. Initial periodontal therapy including oral hygiene instructions with supra and sub-gingival debridement followed by review of the periodontal response.
2. Diagnostic wax-up replacing 36, 37 including a Kesling set-up of the right buccal segment in normal bucco-lingual relationship at an increased vertical dimension of occlusion.
3. Composite resin additions to the incisal edges of the six lower anterior teeth (33 to 43).
4. Addition of acrylic resin to the occlusal surface of existing cobalt-chrome appliance.
5. Placement and restoration of two dental implants in the lower left quadrant (36, 37 region) with a superstructure to facilitate orthodontic treatment.
6. Orthodontic treatment to correct the scissor bite.
7. Definitive implant supported restorations replacing 36, 37.

Management strategy: The decision to place implants in the lower left molar region was made to facilitate both orthodontic correction of the malocclusion and future restoration of posterior support and occlusion. The treatment plan involved placement of two implants in the 36 and 37 position and initially restoring them at an increased vertical dimension of occlusion to permit correction of the cross-bite. Patient tolerance to these proposed changes in occlusion was assessed by addition of acrylic to the occlusal surface of the onlay appliance and composite resin additions to the incisal edges of the lower anterior teeth. The feasibility of implant treatment and final expected outcome were assessed by making a Kesling set-up with the lower right segment in a normal bucco-lingual relationship. This also facilitated an assessment of the vertical space available to restore the implants in the left mandible (figure 4 a and b).

Treatment: The treatment was divided into three phases:

1. Initial Restorative Treatment:

This initial phase involved addition of light -cured acrylic resin to the occlusal surface of the existing onlay appliance as a means of improving the aesthetics and verifying the patient's ability to tolerate the increase in the vertical dimension of occlusion. Bonding of acrylic to metal was enhanced by sandblasting and application of a metal adhesive primer (Alloy Primer®)* to the mechanically roughened metal. This was complemented by composite resin additions to the incisal edges of the lower anterior teeth, to correct the tooth wear and provide multiple occlusal contacts.

Implant Placement: Two wide platform Brånemark implants (length=8.5mm) were placed in the lower left first and second molar regions using a two-stage procedure (fig 5). After a healing period of 3 months, second stage surgery was performed to expose the implants and connect abutments. These were subsequently restored using 2 mirus cone® abutments and cast gold splinted crowns. The bridge was constructed at a 2mm increase in the occlusal vertical dimension (fig 7 a and b) and was designed with two distally facing cleats (fig 6) to facilitate the placement of an arch wire and elastics on the bridge. With the bridge in-situ the patient occluded on the implant supported bridge only, thus providing disclusion of teeth on the right hand side to permit correction of the scissor bite.

4a. *Kesling set up with correction of scissor bite*

4b. *Vertical space for implant supported restorations*

Figure 4.

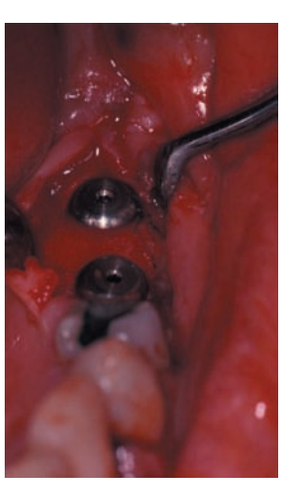


Figure 5. *Implant placement*

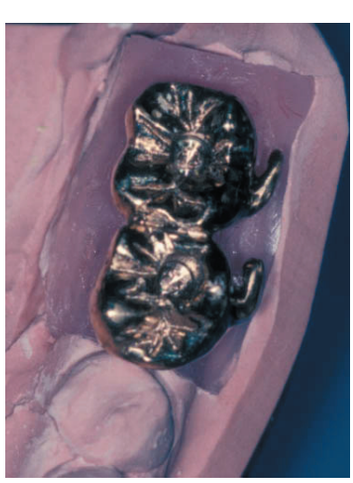
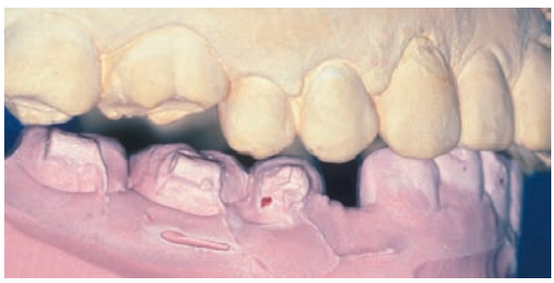


