

Treatment of a Class I deep bite malocclusion in a periodontally compromised adult

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Background: Light forces and an appropriate force system should be used to treat adult patients with periodontal disease.

Aims: To describe the orthodontic treatment of an adult patient with a Class I deep bite malocclusion, horizontal and vertical bone loss and root resorption.

Methods: After periodontal surgery and initial alignment of the maxillary incisors with a fixed orthodontic appliance the maxillary incisors were splinted together as a single unit. A double palatal arch and sectional buccal archwires were used for anchorage. The palatal arch and splint were joined by a NiTi coil spring (100 g). The incisor segment was then intruded and retracted with a force acting just below the centre of resistance of the splinted incisor teeth. The force system avoided extruding the maxillary molars. The maxillary teeth were then rebonded to close the spaces between maxillary lateral incisors and canines. A Hawley appliance was used for retention. Treatment was completed in 22 months.

Conclusions: Surgical treatment and intrusion with light forces encouraged the development of periodontal attachment to the teeth affected by severe horizontal and vertical bone loss. Retraction of the proclined incisors improved the facial aesthetics. (Aust Orthod J 2007; 23: 130–136)

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Introduction

Many adult patients will agree to orthodontic treatment when the benefits, such as improved facial aesthetics and the preservation of periodontally compromised teeth, are explained to them.^{1,2} Patients with active periodontal disease threatening the longevity of their dentitions are often unaware of this fact, despite the appearance of spaces between teeth that were previously in contact and/or previously well-aligned incisors that have become flared and protrusive.² The first step in the management of these complex clinical problems is to ensure that the patient understands the importance of the procedures prior to orthodontic treatment. These generally involve improved oral hygiene, better diet and extensive periodontal treatment, often involving flap surgery. Because treatment for these cases has certain risks and limitations, such as loss of teeth and incomplete treatment, patients should give their informed consent before any orthodontic treatment is undertaken. For his part the orthodontist should use light forces, and a force system capable of completing the

desired treatment with the minimal damage to an already compromised periodontal attachment.^{3,4}

In this report we describe a case with vertical and horizontal bony defects in both arches. A successful outcome for this patient depended on the establishment of a comprehensive treatment plan, and extensive periodontal treatment before orthodontic treatment to retract procumbent incisors could be undertaken.⁵

Case report

A 47 year-old male Caucasian asked for an orthodontic evaluation. He had noticed that his previously well-aligned maxillary incisors had become spaced and protrusive. Apart from this observation he was unaware of the health of his teeth and their supporting tissues. He was mesofacial and had a symmetrical face with a mildly convex profile (Figure 1). The maxillary incisors and lower lips were protrusive.

Dental analysis

The patient had a bilateral Class I molar relationship, with flared and procumbent maxillary incisors, an

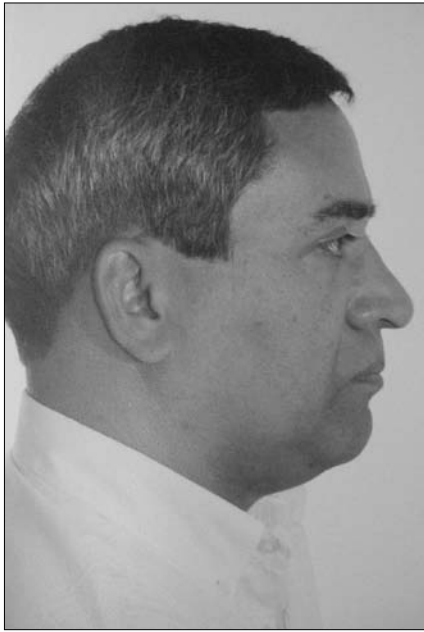


Figure 1. Pretreatment profile and frontal photographs.



