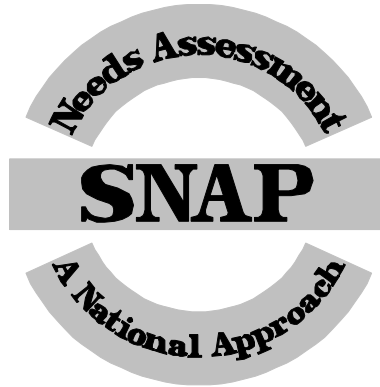


Scottish Needs Assessment Programme



Orthodontic Care

SCOTTISH FORUM FOR PUBLIC HEALTH MEDICINE

Scottish Needs Assessment Programme
Oral Health Network
Orthodontic Care

Professor D R Stirrups	Consultant Orthodontist Dundee Dental Hospital and School
Mr I B Buchanan	Consultant Orthodontist Glasgow Dental Hospital and School
Miss C E Dawson	Consultant in Dental Public Health Grampian Health Board
Mr P McCallum	Specialist Orthodontic Practitioner Forth Valley
Mr G O Nicoll	General Dental Surgeon Fife
Dr C Pine	Consultant in Dental Public Health Dundee Dental Hospital and School
Mr P Sweeney	Senior Registrar in Dental Public Health Greater Glasgow/Argyll & Clyde Health Boards

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**Scottish Forum for Public Health Medicine
69 Oakfield Avenue
Glasgow G12 8QQ
Tel: 0141 330 5607
Fax: 0141 330 3687**

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

1. Remit of this report is orthodontic care excluding that required for the treatment of Cleft Lip and Palate and other gross cranio-facial disproportions that require combined orthodontic and surgical treatment.

2. Introduction Orthodontics is a sub speciality of dentistry primarily concerned with disturbances of the positions of the teeth (Malocclusion*) and the jaws that support them. Orthodontic treatment is the means by which these problems are managed.

3. Statement of the problem About a third of children have malocclusions that would show clear need for orthodontic therapy and about another third are borderline for need when assessed using the Index of Orthodontic Treatment Need (IOTN - see Appendix 1). This is affected little by gender or social class and there is no evidence of geographic variation. The uptake of orthodontic treatment is considerably less than this and is related to Social Class. Demand for orthodontic treatment is rising as the dental health and expectations of the population improve. Orthodontic problems in children are largely developmental and the incidence is unchanging but there is a pool of untreated problems in adults that adds to the potential demand.

4. Effective Care This will vary from patient to patient and will depend on the severity of the problem and the patient's willingness and ability to cope with the demands of treatment. Effective care should show worthwhile improvement. This improvement may be in either (or both) dental health or dento-facial aesthetics. Malocclusion is largely a developmental problem and there is little scope for prevention.

5. Orthodontic Care Providers Orthodontic treatment is provided by dentists at three levels of training and working in either primary or secondary care. These are Non-specialist Primary Care Practitioners, Specialist Orthodontic Practitioners working in primary care and Consultant Orthodontists. The Nuffield report (Nuffield Inquiry into Personnel Auxiliary to Dentistry 1993) suggested that the use of extended duty dental auxiliaries could take on some of the routine technical tasks of orthodontic treatment in a specialist environment. Changes to the Dentist's Act will be required to allow this to take place. The training of orthodontic specialists for both primary and secondary care is undergoing change as a result of the Report on Specialisation in Dentistry (Chief Dental Officer England and Wales 1995). For Orthodontic training, this report has created more problems than it solves and it is likely to be several years before clearly defined training pathways are re-established.

6. Frameworks for consultation This can be achieved with those practitioners providing orthodontic services or acting as a gateway to specialist treatment, locally through Area Dental Committees and nationally through the British Orthodontic Society and the British Dental Association. There are no readily identifiable patient groups and the interests of users are probably best represented by Local Health Councils. Discussions locally need to be focused on mechanisms for achieving the equitable rationing of access to care, so that provision of treatment is on need rather than opportunistic timing of referral.

7. Deficiencies in provision and Priority Action areas In all areas of Scotland there is a gross shortage of Orthodontic Specialists. In the current climate, there is also no possibility of adequate public financing of comprehensive orthodontic care for all who may need and desire it. Even if care is limited to those with professionally assessed need and who would benefit from care there is a shortfall in treatment provision for those patients whose treatment is more complex than their primary general dental carer can provide. This can in part be addressed by limiting access to specialist care only to the more severe problems and by raising the skill levels of the

primary dental care practitioner. There is a need to obtain local agreement on mechanisms for implementing the targeting of the existing managed treatment resources - the Community Dental and Hospital Services. The targeting of resources in the General Dental Services will require agreement with the profession at a national (UK) level for alterations in the regulations. Further training of primary dental carers in diagnosis, so they know what and when to refer, would improve their effectiveness. There are many parts of Scotland where the population base would not support a specialist orthodontic practice. To minimise costs of providing treatment and travelling by patients it is important to raise the skill levels of general dental practitioners. They need continuing professional education in treatment skills at two levels, short courses in simple treatment skills and training in intermediate treatment skills, with longitudinal attachments to Consultant Orthodontic Units. The shortage of specialists is a consequence of a national shortage of training opportunities. However, increasing the number of specialists is the quickest and, probably, most cost-effective way of increasing the availability of orthodontic care. The likelihood of specialists setting up practice in Scotland would increase if training opportunities in Scotland were increased. More Consultant Orthodontists would also help and is an option which Health Boards can implement. Consideration should be given to sharing appointments between adjacent Boards.