Figure 6. *Gold bridge with distally facing cleats*

7a. *Gold crowns constructed at an increased vertical dimension of occlusion*



7b. *Disclusion of teeth on right side*

Figure 7. *Mounted casts with gold crowns.*

8a. *Right buccal view*

8b. *Glass-ionomer cement on implant crowns to provide additional disclusion, 22 extracted due to endodontic failure*

Figure 8. *Sectional Edgewise Appliance with cross elastics*

9a. *labial view*

9b. *Right buccal*

9c. *definitive implant crowns 36, 37 and 22.*

Figure 9. *Post treatment views*

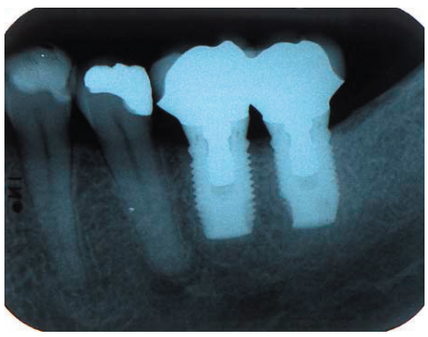


Figure 10. *Periapical radiograph of implants with definitive splinted crowns*

2. Orthodontic Treatment

Sectional pre-adjusted Edgewise fixed appliances were fitted to 14, 15, 16, 17 and 45, 46, 47 and traction force was applied with the use of cross elastics (Fig 8 a and b). Additional occlusal clearance was achieved by placing glass-ionomer cement on the occlusal surfaces of the implant supported crowns. Upon completion of treatment, a removable Hawley type retainer was fitted.

3. Definitive Restorative Treatment:

Following successful completion of orthodontic treatment, the implants in the lower left mandible were restored with screw retained porcelain fused to metal splinted crowns (fig 9 b and c). The occlusion on the crowns was designed to conform to the new occlusal relationship that was established as a result of the orthodontic treatment, with light contacts in the intercuspal position and no contacts in protrusion or lateral excursions.

The patient subsequently lost the upper left lateral incisor as a result of failed endodontic treatment. This was replaced with an implant supported cement retained crown (fig 9 a).

DISCUSSION

Implants for orthodontic anchorage:

Successful orthodontic treatment is dependant on having adequate anchorage to counteract any biomechanical reactive forces. Traditionally this has been achieved by pitting groups of teeth against the teeth to be moved or with the use of extra-oral headgear, which relies heavily on patient compliance. Osseo-integrated implants that are appropriately located offer an ideal form of anchorage due to the nature of the rigid bone to implant contact, which does not permit any movement of the implant [13, 14]. Therefore, anchorage cannot be lost during orthodontic treatment if implants are used.

Several studies have been conducted on the efficacy of implant mediated anchorage, in animals [15,16], and in humans [6,7,8,17]. The results are very encouraging, both for the ability to produce different types of orthodontic tooth movement [15], as well as for the relative lack of complications [18]. In addition the force levels generated by orthodontic appliances on the implants have been measured by Higuchi and Slack [8], Ödman and associates [6] and Roberts and co-workers [17]. Clinically, upto 400g of orthodontic force has been successfully anchored against an osseointegtrated implant in several malocclusions without any detrimental effect [8]. The stability of implants used for orthodontic anchorage has been investigated by Hurzeler et al [19]. Histological findings from their study indicate that repetitive mechanical trauma does not lead to an increase in peri-implant bone loss, but in fact there is a compensatory increase in density of the peri-implant bone due to structural adaptation.

In this case, due to the lack of sufficient posterior teeth in the mandible and the over-eruption of teeth in the upper right quadrant, orthodontic correction of the malocclusion would be almost impossible without the use of implants to increase the vertical dimension of occlusion. Although cleats were placed on the implant crowns it was not necessary to use them. If the cross elastics had been unsuccessful, then a full arch wire could have been placed engaging the cleats and using the implants as transverse anchorage. By providing a rigid and stable platform to disengage the occlusion, the implants permitted correction of the scissor bite by conventional orthodontic mechanics.