Figure 2. Pretreatment intra-oral photographs.

overjet of 8 mm and an overbite of 5 mm. The mandibular incisors impinged on the palatal mucosa. Although the maxillary dental midline was coincident with the facial midline, the mandibular midline was 2 mm to the right side of the maxillary midline (Figure 2). The lower arch was constricted with the right second premolar inclined lingually. The curve of Spee was increased, and there was 3 mm of crowding in the mandibular arch. The Bolton analysis suggested a slight tooth size discrepancy in the mandibular anterior region. The patient had no temporomandibular symptoms and there were no clinical signs of temporomandibular joint dysfunction. There was no history of bruxing or parafunctional activity.

Radiographic evaluation

The pretreatment panoramic film confirmed that all permanent teeth, except the third molars, were present. It also confirmed that the maxillary right lateral and central incisors, the maxillary right second premolar and mandibular right lateral incisor were root filled (Figure 3). There were vertical and horizontal bony defects in both arches, particularly involving the maxillary right lateral and central incisors. Bone had been lost along more than half the mesial and distal root surfaces of these teeth. There was also evidence of external root resorption involving the maxillary central and lateral incisors. The mandibular condyles appeared to be asymmetrical.



Figure 3. Pretreatment panoramic radiograph.



Figure 4. Pretreatment cephalometric radiograph.



Figure 5. Estimated centre of resistance for lateral and central incisors. The open circle indicates the estimated centre of resistance for maxillary lateral and central incisors.

Periapical views confirmed the extensive bone loss and external resorption.

The lateral cephalogram confirmed that the patient had a skeletal 1 relationship, protruding maxillary incisors and proclined lower central incisors (Table I, Figure 4).

Problem list

The principal problems were: generalised severe chronic periodontitis with horizontal and vertical bone loss, particularly on the maxillary incisors; external root resorption involving the maxillary right incisors; proclined maxillary incisors with an 8 mm overjet and severe lip strain on closure; the mandibular incisors impinged on the palatal mucosa.

The first objective was to improve the patient's periodontal health by improving his oral hygiene, by deep scaling and root planing, and periodontal surgery of the teeth with deep pockets. When this objective had been met the intention was to align the teeth in both arches, to reduce the overbite and overjet by intruding and retracting the maxillary anterior teeth with a force acting just below the combined centre of resistance of the incisors; to obtain facial balance with the lips in contact when at rest; to provide a stable and functional occlusion.

Treatment

Root scaling, planing and modified Widman flap surgery were used to correct the bony defects and remove

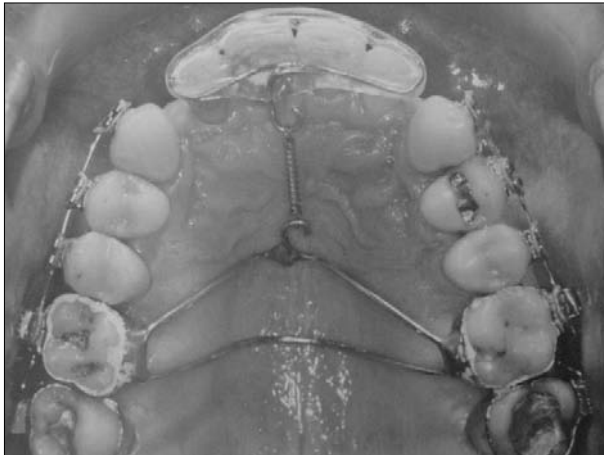


Figure 6. Upper appliance. Double palatal arch, NiTi closed coil from palatal arch to splint, sectional buccal archwires.

debris and granulation tissue from the teeth with pockets. Ten days later the periodontal status was considered to be healthy and under control.³ After the treatment plan and risks had been explained to the patient, it was decided to band and bond both arches with a 0.022 × 0.028 inch preadjusted brackets and use 0.0175 inch multistrand archwires to align the teeth. The initial archwires were replaced

