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Expansion: how much can the periodontium tolerate?

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Abstract: Arch length discrepancy can be resolved either by extraction or expansion. Normally, the choice of the clinician is founded on evidence-based treatment outcome reports. The adverse effect related to either approach is considered carefully before deciding. In the adult patient, the retraction of soft tissues consequent to extractions may be undesirable. Also, the deep bite may be difficult to correct if incisor proclination is to be avoided. Expansion has been reported to elicit gingival dehiscences. This is a report of a borderline case where the crowding is resolved acceptably through extreme expansion, but without any adverse periodontal effects.

Key words: adult treatment; crowding; expansion; periodontal problems; soft tissue profile

Introduction

Further to the revival of interest in non-extraction treatment with expansion, concern is expressed that expansion beyond certain limits would put the patient at risk for bony dehiscence and gingival recession formation (1). It has long been known that alterations in the gingival dimensions and the positions of the soft tissue margins can occur following orthodontic tooth movement. It has been noted that some patients respond to forward movement of incisors or to lateral movement of posterior teeth with gingival recession and lost attachment (2–6). An alveolar bone dehiscence is considered to predispose the tissues for attachment loss (7). Orthodontic treatment can result in the formation of gingival recession; typically, following the alveolar bone dehiscences that are induced by an

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uncontrolled expansion where teeth are forced through the cortical plate. On the other hand, it has also been shown that labial cortical bone will re-form in an area of dehiscence when the tooth is retracted lingually into a proper position within the alveolar process (8, 9). Alterations in the gingival dimensions and marginal tissue positions associated with orthodontic therapy are a factor of the direction of tooth movement. Labial movement is reported to result in reduced facial gingival dimensions, while an increase is observed following lingual movement (4, 10). Boyd (11) has documented that the prognosis of teeth with excessive proclination, which exhibit recession, may improve when they are lingually positioned (12).

In planning treatment to resolve a crowding, the orthodontist faces the alternatives to extract or to

expand. A thorough analysis of the benefits and drawbacks of these two choices should be carried out before a decision is made. In the adult, growth cannot benefit the treatment. Yet, extractions frequently lead to unfavourable soft tissue changes. In the face of these two realities, the risk of expansion might be preferable. This report describes the treatment of a borderline extraction case.

Case presentation

Patient SA, 52 years and 6 months of age was referred to our clinic for a deep bite with palatal impingement, which at the moment interfered with the general dental treatment (Fig. 1). The patient's chief complaint