8. Options The delivery of "routine" orthodontic care is by a mix of specialist and non-specialist practitioners working in the Primary Care (GDS and CDS) sector; secondary care is provided by the Consultant-led hospital service. Geography, demography and source of funding will dictate the mix within an area. It is unlikely that desirable levels of specialist orthodontic practitioners can be achieved because of work-force shortages and some sub optimal mix of skills will be needed for the foreseeable future. Commissioners should discuss with the present providers of orthodontic care, how to optimise the use of available resources. It is likely that the most economical provision of specialist treatment is by a specialist orthodontic practitioner working in the primary care sector. Current work-force shortages mean this an option that is not within the ability of commissioners to pursue effectively. Within any area, there will be primary care dentists providing non specialist treatment. One option is to increase their skills; this will increase the scope of treatment they can provide at the non-specialist level. There will be a need for treatment of complex, often interdisciplinary, orthodontic care that requires the skills of the consultant service. All areas will need Consultant Orthodontic Service provision for this and to provide advice to primary care practitioners and some routine treatment. As levels of provision of specialists in the General Dental Services is governed by market forces and not influenced by Health Boards, direct recruitment of specialists in the General Dental Services is not an option. The only means Health Boards have of increasing the availability of specialist care is to increase Consultant Orthodontist numbers.

9. Economic Issues Economic evaluations of current orthodontic intervention and the proposals contained in this document are not possible from the available data. However, costs will vary with geography, demography and the skill-mix available. The inequities of unregulated access to specialist orthodontic treatment can be addressed in part by locally agreed systems of prioritising care.

10. Monitoring Using the Index of Orthodontic Treatment Need (IOTN) prioritisation of access to care can be monitored. Clinical audit can be undertaken by the professionals delivering the service. Patient satisfaction should also be taken into account so there is a need to develop socio-dental indicators that can be used as outcome measures. The results of such audit could be shared with commissioners or undertaken independently by them. The limitations of IOTN should be taken into account.

11.Commissioning Issues For the foreseeable future, demand will continue to exceed the available supply of orthodontic care. Increased provision of services increases demand. Some form of equitable rationing of access to orthodontic care is needed.

12.Recommendations

12.1 Targeting resources Implement a system of rationing of access to orthodontic care based on IOTN with the level of IOTN to be used as a cut off point to be locally agreed. As an **absolute minimum** the service should aim to provide:

- timely access to orthodontic advice on request
- the provision of treatment to those that wish it and who have an objective measure of treatment need (IOTN 4 and 5 on the Dental Health Component Scale and/or 8, 9 and 10 on the Aesthetic Scale) and no contraindications to the provision of that care.

The local negotiations are likely to be about the cut-off point within Grade 3 IOTN Dental Health Component.

12.2 Research and Development

12.2.1 Data Sets Develop methodologies and common data sets to measure workload, outcome and cost to be used in whatever care setting orthodontic treatment is provided.

12.2.2 Indices

- Develop and evaluate ***Socio-Dental Indicators***^{*} that take account of patients' perceptions of Treatment Need and Treatment Outcome.
- Develop and evaluate a measure of the ***complexity of treatment*** which can be applied retrospectively to be used for case mix assessments when making economic comparisons between providers. For skill-mix planning a measure that could be applied prospectively is desirable and should be developed in the longer term.
- Develop and evaluate an outcome measure that reflects ***health gain***. This is needed to make rational decisions on the relative value of orthodontics when compared with other health care programmes.

12.2.3 Assessment of population need The Scottish Health Boards Dental Epidemiology Programme should include IOTN in the measures for the 12 year old's survey. To assess unmet need it should consider a similar examination of a 15/16 year old cohort.

12.2.4 Evaluation Once appropriate measures and data sets are available an evaluation should be carried out of alternatives for delivery of orthodontic care that looks at both economic aspects and clinical outcome.

12.2.5 Use of orthodontic auxiliaries Once permissive legislation is in place, pilot studies should be carried out to investigate the utility of such personnel. Such pilots should investigate clinical effectiveness, patient acceptability and economics in the context of the diverse geography that affects the delivery of health care in Scotland.

12.3 Training

12.3.1 Post-graduate continuing education for non specialists in both the General and Community Dental Services

Diagnostic and gate-keeping Short training courses for non specialists in diagnostic and gate-keeping skills should be provided.

Simple treatment skills Short training courses for non specialists in simple treatment skills should be provided.

Intermediate treatment skills Longitudinal clinical training courses should be provided to enable some intermediate level treatment to be carried out in the local community. These should be targeted at raising the skill level of primary care practitioners in geographically disadvantaged areas that cannot attract specialists. Such training should be bought from the consultant orthodontic service but will require an investment of both capital and revenue resource.

12.3.2 Post Graduate Specialist More places for training orthodontic specialists should be provided in Scotland. This is the quickest and most cost effective way of increasing the provision of orthodontic care in Scotland and needs to be addressed at a national level. Most of these practitioners would work in primary care.

12.4 Service development (see page 9 for definitions)

Non-specialist Primary Care Services One barrier to the take up of intermediate level skill training by primary care practitioners may be the start-up capital costs. Support for such costs could be considered but must be linked to appropriate training and a commitment to continuing provision of orthodontic care within the National Health Service.

Specialist Orthodontic Services Temporary financial support to new specialist practices may help recruitment to an area, especially if disadvantaged by the lack of local training provision. Any such support must be linked to a commitment to continuing provision of orthodontic care within the National Health Service.

Consultant Orthodontic Services More posts, possibly shared between Health Boards, is a direct way of increasing the provision of specialist care.

12.5 Monitoring The present orthodontic indices, and others yet to be developed, should be used to monitor standards of patient care.

