


# 1

## The rationale for orthodontic treatment

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## 2 The rationale for orthodontic treatment

### 1.1 Definition

Orthodontics is that branch of dentistry concerned with facial growth, with development of the dentition and occlusion, and with the diagnosis, interception, and treatment of occlusal anomalies.

### 1.2 Prevalence of malocclusion

Numerous surveys have been conducted to investigate the prevalence of malocclusion. It should be remembered that the figures for a particular occlusal feature or dental anomaly will depend upon the size and composition of the group studied (for example age and racial characteristics), the criteria used for assessment, and the methods used by the examiners (for example whether radiographs were employed).

It has been estimated that approximately 66 per cent of 12-year-olds in the UK require some form of orthodontic intervention, and around 33 per cent need complex treatment. The results of the recent survey of children in the United Kingdom is given in Table 1.1.

Now that a greater proportion of the population are keeping their teeth for longer, orthodontic treatment has an increasing adjunctive role prior to restorative work. In addition, there is an increasing acceptability of orthodontic appliances with the effect that many adults who did not have treatment during adolescence are now seeking treatment.

### 1.3 Need for treatment

It is perhaps pertinent to begin this section by reminding the reader that malocclusion is one end of the spectrum of normal variation and is not a disease.

Ethically, no treatment should be embarked upon unless a demonstrable benefit to the patient is feasible. In addition, the potential advantages should be viewed in the light of possible risks and side-effects, including failure to achieve the aims of treatment. Appraisal of these factors is called risk–benefit analysis and, as in all branches of medicine and dentistry, needs to be considered before treatment is commenced for an individual patient. In parallel, financial constraints coupled with the increasing costs of health care have led to an increased focus upon the cost–benefit ratio of treatment. Obviously the threshold for treatment and the amount of orthodontic intervention will differ between a system that is primarily funded by the state and one that is private or based on insurance schemes.

#### Decision to treat

Benefits of treatment		depends upon	Risks	
<i>Improved function</i>	versus		<i>Worsening of dental health (e.g. caries)</i>	
<i>Improved aesthetics</i>			<i>Failure to achieve aims of treatment</i>	

**Table 1.1** UK child dental health survey 2003

#### In the 12-year-old age band:

Children undergoing orthodontic treatment at the time of the survey	8%
Children not undergoing treatment – in need of treatment (IOTN dental health component)	26%
No orthodontic need (NB includes children who have had treatment in past)	57%

The decision to embark upon a course of treatment will be influenced by the perceived benefits to the patient balanced against the risks of appliance therapy and the prognosis for achieving the aims of treatment successfully. In this chapter we consider each of these areas in turn, starting with the results of research into the possible benefits of orthodontic treatment upon dental health and psychological well-being.

#### 1.3.1 Dental health

##### Caries

Research has failed to demonstrate a significant association between malocclusion and caries, whereas diet and the use of fluoride toothpaste are correlated with caries experience. However, clinical experience suggests that in susceptible children with a poor diet, malalignment may reduce the potential for natural tooth-cleansing and increase the risk of decay.

##### Periodontal disease

The association between malocclusion and periodontal disease is weak, as research has shown that individual motivation has more impact than tooth alignment upon effective tooth brushing. Certainly, good toothbrushers are motivated to brush around irregular teeth, whereas in the individual who brushes infrequently their poor plaque control is clearly of more importance. Nevertheless, it would seem logical that in the middle of this range that, irregular teeth would hinder effective brushing. In addition, certain occlusal anomalies may prejudice periodontal support.

Crowding may lead to one or more teeth being squeezed buccally or lingually out of their investing bone, resulting in a reduction of periodontal support. This may also occur in a Class III malocclusion where the lower incisors in cross-bite are pushed labially, contributing to gingival recession. Traumatic overbites can also lead to increased loss of periodontal support and therefore are another indication for orthodontic intervention.

Finally, an increased dental awareness has been noted in patients following orthodontic treatment, and this may be of long-term benefit to oral health.