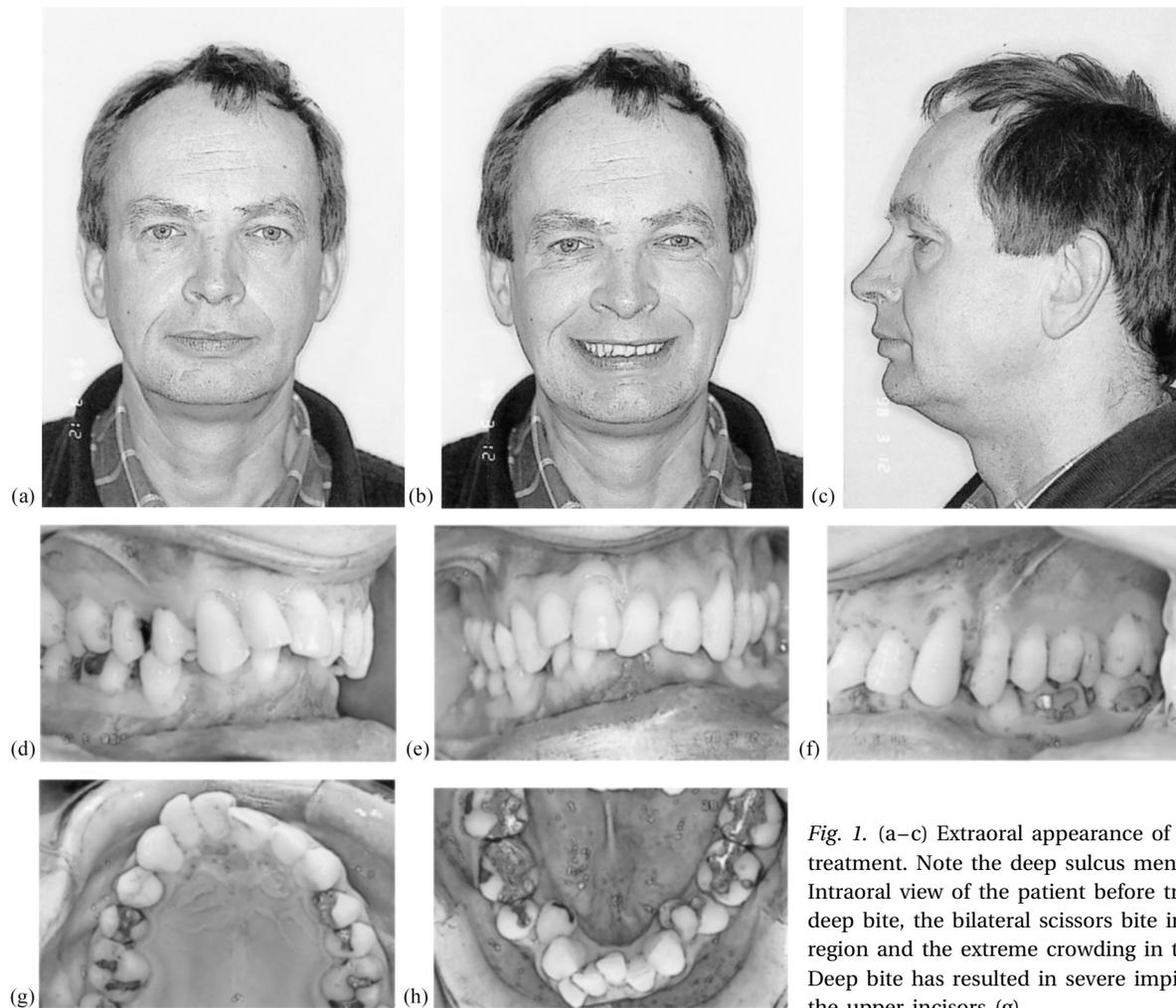


Fig. 1. (a–c) Extraoral appearance of the patient before treatment. Note the deep sulcus mentolabialis. (d–h) Intraoral view of the patient before treatment. Note the deep bite, the bilateral scissors bite in the premolar region and the extreme crowding in the lower jaw. Deep bite has resulted in severe impingement behind the upper incisors (g).

Table 1. Problem list and treatment plan

Chief complaint	'The crowding in the lower jaw is increasing. I don't like my smile'		
Objective analysis			
Facial appearance:	Symmetrical face with increased sulcus mentolabialis decreased lower facial height		
Function:	Palatal impingement and lip catch		
Dentition:	Missing teeth:	18, 28, 38, 48	
	Mesial rotation:	17, 16, 26, 27, 32, 41, 45	
	Distal rotation:	13, 12, 21, 22, 23, 24, 33, 32, 42, 43, 44	
	Lingual tipping:	21, 22, 34, 33, 32, 31, 41, 42, 43, 44	
Occlusion:	Sagittal:	Distocclusion bilaterally	
	Vertical: overbite:	10 mm	
	Transversal:	Scissors bite: 14, 24, 25	
		Midline discrepancy: upper: 1 mm to the right; lower: 2 mm to the left	
Space conditions:	Upper: - 3 mm	Lower: - 13 mm	
Anterior ratio:	78.6%	Mean: 77.2%	SD: ± 1.65
Treatment plan and mechanics			
Intrusion of upper canines:	This movement was done with two 0.017 × 0.025 TMA cantilevers using the first and second molars consolidated with a transpalatal bar as anchorage		
Intrusion and proclination of the lower incisors:	Bands 36, 46 and LLA. Bonded acrylic occlusally. Bonded power arms on 33-32 and on 43-42; 0.017 × 0.025 TMA intruding cantilevers		
Intrusion of 12, 11, 21, 22:	0.017 × 0.025 TMA base arch		
Intrusion and proclination of 31-41:	Brackets on 31 and 41 and 0.017 × 0.025 TMA base arch		
Intrusion of 24 and 25:	0.017 × 0.025 TMA by passing arch 0.016 Ni-Ti overlay arch		
Intrusion and transverse expansion of 34 and 44:	0.017 × 0.025 TMA cantilevers		
Finishing			