* see Glossary

REMIT

The remit of this report is orthodontic care excluding that required for the treatment of Cleft Lip and Palate and other gross cranio-facial disproportions that require combined orthodontic and surgical treatment. The majority of orthodontic therapy is covered by the remit of this report. For patients with facial clefts and those who are to receive dento-facial surgery, orthodontic treatment is usually carried out in specialist hospital units.

INTRODUCTION

Orthodontics

Orthodontics is a sub speciality of dentistry primarily concerned with disturbances of the positions of the teeth (malocclusion) and the jaws that support them. Orthodontic treatment is the means by which these problems are managed. The British Dental Association "Memorandum on Orthodontics" (1954) defined the speciality as "that branch of dental science concerned with genetic variations, development and growth of facial forms and the manner in which these factors effect the occlusion of the teeth and the function of the associated organs. The aim of orthodontic treatment is to produce improved function by the correction of irregularities and so to create not only greater resistance to disease, but also to improve personal appearance, which later will contribute to the mental as well as the physical well-being of the individual."

Malocclusion is defined as deviation from normal occlusion and includes, for example, protruding incisor teeth and crowding of the dental arches. A non technical description of "normal occlusion" is: When the upper and lower jaws are closed together without straining of the facial muscles, the upper and lower side teeth interdigitate fully, with the outer surfaces of the upper teeth slightly outside the lower teeth. The front teeth meet with a slight overlap vertically and horizontally with the upper teeth in front of the lower. A more precise, but technical definition, is provided in the glossary.

Normal occlusion, thus defined, is very rarely found in the population and most people have a malocclusion. Many malocclusions are only mildly unaesthetic and not detrimental to the health of the teeth and their supporting tissues and there is little likely gain from treatment. Other malocclusions may have more detrimental effects on oral health or are a significant aesthetic handicap for which treatment is beneficial (Shaw et al 1991). The range of malocclusions is a continuum with no clear, simple division as to when treatment becomes desirable. There are usually twenty primary (baby) and thirty-two adult teeth, any of which can be displaced from their "normal" positions in the three planes of space. These positions may also change through time as growth and age changes occur. There are thus countless ways in which occlusions can depart from normality and it is the combination and extent of all tooth displacements that make up an individual's malocclusion. Thus, there can be no simple definition of the extent of deviation from "normal occlusion" or unequivocal boundaries as to the need for treatment. Some malocclusions have features that are deleterious to long-term dental health, others present aesthetic problems that have psycho-social implications. Many of the latter are of cultural origin and are influenced heavily by the desire to conform to current standards of acceptable personal appearance. The need for treatment is dependent on risk factors for future dental health (which have to be assessed professionally) and the perception by the patient, relatives and peer group as to the aesthetic handicap. Since this last factor is both

culturally and personality dependent it is subject to wide individual variation. It is, in part, responsible for the discrepancy between professionally determined need and the demand for orthodontic care. An aesthetically unacceptable malocclusion can therefore be regarded as one that is disturbing to individuals because they do not and cannot conform to the expectations of society or the social groups to which they belong.

There are great difficulties in carrying out and interpreting prevalence studies on malocclusion. Most studies describe the range and distribution of key diagnostic criteria but these alone are unhelpful in defining treatment need. Prevalence figures for malocclusion are determined by the boundaries set to the need for treatment. These vary between investigators and are rarely clearly defined. Researchers used their perception of the prevailing consensus within the speciality to determine those malocclusions for which they believed there would be little or no benefit from treatment. The development of the Index of Treatment Need (IOTN) was an attempt to define this consensus in a meaningful and reproducible manner. While a professional assessment of treatment need can be measured using IOTN, this index does not necessarily reflect the complexity of treatment required.

STATEMENT OF THE PROBLEM

Prevalence of the problem

Figures from elsewhere in the United Kingdom (Brook and Shaw 1989, Holmes 1992a) have found that about a third of children have malocclusions that would show clear need for orthodontic therapy and about another third are borderline for need when assessed using the Index of Orthodontic Treatment Need (IOTN - see Appendix 1). This is affected little by gender or social class and there is no evidence of geographic variation. There have been no equivalent studies in Scotland and the situation is believed to be similar as previous studies, using now obsolete assessment methods, showed minimal differences between Scotland and elsewhere in the United Kingdom.

The uptake of orthodontic treatment is considerably less than this and is related to social class (Jenkins et al. 1984a, 1984b). Orthodontics is seen as secondary care and is accessed only by those in receipt of regular dental care. The higher the social class the greater is the likelihood of regular dental care and hence access to orthodontics. However, demand for orthodontic treatment is rising as the dental health and expectations of the population improve. When all barriers to orthodontic treatment are removed uptake of orthodontic treatment may be as high as 60% of the child population (Helm 1990). This picture is further complicated by the increasing expectation of the quality of treatment. This has been accompanied by a shift from simple treatments (extractions only or use of removable appliances) to more complex treatments using functional appliances and fixed appliances. The orthodontic problems in children are largely developmental and the incidence is unchanging but there is a pool of untreated problems in adults that adds to the potential demand.

Demand for Orthodontic Care

A primary factor that influences the demand and uptake of dental services and orthodontics in particular is the availability of services (Stephens and Bass 1973, O'Brien et al. 1989). Besides confirming this relationship O'Brien (1991) showed that the level of referrals to the hospital service was not influenced by the distribution of manpower in the other services. He hypothesised that as the dentist:population ratio increases the level of dental awareness of the population increases, and this is accompanied by an increase in demand for orthodontic treatment. This increase in demand is primarily met by the General Dental Service, primarily by the specialist practitioners. Baldwin (1980) and Tulloch et al. (1984) have shown that high dentist and high specialist:population ratios raise the level of awareness of orthodontics in the population and this, in turn, raises the level of demand for such care. Holmes (1992b), in a survey of English school children, showed that the demand for orthodontic treatment was for aesthetic improvement. The children's own perceived need for aesthetic improvement was greater than the levels of treatment need professionally assessed using the combined dental health and aesthetic components of IOTN.