#### Trauma to the anterior teeth

Any practitioner who treats children will confirm the association between increased overjet and trauma to the upper incisors. A recent systematic review has provided additional evidence for this association. This paper used a meta-analysis technique to synthesize the results from previous studies. Eleven studies were deemed to fit the reviewers' criteria. The authors found that individuals with an overjet in excess of 3 mm had more than double the risk of injury. The odds ratio for traumatic injury was calculated to be 2.30 for overjets less than 3 mm.

Overjet is a greater contributory factor in girls than boys even though traumatic injuries are more common in boys. Other studies have shown that the risk is greater in patients with incompetent lips.

#### Masticatory function

Patients with anterior open bites (AOB) and those with markedly increased or reverse overjets often complain of difficulty with eating, particularly when incising food. Classically patients with AOB complain that they have to avoid sandwiches containing lettuce or cucumber.

#### Speech

The soft tissues show remarkable adaptation to the changes that occur during the transition between the primary and mixed dentitions, and when the incisors have been lost owing to trauma or disease. In the main, speech is little affected by malocclusion, and correction of an occlusal anomaly has little effect upon abnormal speech. However, if a patient cannot attain contact between the incisors anteriorly, this may contribute to the production of a lisp (interdental sigmatism).

#### Tooth impaction

Unerupted teeth may rarely cause pathology. Unerupted impacted teeth, for example maxillary canines, may cause resorption of the roots of adjacent teeth. Dentigerous cyst formation can occur around unerupted third molars or canine teeth. Supernumerary teeth may also give rise to problems, most importantly where their presence prevents normal eruption of an associated permanent tooth or teeth.

## 1.4 Demand for treatment

After working with the general public for a short period of time, it can readily be appreciated that demand for treatment does not necessarily reflect need for treatment. Some patients are very aware of mild rotations of the upper incisors, whilst others are blithely unaware of markedly increased overjets. It has been demonstrated that awareness of tooth alignment and malocclusion, and willingness to undergo orthodontic treatment, are greater in the following groups:

#### Temporomandibular joint dysfunction syndrome

This topic is considered in more detail in Section 1.7.

#### Those occlusal anomalies for which there is evidence to suggest an adverse effect upon the longevity of the dentition, indicating that their correction would benefit long-term dental health

- Increased overjet
- Increased traumatic overbites
- Anterior crossbites (where causing a decrease in labial periodontal support of affected lower incisors)
- Unerupted impacted teeth (where there is a danger of pathology)
- Crossbites associated with mandibular displacement

#### 1.3.2 Psychosocial well-being

While it is accepted that dentofacial anomalies and severe malocclusion do have a negative effect on the psychological well-being and self-esteem of the individual, the impact of more minor occlusal problems is more variable and is modified by social and cultural factors. Research has shown that an unattractive dentofacial appearance does have a negative effect on the expectations of teachers and employers. However, in this respect, background facial appearance would appear to have more impact than dental appearance.

A patient's perception of the impact of dental variation upon his or her self-image, is subject to enormous diversity and is modified by cultural and racial influences. Therefore, some individuals are unaware of marked malocclusions, whilst others complain bitterly about very minor irregularities.

The dental health component of the Index of Orthodontic Treatment Need was developed to try and quantify the impact of a particular malocclusion upon long-term dental health. The index also comprises an aesthetic element which is an attempt to quantify the aesthetic handicap that a particular arrangement of the teeth poses for a patient. Both aspects of this index are discussed in more detail in Chapter 2.

The psychosocial benefits of treatment are however countered to a degree by the visibility of appliances during treatment and their effect upon the self-esteem of the individual. In other words a child who is being teased about their teeth will probably also be teased about braces.

- females
- higher socio-economic families/groups
- in areas which have a smaller population to orthodontist ratio, presumably because appliances become more accepted

One interesting example of the latter has been observed in countries where provision of orthodontic treatment is mainly privately funded, for

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example, the USA, as orthodontic appliances are now perceived as a 'status symbol'.

With the increasing dental awareness shown by the public and the increased acceptability of appliances, the demand for treatment is increasing rapidly, particularly among the adult population who may not have had ready access to orthodontic treatment as children. In addition, increased dental awareness also means that patients are seeking a higher standard of treatment result. These combined

pressures place considerable strain upon the limited resources of state-funded systems of care. As it appears likely that the demand for treatment will continue to escalate, some form of rationing of state-funded treatment is inevitable and is already operating in some countries. In Sweden for example, the contribution made by the state towards the cost of treatment is based upon need for treatment as determined by the Swedish Health Board's Index (see IOTN in Chapter 2).