was the progressively crowded lower teeth and a sensation of a forced bite. He was well motivated for orthodontic treatment. His lips were full as well as procumbent. The soft tissue profile was slightly convex, the mentolabial sulcus increased, while the nasolabial angle was within the norms. The medical history was non-contributory. Periodontal examination did not reveal any pathological pockets, but gingival inflammation was present due to the impinging deep bite and difficulties of cleaning crowded teeth.

The problem list appears in Table 1 and the treatment goal can be seen in the composed tracing and occlusograms (Table 2 and Fig. 2). The occlusogram has been described in an earlier issue of this journal (12). Intraoral examination revealed a normal colour and texture of the hard and soft palates, cheeks and tongue. The dentition exhibited a high-level treat-

ment experience; almost all teeth had amalgam or composite fillings. The right upper central incisor had a dramatic wear of the incisal edge. At the time of treatment, all the teeth were present with the exception of the four third molars.

Table 2. Treatment goal

Aesthetics	Improve the smile by correcting the severe overjet and deep bite and by solving the crowding
Function	Eliminate the palatal impingement and the lip catch
Occlusion	Establish a neutral occlusion with normal overjet and overbite Coordinate the midlines Solve the crowding by expansion

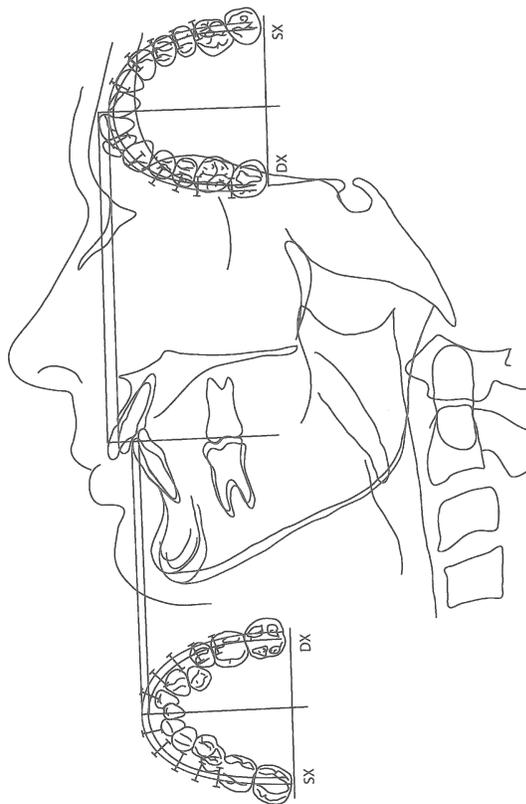


Fig. 2. Three-dimensional simulation of the treatment goal through a combination of cephalometric tracing and the occlusograms. An expansion of 10 mm is anticipated in the premolar region and a sagittal expansion of 7 mm in the incisor region.

Indication for treatment

Orthodontic treatment was necessary to correct the severe deep bite and palatal impingement, since the incisor stops were missing and there was a high risk for the palatal impingement to worsen and conse-

quently to jeopardise the periodontal health. Furthermore, treatment was indicated in order to correct the collapsed lower arch. The collapse had led to severe crowding of the lower anterior segment and reduced the vertical support of the posterior region. Severe crowding is a predisposing factor for plaque accumulation and subsequently development of periodontal diseases and possibly increased carious lesions. Another indication for treatment was to improve dental aesthetics and to achieve incisal contact for long-term stability.