The scope of orthodontic treatment

Orthodontic appliance treatment is just one aspect of orthodontic care. The assessment, treatment planning and monitoring of children's developing dentitions are equally, if not more important, aspects of orthodontic care. If treatment is to be provided, then the timing and details of this require prior planning by an appropriately

skilled individual. It may be that a potential patient, with a significant malocclusion, will be advised correctly not to proceed with appliance treatment. Conversely, some attend with genuine concerns about a problem that may appear objectively to be minor. Nevertheless, they still merit advice. The scope of treatment is wide. This can be as little as the judicious extraction of primary or secondary teeth, or the complex appliance therapy needing 20 or more hours of clinical time spread over a number of years.

Malocclusion may present in a wide variety of forms, some of which require a combined approach to treatment involving other fields of dentistry. Most problems are developmental in origin including crowding of teeth, spacing of teeth, prominence of the upper teeth and other malrelations of upper and lower teeth to each other. Some treatment is also required secondary to surgical intervention to deal with pathology, the results of trauma or extreme aberrations of tooth positions. There is also a group of patients who have extreme dento-facial problems. It is not within the remit of this report to look at the needs of these later groups although they require a very highly skilled surgical and orthodontic team approach that is usually provided by secondary care services.

Treatment of Crowding

This is the most common feature of malocclusions (Holmes 1992a). A disproportion between the size of the jaws and the size of the teeth they support causes the arrangement of the teeth to be irregular, with individual teeth out of line and often rotated. There is little scope for increasing the size of the jaws and treatment of crowding usually involves the extraction of teeth. It is usually not possible to extract teeth in exactly the right place to relieve crowding and, since teeth are of a fixed size and crowding is variable, extractions usually result in residual spaces that may be as unacceptable as the original crowding. Appliances are usually needed to complete alignment and to close residual space.

Appliance Therapy

Where active intervention with braces is indicated, three main types may be used. Treatment may involve a combination of these appliances at different stages of treatment. Careful selection of the appropriate technique is essential if treatment is to be successful. This decision can be taken only after assessment and treatment planning that takes account of both the features of the malocclusion along with the motivation and ability of the patient to cope with the proposed treatment.

The three main types of orthodontic appliance are:

Removable appliances (Active Plates)

This type of appliance is removable by the patient for cleaning and should normally be worn at all other times. These consist of a rigid plastic base with wire clasps to hold it in place. Wire springs and screws are used to move the teeth. Removable appliances can only tip the teeth, a factor that severely limits their applicability. It is, however, the type of orthodontic appliance which most dentists learn to use during undergraduate training.

Functional appliances

These appliances are usually removable and are used to change the relationship of the dental arches to each other. They are often used in an attempt to modify facial

growth although success in doing so is both unpredictable and controversial. Despite this, functional appliances can be useful in appropriate cases for complete treatment or to simplify future care. A high degree of patient co-operation is required as these bulky appliances need to be worn almost full-time to be successful. As they attempt to modify growth their use is generally confined to children. The use of these appliances tends to be restricted to specialists.

Fixed Appliances

There are a variety of types of fixed appliances but all work on the same principle. An attachment is fixed to each tooth and this provides a “handle” for the precise application of force to the teeth to cause movement in the three planes of space. A fixed appliance is capable of dealing with multiple tooth displacements and gives much greater scope for treatment than do removable appliances. The best results of treatment are achieved with fixed appliances used either alone or in conjunction with the other appliance types (O’Brien et al. 1993, Richmond et al. 1993). Treatment with fixed appliances usually takes 18 months to two years to complete. The duration of treatment is influenced by both the severity of the problem and by patient co-operation. Such fixed attachments require a high standard of tooth cleaning by the patient if dental decay and gum disease are to be avoided.

The use of fixed appliances is usually taught as part of postgraduate specialist training that takes three years. As orthodontic treatment frequently takes two years to complete, training is necessarily lengthy to give adequate experience in completed treatments. For these reasons, “weekend” type courses without longitudinal clinical attachments are inappropriate for learning the use of fixed appliances.

Extra oral auxiliary appliances.

When intra-oral appliances are used to move teeth, some are moved in the desired direction but Newton’s Third Law means that other teeth move in the opposite direction. If this is undesirable, then auxiliary attachments are used to apply forces from the back of the neck and head, the chin or forehead, to control or alter the direction of movement of the teeth.

Timing of treatment

Most orthodontic intervention is carried out between the ages of seven and seventeen years. This is the age at which most problems become apparent and treatment may be facilitated by growth. An increasing number of adults also seek orthodontic advice and treatment for problems that may have developed secondary to other dental disease, or for problems that were either untreated or poorly treated in childhood.

Duration of Treatment

Most orthodontic treatment takes between one and two years of approximately monthly visits for appliance adjustment. Growth-dependent treatment may take considerably longer, as will treatment of the more severe problems. Some malocclusions will need several phases of treatment during dental development and an important aspect of care will be the monitoring and timing of appropriate intervention. Active treatment is usually followed by a period of “retention” to allow the repositioned teeth to stabilise. During this time, control of the teeth is gradually reduced, as the reorganisation of the bone and gum supporting the teeth is completed.