one month later with 0.014 inch stainless steel archwires and then, at monthly intervals, 0.016 inch stainless steel and 0.016 × 0.016 inch NiTi archwires. When final alignment had been obtained, the incisor brackets were removed and impressions were taken for a modified splint plate to intrude and retract the maxillary incisors as a single unit, with the retraction force passing slightly below their combined centre of resistance (Figure 5).⁶ The objectives were to retract the upper incisors with minimal extrusion, and with little/no molar extrusion. The splint plate would ensure that the incisors acted as a single unit during retraction. A closed 100 g NiTi coil spring (GAC International, Japan) was stretched between a hook set into the acrylic splint section of the appliance and a hook on the palatal arch soldered to the upper first molar bands (Figure 6). Two sectional 0.016 × 0.022 inch stainless steel wires were placed buccally in the maxillary arch. A 0.017 × 0.025 inch stainless steel archwire was placed in the lower arch. After intrusion and retraction of the maxillary incisors, the incisor brackets were rebonded and a continuous 0.017 × 0.025 inch TMA archwire placed. Approximately, one month later this was followed by a 0.019 × 0.025 inch TMA wire. A hybrid archwire (0.019 × 0.025 inch TMA wire in the incisor segment and sectional

Table I. Summary of cephalometric findings.

Area	Measurement	Standard	Pretreatment	Post-treatment	Difference
Maxilla to cranial base	SNA (°)	82 ± 4	80	79	1
Mandible to cranial base	SNB (°)	76 ± 3	77	76	1
	SN-Go-Gn (°)	32	34	35	1
	FMA (°)	22 ± 3	26	27	1
Maxillo-mandibular	ANB (°)	5 ± 2	3	3	0
Maxillary dentition	I to NA (mm)	4	12	7	5
	I to SN (°)	103	120	100	20
	I to NA (°)	22	40	21	19
	I/FPI (°)				
	Ballard	107	132	113	19
Mandibular dentition	I to NB (mm)	4	6	8	2
	I to NB (°)	25	25	26	1
	IMPA (°)	95 ± 6	92	95	3
Interincisal relationship	I/I (°)	127 ± 10	111	129	18
Occlusal plane	Occ. Pl (°)	14	12	16	4
Soft tissue	Z angle (°)	78 ± 5	76	77	1
Facial height index ¹³	PFH (mm)	30 to 60 (41)	54	54	0
	AFH (mm)	39 to 80 (60)	71	74	3
	FHI	0.70	0.76	0.72	0.04



Figure 7. Post-treatment profile and frontal photographs.



Figure 8. Post-treatment intra-oral photographs.

0.019 × 0.025 inch stainless steel wires in the buccal segments joined with 0.017 × 0.025 inch NiTi T-loops) was used to close the spaces between the maxillary lateral incisors and canines. No elastics were worn during treatment. The finishing archwires were 0.019 × 0.025 inch stainless steel.

The appliance was removed and Hawley retainers placed in both arches. The maxillary Hawley appliance had canine hooks for light anterior elastics. The patient was referred to his dentist to determine if there was any need for occlusal adjustment after 22 months of active treatment. No occlusal adjustment was necessary.

Post-treatment the right side molars were in an end-to-end relationship and the canines in Class II relationship, which may have been avoided if the

right second premolar had been extracted. This option was rejected because it considered space closure could result in the incisor extrusion and prolonged treatment. The left side molars and canines maintained a Class I relationship, and the midlines and bone levels improved significantly (Figures 7 to 9). The maxillary incisors were monitored with radiographs and no increase in root resorption was observed post-treatment. Root resorption in orthodontic patients has been associated with a number of systemic conditions, but in patients with chronic periodontal conditions it may occur in the absence of an orthodontic force.^{7,8}

The post-treatment cephalometric tracing shows good control of the vertical occlusal plane (Table I, Figures 10 and 11). The skeletal relationship (angle



Figure 9. Posttreatment panoramic radiograph.



Figure 10. Posttreatment cephalometric radiograph.

