10 Orthodontic options

R. D. Evans[1]

Some of the changes which occur in the relationships of worn teeth can be corrected by orthodontic treatment. This can improve the quality of restorative care.

Previous articles in this series have described the changes that take place when teeth wear. If this is caused by attrition, slowly progressive erosion or a combination of both, there is invariably compensation by tooth eruption and dentoalveolar growth to maintain occlusal contact in maximum intercuspation.[1,2] When the tooth wear primarily affects the palatal surfaces of the maxillary incisors and less frequently the lower incisal edges, contact is maintained in maximum intercuspation. This, unfortunately, means that often there will be insufficient interocclusal space to place restorations if these are needed. This can be created in a number of ways:

- Tooth preparation with the consequent removal of more tooth tissue
- Changing the jaw relationship
- Conventional orthodontic treatment using combinations of fixed and/or removable appliances
- Fixed or removable bite platforms – originally described by Dahl.[3]

The possibility of orthodontic treatment is often not considered for adults. This is either on grounds of potential difficulties in treatment or the acceptability of appliances to adult patients, particularly those that are fixed. However, orthodontic treatment is increasingly common in older age groups. Optimal aesthetic results are achieved when teeth are correctly positioned. Restorative procedures can be facilitated by orthodontics: for example, the re-creation of the space that would have been occupied by maxillary lateral incisors in patients affected by hypodontia.

The previous article discussed ways in which space could be created when worn teeth need restoration. One approach centred on changing the jaw relationship and consequently the position of mandibular closure. The second described the application of Dahl's work which uses bite platforms or modifications of them to produce relative axial tooth movement: this is essentially a type of orthodontic treatment. Conventional orthodontic treatment may also be useful in the prerestorative treatment of worn teeth allowing the relationship between them to be altered so that restoration becomes easier or sometimes possible when previously it was not.

Fig 1a Labial view of teeth worn through a combination of erosion and attrition

Fig 1b Palatal view of the worn maxillary anterior teeth

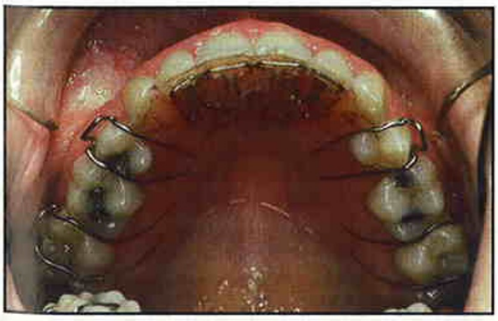

Fig 1c Removable appliance to procline the maxillary incisors

Fig 1d The increased overjet produced by the orthodontic treatment

The Series Editors are Richard Ibbetson and Andrew Eder of the Eastman Dental Institute for Oral Health Care Sciences and the Eastman Dental Hospital

[1]*Consultant Orthodontist, Eastman Dental Hospital, University College London Hospitals Trust and The Hospital for Sick Children, Great Ormond Street & Honorary Senior Lecturer, Eastman Dental Institute for Oral Health Care Sciences, University of London, 256 Gray's Inn Road, London WC1X 8LD*

1999; 186: 605–608

Fig 2a Labial view of dentition affected by erosion caused by bulimia

Fig 2b The worn incisal edges of the mandibular anterior teeth

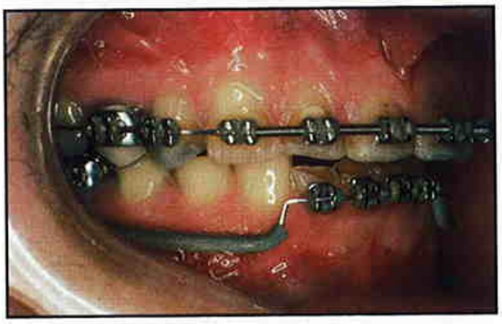

Fig 2c Treatment with fixed appliances

Fig 2d Labial view to show lower incisor intrusion to allow restoration

The orthodontic approach

Before embarking on treatment it is essential that the case is considered by both orthodontic and restorative specialists to clearly identify the aims and often more importantly, the limitations of treatment.[4,5] A number of orthodontic techniques is available to create localised interocclusal space and the decision about which is the most appropriate will depend on a careful examination of the accompanying malocclusion. In cases of localised anterior tooth wear, interocclusal space can be created by careful overbite reduction and in certain cases lower incisor retraction. The tooth movements required to reduce an overbite[6] include:

- Upper and lower incisor and canine intrusion
- Upper and lower incisor proclination
- Premolar and molar extrusion.