Patient Selection

Orthodontic appliances require a high standard of oral hygiene and control of dietary sugars if damage to the teeth and gums is not to occur during treatment. The presence of any appliance alters the microbial flora of the mouth and increases the number of bacteria normally present. High sugar diets and poor cleaning are likely to lead to decay on the surfaces of the teeth, including the front ones. This initially presents as white marks on teeth and, if not controlled, progresses to cavities. Orthodontic appliances are usually, at times uncomfortable, inconvenient to wear, fragile, visible and treatment usually takes one to two years. This places great demands on co-operation by the patient. In some cases optimal treatment is refused because the patient believes the demands of the treatment offered outweigh the potential improvement. For some patients appliance therapy is not appropriate because the oral health is inadequate. A common cause of poor treatment outcome is either over or underestimating the patient's ability to cope with therapy. The greatest scope for improvement with orthodontic treatment is likely when a highly motivated patient with a severe malocclusion has treatment from an appropriately trained operator using contemporary techniques.

EFFECTIVE CARE

Effective care - individual

This will vary from patient to patient and will depend on the severity of the problem and the patient's willingness and ability to cope with the demands of treatment. Effective care should show worthwhile improvement. This improvement may be in either (or both) dental health or dento-facial aesthetics. Effective treatment may be as little as the appropriately timed extraction of primary teeth or complex appliance therapy lasting several years. At present, there is no index of treatment complexity nor one that can be used to predict the complexity of future treatment needs. There are, however, the indices of treatment need (IOTN) and of treatment outcome (PAR index). These orthodontic indices are described in Appendix 1. They can be used to measure some aspects of treatment outcome. The index of treatment need should reduce with treatment, and the PAR index can be used to quantify one aspect of treatment change. Neither index is constant with time and both are unreliable during the transition between the primary and secondary dentition (Kerr and Buchanan, 1994). Neither of these indices measure the psycho-social gains of treatment but IOTN does have a professionally assessed aesthetic component. They should not be used as the sole determinant of either treatment need or benefit. Unfortunately, there is only a weak relationship between the IOTN and the complexity of treatment required.

Effective care is dependent on a number of factors such as patient selection, appropriate diagnosis and an appropriate treatment plan. The type of appliance used is of major significance - fixed appliances give greater improvements than removable braces (O'Brien et al. 1993). Patient compliance is of overwhelming significance, and frequently changes during treatment. The acceptability of treatment to the patient, patient expectations of treatment and the patient's oral health, may all limit treatment goals. The ability of the patient to cope with appliances may require the modification of treatment goals during therapy. Failure of the patient to maintain an adequate level of oral hygiene may force premature cessation of treatment. For whatever reason, there is a failure rate of between 12 and 17 per cent of patients to complete treatment (Murray, 1989). Unfortunately, there are no proven methods of assessing or predicting a patient's ability to cope with appliances or comply with treatment. When assessing outcome and efficacy of treatment there is a need to take into account patient characteristics as well as occlusal factors.

Effective care - population

Dental Health Surveys, including assessment of orthodontic treatment need at age twelve and fifteen/sixteen years would reveal the extent of professionally assessed unmet needs (Burden et al. 1994). Ideally, all sixteen year olds with a clear need for orthodontic care determined by the dental health and aesthetic components of IOTN should have had the opportunity of receiving orthodontic advice and treatment.

Prevention

Malocclusion is largely a developmental problem and there is thus little scope for prevention. The complexity of treatment of some developmental problems can, in some cases, be reduced or eliminated by early identification and simple intervention

and appropriate treatment, i.e. ectopic canines*, (Kurol 1987). For others early identification and intervention can improve the prognosis for successful treatment (Galloway and Stirrups 1989). The key to appropriate interception is timely, appropriate assessment and, where necessary, referral for specialist advice. This is dependent on the primary care dentist being trained in diagnosis, the development of protocols for referral and the availability of appropriate specialist advice.

* see Glossary

ORTHODONTIC CARE PROVIDERS

Orthodontic treatment is provided by dentists at three levels of training and in either primary or secondary care (see Glossary of terms).

Non-specialist primary care practitioners (Primary Care Services)

These dentists are working in either the General Dental or Community Dental Services. They have skill levels, largely based on their undergraduate training, which usually limit them to the simpler forms of intervention. They act as the gateway to secondary care and may provide some treatment to the prescription of a specialist. Postgraduate training and experience may expand the complexity of care that some can provide. However, many dentists provide no orthodontic appliance therapy and few treat more than ten patients a year. In 1994/95, 976 practitioners carried out at least one course of orthodontic treatment under GDS Regulations in Scotland (source Scottish Dental Practice Board, SDPB). However, any dental surgeon is legally permitted to carry out any form of dental treatment.

The CDS provide a similar range of treatment to that of the GDS but the provision varies across Scotland.

Specialist orthodontic practitioners (Specialist Services)

These practitioners are working in General Dental or Community Dental Services. Although working in primary care, they usually have a secondary care role. The majority have had postgraduate training and most limit their professional activity to orthodontic treatment. Some are involved in postgraduate teaching. They provide the majority of orthodontic care provided in the General Dental Services in Scotland (source SDPB). Only a small amount of orthodontic treatment is carried out under private contract. They are capable of treating the whole range of routine orthodontic problems but there is a national shortage of training places and trained personnel. This arises as there have been increases in the length of training to the current three years without a corresponding increase in training places. Consideration of the SDPB's statistics for total fees and number of courses of orthodontic treatment indicates that few practitioners are working full-time at orthodontics in the GDS. The SDPB identify 19 such individuals. The number of Specialists in the CDS in Scotland is low, we have only been able to identify five (3.2 F.T.E.). These figures demonstrate the considerable personnel shortage. At present the General Dental Council does not recognise specialists but they will soon be implementing a specialist register for orthodontics.