### 1.5 The disadvantages and potential risks of orthodontic treatment

Like any other branch of medicine or dentistry, orthodontic treatment is not without potential risks (see Table 1.2).

#### 1.5.1 Root resorption

It is now accepted that some root resorption is inevitable as a consequence of tooth movement. On average, during the course of a conventional 2-year fixed-appliance treatment around 1 mm of root length will be lost. However, this mean masks a wide range of individual variation, as some patients appear to be more susceptible and undergo more marked root resorption. Evidence would suggest a genetic basis in these cases. Radiographic signs which are associated with an increased risk include shortened roots with evidence of previous root resorption, pipette-shaped or blunted roots, and teeth which have previously suffered an episode of trauma. In addition, more resorption is seen in cases where extensive movement of root apices has been undertaken.

#### 1.5.2 Loss of periodontal support

As a result of reduced access for cleansing, an increase in gingival inflammation is commonly seen following the placement of fixed

appliances. This normally reduces or resolves following removal of the appliance, but some apical migration of periodontal attachment and alveolar bony support is usual during a 2-year course of orthodontic treatment. In most patients this is minimal, but if oral hygiene is poor, particularly in an individual susceptible to periodontal disease, more marked loss may occur.

Removable appliances may also be associated with gingival inflammation, particularly of the palatal tissues, in the presence of poor oral hygiene.

#### 1.5.3 Decalcification

Caries or decalcification occurs when a cariogenic plaque occurs in association with a high-sugar diet. The presence of a fixed appliance predisposes to plaque accumulation as tooth cleaning around the components of the appliance is more difficult. Decalcification during treatment with fixed appliances is a real risk, with a reported prevalence of between 2 and 96 per cent (see Chapter 18, Section 18.7). Although there is evidence to show that the lesions regress following removal of the appliance, patients may still be left with permanent 'scarring' of the enamel Fig. 1.1.

#### 1.5.4 Soft tissue damage

Traumatic ulceration can occur during treatment with both fixed and removable appliances, although it is more commonly seen in association

**Table 1.2** Potential risks of orthodontic treatment

Problem	Avoidance/Management of risk
Decalcification	Dietary advice, improve oral hygiene, increase availability of fluoride Abandon treatment
Periodontal attachment loss	Improve oral hygiene. Avoid moving teeth out of alveolar bone
Root resorption	Avoid treatment in patients with resorbed, blunted, or pipette-shaped roots
Loss of vitality	If history of previous trauma to incisors, counsel patient
Relapse	Avoidance of unstable tooth positions at end of treatment Retention



**Fig. 1.1** Decalcification.

with the former as a removable appliance which is uncomfortable is usually removed. Over-enthusiastic apical movement can lead to a reduction in blood supply to the pulp and even pulpal death. Teeth

which have undergone a previous episode of trauma appear to be particularly susceptible, probably because the pulpal tissues are already compromised.

## 1.6 The effectiveness of treatment

The decision to embark upon orthodontic treatment must also consider the effectiveness of appliance therapy in correcting the malocclusion of the individual concerned. This has several aspects.

- Are the tooth movements planned attainable? This is considered in more detail in Chapter 7 but, in brief, tooth movement is only feasible within the constraints of the skeletal and growth patterns of the individual patient. The wrong treatment plan, or failure to anticipate adverse growth changes, will reduce the chances of success. In addition, the probable stability of the completed treatment needs to be considered. If a stable result is not possible, do the benefits conferred by proceeding justify prolonged retention, or the possibility of relapse?
- There is a wealth of evidence to show that orthodontic treatment is more likely to achieve a pleasing and successful result if fixed appliances are used, and if the operator has had some postgraduate training in orthodontics.
- Patient co-operation.

The likelihood that orthodontic treatment will benefit a patient is increased if the malocclusion is severe, the patient is well-motivated and appliance therapy is planned and carried out by an experienced orthodontist. The likelihood of gain is reduced if the malocclusion is mild and treatment is undertaken by an inexperienced operator.