Treatment

The treatment was divided into four phases. In the first phase, the upper canines were intruded (Fig. 3). A slight bite opening was performed with light cured acrylic onlays on the lower lateral teeth. Simultaneously, the lower canine region was widened by two cantilevers extending from the molar region. During the second phase of treatment, the upper incisor region was levelled (Fig. 3e) and the expansion continued in the lower arch (Fig. 4). In the third phase, a proclination and intrusion of the lower incisors was performed with a utility-shaped base arch, while an overlay Ni-Ti arch was used for levelling. Finally, the last and fourth phase of treatment was dedicated to the lateral expansion of the collapsed premolar region with a Ni-Ti overlay arch, while the sagittal expansion was maintained by a stainless steel continuous arch (Fig. 5).

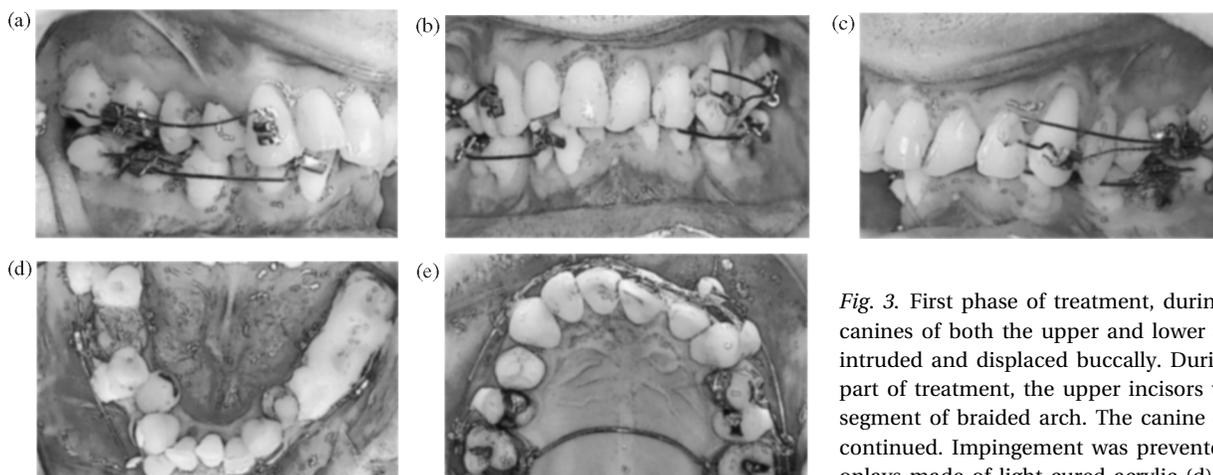


Fig. 3. First phase of treatment, during which the canines of both the upper and lower arch are intruded and displaced buccally. During the second part of treatment, the upper incisors were levelled a segment of braided arch. The canine displacement continued. Impingement was prevented through onlays made of light cured acrylic (d).

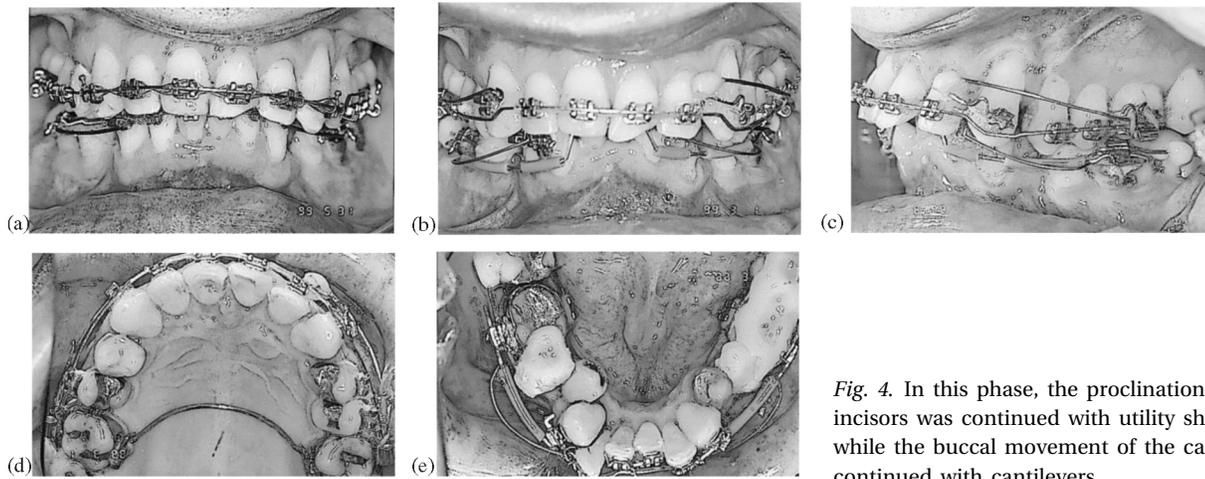


Fig. 4. In this phase, the proclination of the lower incisors was continued with utility shape base arch, while the buccal movement of the canine was continued with cantilevers.