The consultant orthodontic service (Consultant Services)

Consultant Orthodontists work in Dental and General Hospitals and many hold outreach clinics in Community Dental Clinics. They have an extended training programme (currently a total of 6 years) and provide:

- An advice service to primary care practitioners, and other specialists, within and outwith the hospitals.
- Treatment of interdisciplinary and cranio facial problems.
- "Routine orthodontic care".

- Postgraduate training for primary care practitioners, specialists and for the hospital service.
- Those in Dental Teaching Hospitals are involved in undergraduate teaching.
- Research.

There are, at present, 25 Consultants in Scotland, four of whom are University Academics. Some have part-time contracts and work part-time as “specialists” in the GDS.

Training of Specialists and Consultants

This is undergoing change as a result of the “Report on Specialisation in Dentistry” (Chief Dental Officer, England and Wales 1995). This report applies to all fields of dentistry but for orthodontic training creates more problems than it solves. The chaos and uncertainty created will take several years to resolve and it will be some time before clearly defined training pathways are re-established.

Orthodontic auxiliaries

The Nuffield report (Nuffield Inquiry into Personnel Auxiliary to Dentistry 1993) suggested that the use of extended duty dental auxiliaries could take on some of the routine technical tasks of orthodontic treatment in a specialist environment. Changes to the Dentist’s Act will be required to allow this to take place, and pilot studies and evaluation would take place before their widespread introduction. Experience in the United States suggests that to be cost effective a number of auxiliaries need to work with each specialist with a high capital investment. It is unlikely that such auxiliaries will make a significant impact on the delivery of orthodontic care for some considerable time. Only high population areas can provide the volume of patients to make such a set up viable. Their use is likely to further increase the cost disadvantage in providing orthodontic care to the more scattered communities in Scotland where the capital investment in order to use such individuals may not be justified by the level of patient flow.

FRAMEWORKS FOR CONSULTATION

Dentists

This can be achieved with those practitioners providing orthodontic services or acting as a gateway to specialist treatment, locally through Area Dental Committees and nationally through the British Orthodontic Society and the British Dental Association.

Patient groups

There are no readily identifiable patient groups and the interests of users are probably best represented by Local Health Councils. Local NHS consumer surveys could also be used to access the views of patients. Demand for treatment is at present partly limited by lengthy waiting lists. Reducing waiting times increases demand and any effort to reduce waiting times is likely to be only of short-term benefit. Discussions locally need to be focused on mechanisms for achieving the equitable rationing of access to care, so that provision of treatment is on need rather than opportunistic timing of referral. If equity is to be achieved, prioritising of access to care should apply across all providers, but this will involve changes to the regulations governing NHS general dental practice at a national (UK) level. In the short-term, targeting of resources is only likely to be possible in the salaried parts of the service - the community dental service and the hospital service. The Index of Orthodontic Treatment Need provides possible, but imperfect, criteria for such rationing, with local discussions setting the level at which care is initiated within the manpower and resources available.

DEFICIENCIES IN PROVISION AND PRIORITY ACTION AREAS

Deficiencies in provision

In all areas of Scotland there is a gross shortage of Orthodontic Specialists. In the current climate, there is also little likelihood of adequate public financing of comprehensive orthodontic care for all who may need and desire it. Even if care is limited to those with professionally assessed need and who would benefit from care there is a shortfall in treatment provision for those patients whose treatment is more complex than their primary general dental carer can provide. This can in part be addressed by limiting access to specialist care only to the more severe problems and by raising the skill levels of the primary dental care practitioner.

Priority action areas

Targeting Resources

There is a need to obtain local agreement on mechanisms for implementing the targeting of the existing managed treatment resources - the community and hospital services. The targeting of resources in the General Dental Services will require agreement with the profession at a national (UK) level as this would require alteration to the GDS regulations and terms and conditions of service.

Training

Primary Care Dental Practitioners

Gatekeeper Skills

General Dental Surgeons and Community Dentists are the gatekeepers of access to specialist treatment in either primary or secondary care. They are already very selective in whom they refer. Further training of primary dental carers in diagnosis, so they know what and when to refer, would improve their effectiveness. However, access to advice should still be freely available since IOTN may not record all developing problems that may respond to simple early intervention. If IOTN were to be used as one of the criteria for targeting routine orthodontic care a wider understanding, by primary care dental practitioners, of the application and limitations of IOTN would be needed.

Scottish Council for Postgraduate Medical and Dental Education (SCPMDE) need to ensure that appropriate short courses of continuing professional education are available in diagnosis, management of the developing dentition and referral skills. These should be available to those working in both the General and Community Dental Services. Employing authorities need to ensure that funded study leave is available to Community Dental Officers for such courses.

Orthodontic treatment skills

There are many parts of Scotland where the population base would not support a specialist orthodontic practice. To minimise costs of providing treatment and travelling by patients it is important to raise the skill levels of general dental practitioners. If this is achieved then they could cope with a wider range of occlusal problems than at present (Pender 1988). This is only a partial solution since it will only reduce and not eliminate the need for some patients to be treated by specialists in either primary or secondary care. There will be cost implications of training but it

will result in an increase in local availability of care. It can be targeted at areas of geographic isolation to reduce the need and demand for increased secondary care provision.

The training in treatment skills is needed at two levels:

1. Short courses of continuing professional education in simple treatment skills,
2. Courses with longitudinal attachments to Consultant Orthodontic Units for training in the use of simple fixed appliances for appropriate cases.

SCPMDE need to ensure that such courses of continuing professional education are available. These should be available to those working in both the General and Community Dental Services. Employing authorities need to ensure that funded study leave is available to Community Dental Officers for such courses.