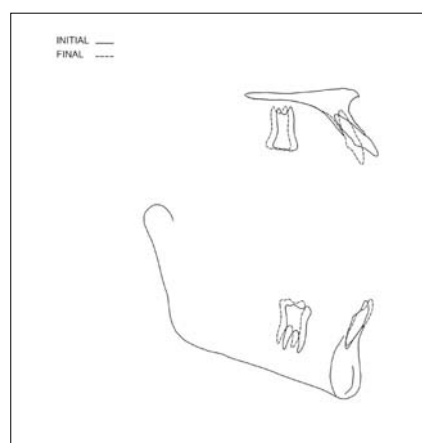
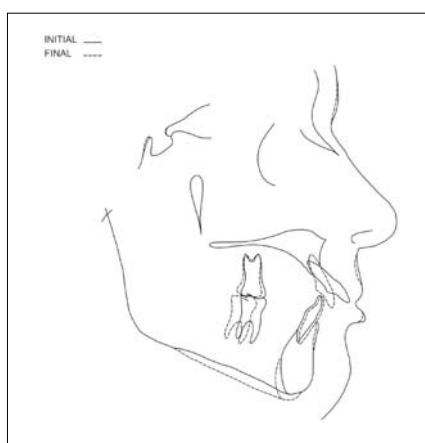


Figure 11. Pre- and post-treatment cephalometric superimpositions. Superimposition on SN plane at sella (left), and area superimpositions on ANS-PNS at ANS and mandibular plane at menton (right).

ANB) was maintained, and the maxillary incisors were retroclined and extruded slightly. The mandibular incisors were proclined slightly and the mandibular molars distalised and slightly extruded. The maxillary molars were protracted bodily.

Discussion

The external root resorption, severe bone loss and procumbent incisors limited the treatment approach, which was chosen to minimise the risk of further attachment loss and root resorption. Due to the fact that there had been significant bone loss around the

maxillary incisors pretreatment and periodontal surgery had been carried out, loss of the interdental papillae was expected. As a result, dark spaces were present between the anterior teeth at the end of treatment.

One of the aims of the appliance used was to apply a light and predictable force (about 25 g to each incisor) from a 100 g NiTi coil spring stretched between the splint and palatal sections of the appliance. A second aim was to arrange the force vector slightly below the combined centre of resistance of the incisors so that the incisors would be tipped

palatally. In the present case true palatal translation of the maxillary incisors may have reduced the overjet, but it would not have reduced the marked incisor proclination associated with the periodontal condition.

A combined orthodontic-periodontal approach is essential for the successful management of adults with a malocclusion and severe horizontal and vertical bone loss.³ The first steps are to stabilise the patient's periodontal condition with good home care and periodontal treatment. It is also necessary to obtain good compliance from the patient. Providing there is no further periodontal disease a new attachment may be formed after orthodontic intrusion. There is also some evidence that periodontal surgery produces a positive stimulus for new bone formation.^{3,9-11}

The small decrease in the facial height index (from 76 degrees to 72 degrees) occurred because the vertical dimension increased slightly.^{12,13} We attribute this change to the small amount of mandibular molar extrusion as there was a corresponding increase in the occlusal plane to Frankfort plane angle. There were no adverse effects on the vertical positions of the maxillary incisors.

After orthodontic treatment there were still significant bony defects and gingival margin discrepancies, especially in the maxillary anterior and posterior regions. The periodontal tissues appeared healthy, there was minimal apical root resorption and the roots of the teeth were in good positions. Favourable facial aesthetics were also achieved. Interdigitation of the teeth on the right side could have been better had the second premolars been extracted but, as we have mentioned above, this option was rejected to avoid prolonged treatment, possible loss of teeth and extrusion. However, a good functional result was obtained with group function in lateral excursions and anterior guidance with posterior disocclusion. The midline deviation was also corrected.

Summary

Pretreatment periodontal surgery and intrusion with light forces encouraged the development of a periodontal attachment to the teeth affected by severe horizontal and vertical bone loss. Following orthodontic alignment the maxillary incisors were splinted together and retracted with a force acting just below the combined centre of resistance of the maxillary incisors. Anchorage was provided by a palatal arch and sectional buccal archwires and retraction by a

closed coil spring. Retraction of the proclined incisors improved the facial aesthetics.

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