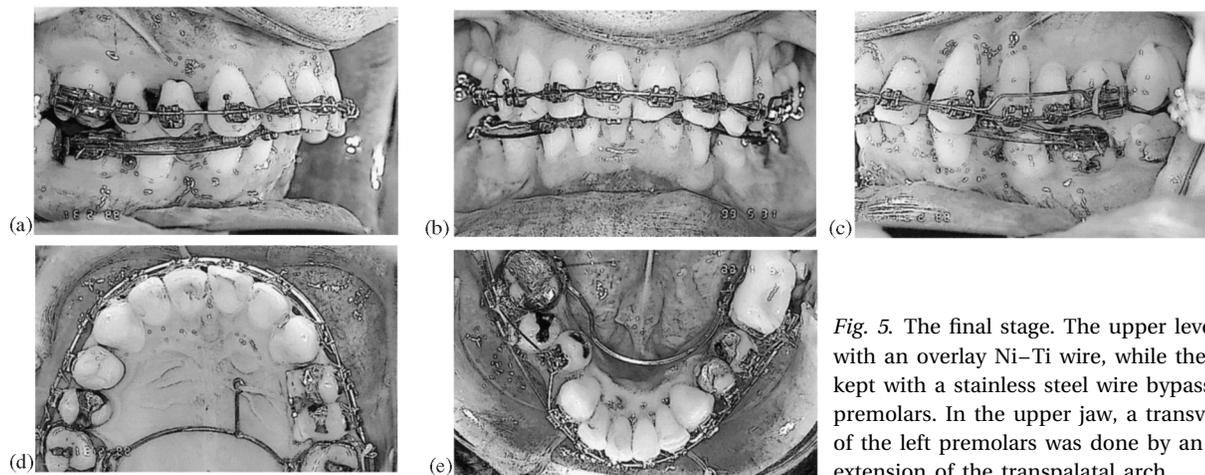


Fig. 5. The final stage. The upper levelling is finished with an overlay Ni-Ti wire, while the incisors are kept with a stainless steel wire bypassing the premolars. In the upper jaw, a transverse correction of the left premolars was done by an elastic to an extension of the transpalatal arch.

Evaluation

No bone loss was detectable on X-rays. Despite the marked proclination of the lower anterior teeth, no periodontal damage has developed; teeth have been moved with bone and not through bone. No signs of root resorption were evident.

Twenty-two months of treatment had resulted in a harmonious smile, which was achieved by means of normalisation of overjet and overbite and alignment of the upper and lower teeth. The patient was satisfied with the result. Palatal impingement and lip catch were no longer present (Fig. 6). The upper and lower dentition displayed coordinated and harmonious dental arch forms. Class I molar relationship was maintained and the canines were brought into a Class I relationship. The overjet and overbite were decreased. The scissors bite on 14, 24, 25 were corrected. The

deviation of the upper and lower midline was corrected to coincide with the facial midline. Minor detailing in the occlusion could have been better if less abrasion facets and fewer restorations were present. In these types of cases, for a perfect finishing collaboration with a prosthodontist is normally necessary.

The superimposed before and after tracings reveal that the lower incisors are considerably more proclined than predicted. Unfortunately, when the crowding was relieved, the patient felt that he had obtained a satisfactory situation and did not wish to go through 6 more months of treatment just to correct the torque on those teeth. The additional 6-month treatment was what we had originally predicted for treatment time. The post treatment examination revealed that the clinical crown height did not differ from the one observed before treatment.