Specialist Orthodontic Practitioners

The shortage of specialists is a consequence of a national shortage of training opportunities. Existing UK training places are overwhelmed by applicants. The limitations on increasing the number of training places are both physical and staff related. Almost all Scottish Hospital Orthodontic Units (in Dental Teaching or General Hospitals), currently, do not have the clinical space in which to train more specialists. If training was to be increased there would be opportunity costs if resources were diverted from existing activity in these units. The problem of specialist training and the resources to carry it out need to be addressed at a national level. However, increasing the number of specialists is the quickest and, probably, most cost-effective way of increasing the availability of orthodontic care.

The region of the United Kingdom in which specialists received their training is a major factor influencing where they set up practice (O'Brien and Roberts 1991). The likelihood of specialists setting up practice in Scotland would increase if training opportunities in Scotland were increased.

Provision of consultant services

Increasing the number of consultants is the only way in which Health Boards can direct the increase of provision of specialist services.

OPTIONS

Skill mix

The delivery of “routine” orthodontic care is by a mix of specialist orthodontic practitioners and non-specialists working in primary care together with secondary care provided by the orthodontic consultants. Geography, demography and source of funding will dictate the mix within an area. It is unlikely that desirable levels of specialist orthodontic practitioners can be achieved because of manpower shortages and some sub optimal mix of skills will be inevitable for the foreseeable future.

Commissioners should discuss with the present providers of orthodontic care within each area how to optimise the use of available resources. The complementary roles of the different providers have already been outlined (section 5).

Altering the skill mix

Recruitment of specialists

It is assumed that the most economical provision of specialist treatment is by a specialist orthodontic practitioner working in the primary care sector. Current workforce shortages mean this is an option that is not within the ability of commissioners to pursue effectively. However, it is in the commissioner's interest to consider some form of incentive to help new practice establishment. Such incentives are more likely to be needed in areas without provision for specialist training since orthodontic specialists are less likely to locate there for reasons previously described (Section 7.2.2.2). It is important that such incentives do not result in specialists moving between adjacent health boards for short term financial gain but without affecting the overall level of specialist provision. Any such support should be linked to a commitment to continuing provision of orthodontic care within the National Health Service.

Increasing skills of non-specialists

Within any area, there will be primary care dentists providing non specialist treatment. One option is to increase their skills. This will increase the scope of the treatment they can provide at the non-specialist level. Locally based postgraduate part time training of primary care dentists has advantages in so far as they can continue to support themselves and have a commitment to the area in which they work. The consultant service is capable of, but not resourced for, providing such training. In other parts of the United Kingdom this strategy has been successful (Pender 1988). To establish this training requires the resourcing of adequate clinical facilities, sessional payment for the trainees and contracts for training as well as clinical services with the consultant service. The costs of setting up a practice to provide fixed appliance treatments are considerable and if used on a part-time basis may not be considered a cost-effective use of capital. Some support for start-up costs may be required to encourage uptake and participation.

Such skill enhancement schemes are not a substitute for adequate provision of specialist services but are a method of partially ameliorating the shortfall in some geographic areas. The effectiveness of such schemes needs to be evaluated. In some areas patients may have to accept long journeys and some inconvenience if they are to receive the level of orthodontic care they require.

Shorter continuing professional education courses are also important for raising the levels of diagnostic and simple treatment skills.

Use of the consultant-led service

There will be a need for treatment of complex, often interdisciplinary, orthodontic care that requires the skills of the consultant service. All areas will need Consultant Orthodontic Service provision for this and to provide advice to primary care practitioners. Guidance from the General Dental Council (1983) requires referral of patients for advice when a dentist does not have the skills or experience to plan or treat particular patients' problems. Providing this advice will identify many of the referred patients as having treatment need but requiring treatment that is too complex for the referring practitioner to be able to provide. These patients will have high expectations of care provision and some routine treatment must be commissioned from the consultant service, possibly linked to a commitment to postgraduate training for local practitioners. The need for this will be greatest in areas unable to attract specialist practitioners. The consultant service could also have a role in monitoring standards and in providing professional advice for any appeals mechanism if rationing of access to services is introduced.

Increasing the number of consultants is the only way in which Health Boards can increase the provision of specialist treatment. As levels of provision of specialists in the General Dental Services is governed by market forces and not influenced by Health Boards, the principal way in which Health Boards can increase the provision of specialist services is by increasing the number of consultants. Consideration should be given to sharing appointments between Boards. Individuals can be identified locally to fill staff grades or other posts which would provide appropriate support. However, national recruitment in the past has, in the main, been unsuccessful.

ECONOMIC ISSUES

Overview

Economic evaluations of current orthodontic intervention and the proposals contained in this document are not possible from the available data. There is concern that much simple orthodontic treatment provides little health or aesthetic gain (Elderton and Clark 1983, 1984, Clark and Elderton 1987). Cost data is only available for the General Dental Services (GDS) but these are collected in relationship to the items for which fees can be claimed. This is on a different basis from the Community Dental Service (CDS) where the basis of data collection is completed cases. For the Consultant Orthodontic Service the basis for data collection is the number of new and return outpatient attendances. No information is available on the number of courses of treatment provided. Thus, no comparisons between the service providers can be made until common datasets are available on workload and cost. A first step in this may be for commissioners of care to assess their activity and expenditure on orthodontic services.