Prior to the successful and routine use of implants, one might have considered a 'bite raising platform' on a partial denture. However, this would have resulted in loss of anchorage due to the resilient nature of soft tissue support offered by the edentulous ridge and material wear, and would also inevitably have accelerated the rate of resorption of the underlying alveolar ridge. In this case, the patient also preferred to have a fixed reconstruction to replace the missing teeth.

Planning for implant placement:

Endosseous osseointegrated implants have an excellent record of success in the treatment of edentulous [20], and partially dentate patients [3,21]. Success rates for implants in the mandible are higher than that of the maxilla [3,20,21]. This is mainly due to the quality of bone, which influences the primary stability and subsequent osseointegration of the implant. Other factors that have an influence on successful implant treatment are pre-operative planning, surgical technique, adequate healing period and post-operative maintenance of the implants [1,2]. Where implants are used for direct anchorage, planning should involve the construction of a diagnostic wax-up of the position, dimensions and orientation of the future restorations. Liaison between the restorative dentist, orthodontist and surgeon is imperative for the success of multi-disciplinary cases. Surgical guides for implant placement are constructed from a copy of the diagnostic wax-up, wax try-in or Kesling set-up. Generally, bone quantity is evaluated with the use of radiographs such as orthopantomograms and sectional Scanora or CT scans. This is particularly important in the mandible, where a safety margin of 2mm above the inferior alveolar canal is maintained. In this case the position of the ID canal was determined with the aid of an orthopantomogram. Implants of a wide diameter (wide platform 5.5mm) were used, primarily to obtain a better emergence profile for the definitive restorations, and also to provide a greater surface area for osseo-integration, as the implants used were only 8.5 mm in length. A recent study on the outcome of wide-bodied implants reported a five-year cumulative

success rate of 80.9% for wide-bodied implants compared to 96.8% for regular bodied implants [22]. Whilst short wide implants are an attractive solution in situations where bone height is lacking, the availability of sufficient residual bone volume circumferentially surrounding the implant appears critical to the success of these implants. Healing could be compromised if the implant is surrounded by insufficient cancellous bone. Implants should be surrounded by a minimum thickness of 1.5mm of bone to facilitate healing and provide primary stability at the time of placement. Where 2 or more implants are placed adjacent to each other, a minimum inter-implant distance of 3mm should be maintained to avoid bone necrosis and provide adequate space for developing the crown contours and preservation of papillae [23].

Surgical and Restorative Considerations:

The provisional gold splinted crowns were designed at an increased vertical dimension of occlusion to provide an occlusal clearance of 2-3mm on the contra-lateral side and facilitate correction of the cross bite. Thus, for the duration of the orthodontic treatment the patient occluded on the implant supported splinted crowns only.

With Brånemark implants marginal bone loss occurs upto the level of the first thread and is maintained thereafter. The maintenance of the marginal bone on both fixtures in this case indicates that the orthodontic treatment did not jeopardize the stability of the implants or preclude their use in the final reconstruction (fig 10). Although the crowns were cast with two distally facing cleats (fig 6) for the archwire and/or elastics, it was not necessary to use them. If the cross elastics had been unsuccessful, then a full arch wire could have been placed engaging the cleats and using the implants as transverse anchorage. Splinting both implants provides a means of distributing the occlusal load over a wide surface area. Other complications reported in the literature include screw loosening and failure of osseointegration. None of these complications were encountered in this case.

The anterior teeth were grade II mobile according to Millers Classification [12] at initial presentation. This may have been the result of functional overload with a lack of adequate posterior support. At the end of treatment, the teeth were stable and demonstrated normal physiological mobility.

CONCLUSION

This case reports illustrates the successful use of osseointegrated implants to disengage the occlusion on the right hand side to permit orthodontic correction of the scissor bite. Following the orthodontic treatment phase, the implants were used to replace the missing molar teeth, providing the patient with good bilateral posterior support and a functional dentition.

MANUFACTURERS DETAILS

- Shimstock foil. Hanel Coltène/Whaledent, Germany.
- Brånemark implants. Nobel Biocare AB, Göteborg, Sweden
- Brånemark Mirus cone abutments. Nobel Biocare AB, Göteborg, Sweden

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