If orthodontic treatment is being carried out to correct other features of the malocclusion such as crowding, spacing and overjet reduction, the creation of anterior interocclusal space forms a part of the overall treatment. In this situation the way in which the overbite is reduced will depend on a number of factors including the determinants of the malocclusion and the age of the patient. In children, where there is remaining growth, it is common to extrude the premolars and molars as a way of reducing the overbite. The increase in the lower face height and backward rotation of the mandible is compensated by continued facial growth. In adult patients, premolars and molars should not be extruded as the result can be potentially unstable in the absence of significant remaining facial growth. In contrast, the orthodontic treatment should be focused, in general, on incisor and canine intrusion.

When the aim of the orthodontic treatment is purely to create anterior interocclusal space the techniques previously described can be adapted to the individual case. A combination of upper incisor proclination, lower incisor intrusion and in certain cases lower incisor retraction is effective. This can allow restorations to be placed on the palatal surfaces of the upper incisors and lower incisal edges. These must provide contacts on mandibular closure to ensure stability of the teeth in their new positions.

The choice of removable, fixed appliances or a combination of both will depend on the type of tooth movements required. Springs incorporated into removable appliances are only capable of producing tipping movements. If all that is required is upper incisor proclination, a removable appliance with suitable stainless steel springs will produce the desired tooth movements. Fixed appliances allow three-dimensional control permitting intrusion, extrusion, translation (bodily movement) or torqueing (root movement) of the teeth. Intrusion of incisors requires light, precisely directed forces, around 15 grams for a lower incisor and 20 grams for an upper incisor. Excessive force may result in apical root resorption and root shortening. The choice between 'full arch' or 'segmental' mechanics will depend on the primary determinants of the overbite and desired tooth movements and can be adapted to the

individual case. A recent study has shown that neither technique is particularly associated with apical root resorption.[7] However, the use of fixed appliances to reduce the overbite is complicated and requires expertise in fixed appliance technique.

These principles are illustrated in the following three cases:

Case 1 (Figs 1a–d). An upper removable appliance has been used to procline the upper incisors. If the incisors are initially well aligned, space will develop between the teeth. This may or may not need restorative intervention. In this particular case the base-plate of the upper appliance was adjusted to provide even contact with the lower incisal edges to prevent an increase in the overbite.

Case 2 (Figs 2a–d). In this case of bulimia affecting a 45 year old man, the upper incisors have been proclined and the lower incisors intruded with fixed appliances.

Case 3 (Figs 3a–d). To create anterior interocclusal space to restore 21|12 in the presence of a Class III incisor relationship, the lower incisors have been retracted following the extraction of one lower incisor.

Some adjustment to the individual tooth positions may be required to equalise the interocclusal space. This is achieved by placing detailing bends in the archwire to produce the ideal final tooth positions.

Having created adequate interocclusal space it is important to maintain it until either the provisional or definitive restorations are placed. It is possible to restore the damaged surfaces of teeth with the fixed appliances in place — the appliances can be removed after the restorations are in place.

One single technique is not suitable for all situations. It is important to consider the aetiology of the increased overbite and age of the patient before deciding on the most appropriate treatment. For many patients where the only problem is anterior tooth wear it may not be acceptable to wear either removable or fixed appliances, especially for periods of up to 12 months, although the patient should be allowed to make that decision for themselves.

The 'Dahl' approach

An alternative method of creating an anterior interocclusal space involves the use of fixed anterior bite raising appliances: this was originally described by Dahl. This technique involves placing an anterior bite raising appliance or bite platform which has been shown in an implant-cephalometric study[8] to result in intrusion of the anterior teeth by an average of 1.05 mm, and extrusion or eruption of the remaining teeth, averaging 1.47 mm after 6–14 months, without causing undue incisor proclination.[9] It was shown that the increase in occlusal face height was variable, averaging 1.9 mm with the post treatment decrease confined to a 6-month period.[10] This type of appliance differs from a conventional flat anterior bite plane built into an upper removable appliance in that the anterior and posterior parts of

Fig 3a Tooth surface loss affecting the maxillary anterior teeth with edge to edge incisor relationship

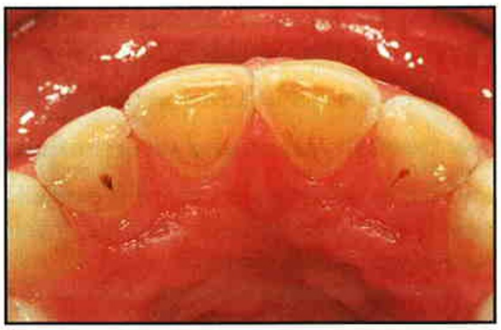

Fig 3b Maxillary anterior teeth showing tooth surface loss caused by acid erosion