In essence, it may be better not to embark on treatment at all, rather than run the risk of failing to achieve a worthwhile improvement.

**Table 1.3** Failure to achieve treatment objectives

Operator factors	Patient factors
Errors of diagnosis	Poor oral hygiene
Errors of treatment planning	Failure to wear appliances
Anchorage loss	Repeated appliance breakages
Technique errors	Failed appointments

## 1.7 The temporomandibular joint and orthodontics

The aetiology and management of temporomandibular joint dysfunction syndrome (TMD) have aroused considerable controversy in all branches of dentistry. The debate has been particularly heated regarding the role of orthodontics, with some authors claiming that orthodontic treatment can cause TMD, whilst at the same time others have advocated appliance therapy in the management of the condition.

There are a number of factors that have contributed to the confusion surrounding TMD. The objective view is that TMD comprises a group of related disorders of multifactorial aetiology. Psychological, hormonal, genetic, traumatic, and occlusal factors have all been implicated. It is accepted that parafunctional activity, for example bruxism, can contribute to muscle pain and spasm. Success has been claimed for a wide assortment of treatment modalities, reflecting both the multifactorial aetiology and the self-limiting nature of the condition. Given this it is wise to try irreversible approaches in the first instance. The reader is directed to look at two recent Cochrane reviews (see further reading) on the use of stabilization splints and occlusal adjustment.

### 1.7.1 Orthodontic treatment as a contributory factor in TMD

A survey of the literature reveals that those articles claiming that orthodontic treatment (with or without extractions) can contribute to

the development of TMD are predominantly of the viewpoint (based on the authors' opinion) and case report type. In contrast, controlled longitudinal studies have indicated a trend towards a lower incidence of the symptoms of TMD among post-orthodontic patients compared with matched groups of untreated patients.

The consensus view is that orthodontic treatment, either alone or in combination with extractions, does not 'cause' TMD.

### 1.7.2 The role of orthodontic treatment in the prevention and management of TMD

Some authors maintain that minor occlusal imperfections lead to abnormal paths of closure and/or bruxism, which then result in the development of TMD. If this were the case, then given the high incidence of malocclusion in the population (50–75 per cent), one would expect a higher prevalence of TMD than the reported 10 per cent. A number of carefully controlled longitudinal studies have been carried out in North America, and these have found no relationship between the signs and symptoms of TMD and the presence of non-functional occlusal contacts or mandibular displacements. However, other studies have found a small but statistically significant association between TMD and some types of malocclusion including Class II skeletal pattern (especially associated with a retrusive mandible); Class III; anterior open bite; crossbite and asymmetry. Further well-designed studies are

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required to delineate the aetiology of TMD in more detail, bearing in mind that this term probably comprises a range of related disorders.

A review of the current literature would indicate that orthodontic treatment does not 'cure' TMD. It is important to advise patients, particularly those who present reporting TMD symptoms, of this and to note this in their records.

Whilst current evidence indicates that orthodontic treatment is not a contributory factor and also does not cure the TMD, it is advisable to carry out a TMD screen for all potential orthodontic patients. At the very least this should include questioning patients about symptoms; an examination of the temporomandibular joint and associated muscles and recording the range of opening and movement (see Chapter 5). If signs or symptoms of TMD are found then it may be wise to refer the

patient for a comprehensive assessment and specialist management before embarking on orthodontic treatment.

### Key points

- The decision to undertake orthodontic treatment or not is essentially a risk–benefit analysis where the perceived benefits in commencing treatment at that time outweigh the potential risks.
- If there is any uncertainty as to whether the patient will co-operate and/or benefit from treatment, then it is advisable not to proceed at that time.



## Principal sources and further reading

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**Contains a good discussion on the need and demand for treatment.**

References for this chapter can also be found at [www.oxfordtextbooks.co.uk/orc/mitchell3e](http://www.oxfordtextbooks.co.uk/orc/mitchell3e). Where possible, these are presented as *active links* which direct you to an electronic version of the work, to help facilitate onward study. If you are a subscriber to that work (either individually or through an institution), and depending on your level of access, you may be able to peruse an abstract or the full article if available. We hope you find this feature helpful towards assignments and literature searches.