Retention

The treatment result was maintained through good intercuspation and with incisor stops. Additionally, a bonded retainer in the lower arch and an Essix retainer in the upper arch were used. The patient was informed to use upper retainer full time during the first 6 months of retention and later only at night-time. It was also explained that the lower bonded retainer should be kept for a lifetime. In its absence, crowding would return probably by the pressure from the mentalis muscle. We did not expect this muscle to fully adapt to new tooth positions.

Discussion

The patient described here suffered from severe crowding. The problem was resolved by transversal

and sagittal expansion. Treatment was performed in phases. Within the first phase, the active and the passive units could clearly be distinguished. This was not the case during the finishing phase, which was carried out according to 'the straight wire' principle. For each phase of treatment, a well-defined part of the treatment was carried out. At the end of each phase of treatment, the teeth displaced during this phase were consolidated. Thereby, the risk of 'jiggling' was, to a great extent, avoided.

Finishing treatment with proclined lower incisors is generally considered unacceptable. In the present case, the alternatives would be to extract in the lower jaw and to perform an orthognathic surgical intervention to displace the mandible forward. The patient did not consider his teeth worth a surgical intervention. Actually, from a cost benefit point of view surgical solution would not be considered acceptable. Extrac-

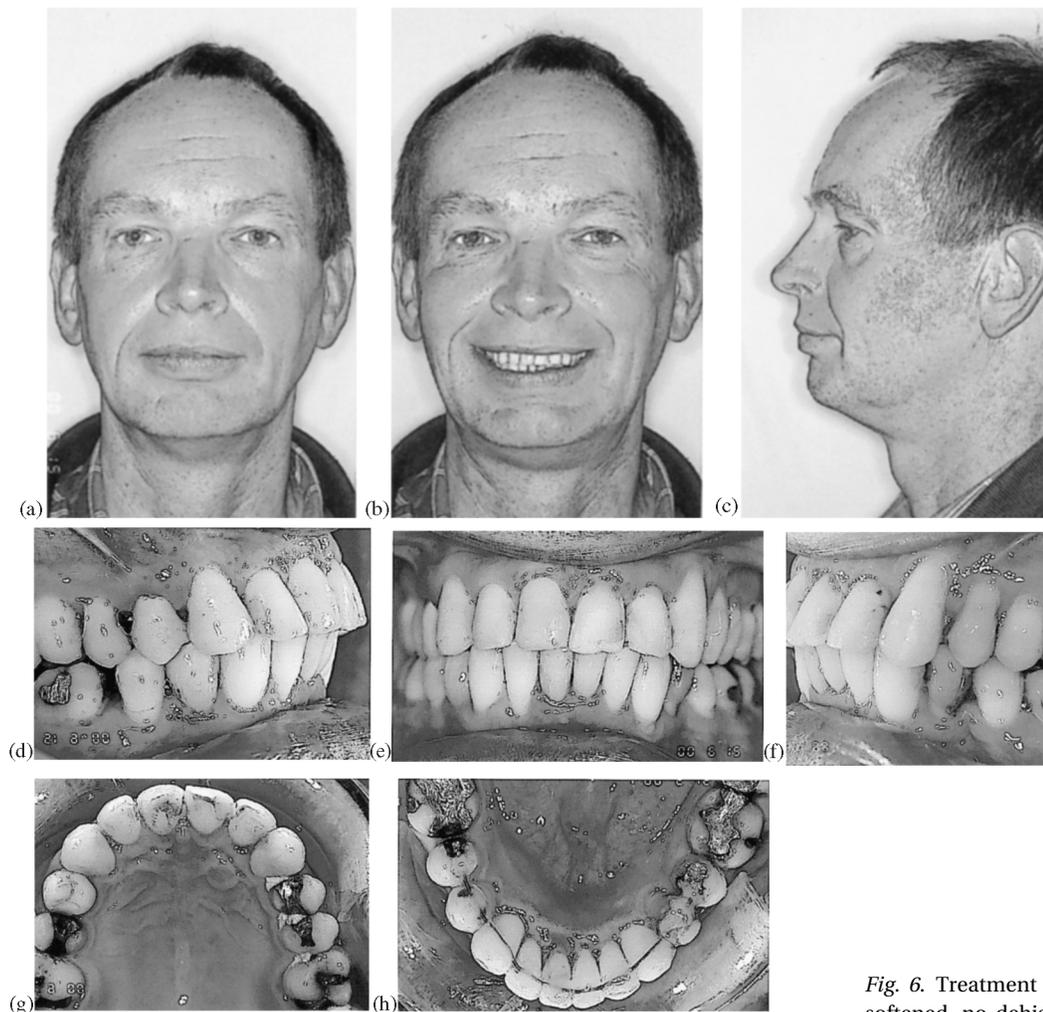