Fig 3c Mandibular fixed appliance in place

Fig 3d Retraction and intrusion of the lower labial segment creating space for restoration of the maxillary anterior teeth

1 Berry D C, Poole D F G. Attrition: possible mechanisms of compensation. *J Oral Rehabil* 1976; 3: 201-206.
2 Crothers A, Sandham A. Vertical height differences in subjects with severe dental wear. *Eur J Orthod* 1993; 15: 519-525.
3 Dahl B L, Krogstad O, Karlsen K. An alternative treatment in cases with advanced localised attrition. *J Oral Rehab* 1975; 2: 209-214.
4 Beckett H A, Evans R D. The interface between orthodontics and restorative dentistry in the management of anterior tooth surface loss. *Br J Orthodont* 1994; **21**: 231-237.
5 Evans R D. Orthodontics and the creation of localised interocclusal space in cases of anterior tooth wear. *Eur J Prosthdont Rest Dent* 1997; 5: 169-173.
6 Bennett J C, McLaughlin R P. Management of deep overbite with a preadjusted edgewise system. *J Clin Orthodont* 1990; 24: 684-696.
7 Costopolous G, Nanda R. An evaluation of root resorption incident to orthodontic intrusion. *Am J Orthod Dentofacial Orthped* 1996; 105: 543-548.
8 Dahl B L, Krogstad O. The effect of a partial bite-raising splint on the occlusal face height. An x-ray cephalometric study in human adults. *Acta Odontol Scand* 1982; 40: 17-24.
9 Dahl B L, Krogstad O. The effect of a partial bite raising splint on the inclination of the upper and lower front teeth. *Acta Odontol Scand* 1983; 41: 311-314.

10 Dahl B L, Krogstad O. Long-term observations of an increased occlusal face height obtained by a combined orthodontic/prosthetic approach. *J Oral Rehab* 1985; **12**: 171-176.
11 Briggs P, Bishop K, Dejmal S. The clinical evolution of the 'Dahl Principle'. *Br Dent J* 1997; **183**: 171-176.
12 Ricketts N J, Smith B G N. Clinical techniques for producing and monitoring minor axial tooth movement. *Eur J Prosthodont Rest Dent* 1994; **2**: 5-9.
13 Ricketts N J, Smith B G N. Minor axial tooth movement in preparation for fixed prostheses. *Eur J Prosthodont Rest Dent* 1993; **1**: 145-149.
14 Darbar U R, Hemmings K W. Treatment of localised anterior tooth wear with composite restorations at an increased occlusal vertical dimension. *Dent Update* 1997; **24**: 72-75.
15 Ibbetson R J, Setchell D J. Treatment of the worn dentition: 2. *Dent Update* 1989; 16: 300-307.

the dental arch are able to move independently of each other. The technique continues to evolve with recent reports describing the use of composite resin both directly and indirectly, intermediate fixed metal prostheses, definitive individual adhesive restorations, intermediate temporary full coverage restorations and finally definitive conventional full coverage restorations.[11–15] Unfortunately, to date there are no published long-term studies evaluating the outcome of many of these new approaches. However, these principles have been in use at the Eastman Dental Institute and Hospital for nearly 20 years in the prerestorative treatment of patients affected by tooth surface loss. They have proved predictable, well tolerated by patients and produce few complications.

Conventional orthodontics should be considered as a way of creating localised interocclusal space in cases of anterior tooth wear if there are other aspects of the malocclusion that require treatment. The 'Dahl' approach is very effective at creating interocclusal space but cannot deal with malaligned teeth. It is therefore important to consider a full orthodontic assessment in cases of anterior tooth wear as it forms an alternative strategy for creating the space necessary for restorations. If appropriate, orthodontic treatment should be offered to patients affected by tooth surface loss as it can reduce the complexities of the restorative procedures.

A theme has been evident in many of the articles in this series that short teeth create restorative difficulties in retention and resistance form, structural durability and may compromise aesthetics. The strategies that have been described for creating space between opposing teeth may, by themselves, not be sufficient to overcome these problems. Surgical crown lengthening may be necessary, involving the dentist working with another specialist in planning restorative work. The next article in the series describes the scope and limitations of surgical crown lengthening in the management of patients with worn teeth.