Fig. 6. Treatment result. The patients profile has softened, no dehiscence has developed.

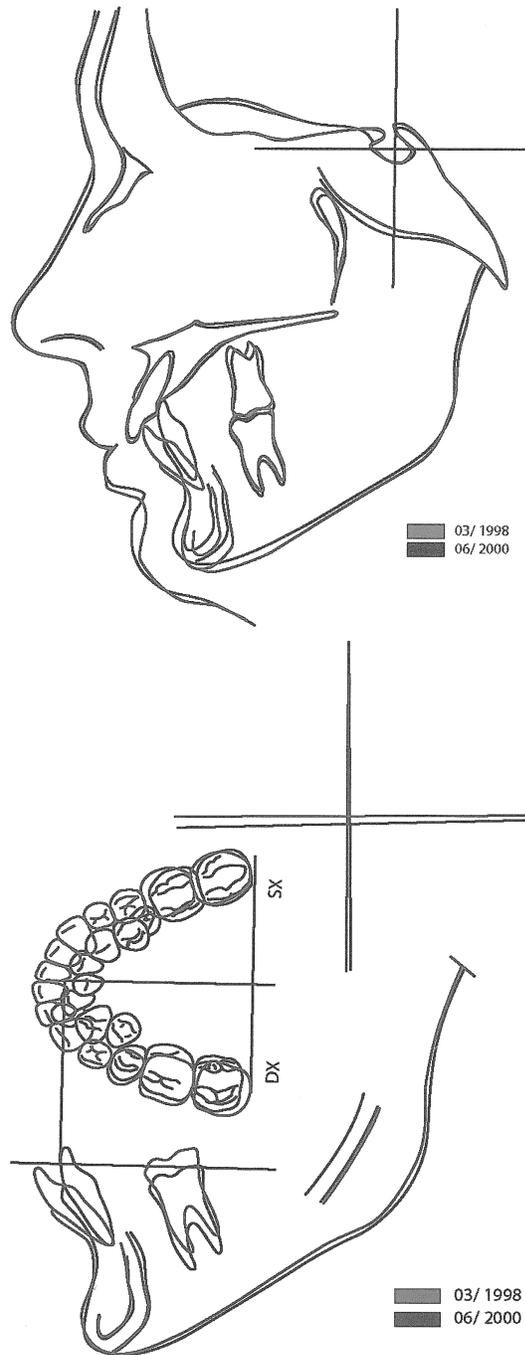


Fig. 7. Treatment result. Incisors were slightly more proclined than predicted. A minor opening of the mandibular plane has taken place. No bone loss had occurred.

tions in the upper jaw to reduce the overjet that would result from extractions in the lower jaw was not recommended either, since it would influence the soft tissue profile in a negative way. The non-extraction approach would have yielded a better result if we could torque the roots of lower incisors buccally. The

patient declined this option during our discussion session with him. He was satisfied and the fact that he was still within the 95% range of an untreated Scandinavian population. The state of progress at that time gave us no scientific basis to convince him to prolong treatment. The post treatment analysis showed that the clinical crown height had remained the same. This indicated to us that the periodontium had followed the orthodontically moving teeth. The tissue reaction to the treatment can thus be considered favourable. It is to be anticipated, however, that without the lower retainer a relapse will occur. This risk was explained to the patient. In the light of the fact that crowding may develop even in untreated individuals, this was considered acceptable. In summary, the patient has received what can be considered a compromised treatment. The alternatives to this treatment have been discussed and the solution we describe here considered the best choice.

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