This still leaves unanswered the question of how to assess the health gain from orthodontic care. Most of the benefits are psycho-social and highly individual and subjective. Development is needed of appropriate socio-dental indicators that take account of patients' perceptions of Treatment Need and Treatment Outcome. Any economic evaluation should take into account the quality of the outcome of intervention. A possible way forward is to develop measures of the relative priority which patients put on different aspects of dental services. A recent survey in Grampian looked at the importance of *location* and *waiting time* in the provision of orthodontic care. As was expected, patients would prefer local clinics for both diagnosis and treatment appointments along with short waiting times. However, given limited resources, trade-offs have to be made. Within the current budget, the introduction of local clinics would have to have been accompanied by longer waiting times. The study showed that waiting time was more important than location in determining user satisfaction. Moreover, the results indicated that service users were willing to trade off location to achieve shorter waiting times. Respondents were willing to wait an extra six days, at the most, for the first appointment at a local clinic as opposed to a central clinic and 19 days at most for their second (and all subsequent) appointment at a local clinic rather than a central clinic. That is the convenience of a local appointment was considered worthwhile only if it meant a very small increase in waiting time. In response to the findings of the study Grampian Health Board decided not to introduce local clinics but rather to concentrate on reducing waiting times at the central clinic.

Current cost of the service

Very little information is available on the cost of providing orthodontic care and the different datasets make comparisons between the service providers impossible. The specialist practitioner is probably the desirable level of care for most patients (O'Brien and Corkill 1990) but may not be available. Economic considerations and personnel shortages create a market place that restricts specialist practitioners to the larger conurbations (O'Brien and Roberts 1991). Neither the community dental service nor the consultant service has the manpower to meet the demand or need for orthodontic care. There is a presumption in government and health boards that providing treatment is cheaper from independent practitioners working in primary care settings, than providing the same care using the managed primary care and secondary care sectors. This prevailing paradigm implies that it would be more

expensive to provide a comprehensive orthodontic service based on the community or consultant services but this is untested.

Table 1

Cost and Volume of Orthodontic Care Provided in the GDS 1995/96

	Orthodontic courses of treatment completed	Gross Cost (£)	Rate per 1000 of Health Board population
Scotland	24,550	5,315,283	4.8
Argyll and Clyde	1,271	179,338	2.9
Ayrshire and Arran	1,267	245,648	3.4
Borders	688	101,252	6.5
Dumfries and Galloway	284	36,010	1.9
Fife	941	165,999	2.7
Forth Valley	1,306	255,509	4.8
Grampian	2,469	599,578	4.6
Greater Glasgow	6,326	1,477,014	6.9
Highland	330	51,920	1.6
Lanarkshire	1,827	418,901	3.3
Lothian	5,916	1,304,441	7.8
Orkney	0	54	-
Shetland	2	224	0.08
Tayside	1,903	477,655	4.8
Western Isles	20	1,740	0.7

(Source SDPB Annual Report 1995/96)

These include both "specialist" and non-specialist care.

There are considerable difficulties in interpreting SDPB figures. The number of appliance cases is greater than the number of courses of treatment since more than one appliance type may be used in a course of treatment.

There is no cost information for orthodontic care in the CDS or hospital service but the activity figures are in Tables 2 and 3.

Table 2

Community Dental Service Activity year ending 1995 Children Aged 5-15 Years

	Orthodontic courses of treatment completed	As % of all Courses of Treatment	Rate per 1000 5 - 15 year old Health Board population
Scotland	5,426	4.3	7.6
Argyll and Clyde	208	3.8	3.4
Ayrshire and Arran	75	1.0	1.4
Borders	126	2.7	9.1
Dumfries and Galloway	51	3.4	2.5
Fife	281	2.7	5.6
Forth Valley	309	4.9	8.2
Grampian	947	4.9	12.7
Greater Glasgow	376	3.2	3.0
Highland	212	1.5	6.9
Lanarkshire	702	3.8	8.4
Lothian	1,412	9.3	14.6
Orkney	318	13.4	108.5
Shetland	211	6.6	35.8
Tayside	88	1.7	1.0
Western Isles	110	5.1	15.9

Source ISD

**Table 3 Hospital Outpatient Activity 1995/96 by Health Board Area of Treatment
(year ending 31 March 1996)**

(Orthodontics and Paediatric Dentistry Combined)

	** Total Orthodontic Outpatient attendances	New Outpatient attendances	Rate per 1000 (New Patients)
Scotland	160,390	23,574	4.6
Argyll and Clyde	10,798	2,164	5.0
Ayrshire and Arran	7,094	1,373	3.6
Borders	2,992	382	3.6
Dumfries and Galloway	4,665	928	6.3
Fife	16,953	1,911	5.4
Forth Valley	10,400	1,253	4.6
Grampian	11,806	1,524	2.9
Greater Glasgow *	32,235	4,497	4.9
Highland	9,259	761	3.6
Lanarkshire	11,033	1,905	3.4
Lothian *	22,088	2,872	3.8
Orkney	320	138	6.9
Shetland	711	122	5.3
Tayside *	19,765	3,732	9.4
Western Isles	271	12	0.4

Source: ISD Scottish Health Statistics 1996

* Only Greater Glasgow, Lothian and Tayside Health Boards have Consultants in Paediatric Dentistry hence inclusion of their workload in the datasets makes inter-board comparisons impossible.

** No figures available by Health Board of residence.

Moving forward

The lack of economic information precludes the inclusion of costing options for care. However, costs will vary with geography, demography and the skill-mix available. Thus, there is a need to develop methodologies and common data sets that enable the assessment of cost, quality of outcome and work load. There is also need for a measure of the benefit of orthodontic care that takes account of the patient's perspective. These would need to be applicable in the general, community dental and hospital services and their development should be a priority for health service research. Such measures should address the lack of information on the cost of providing orthodontic care and the benefit of care, since these preclude evaluation of the cost-benefits of the alternative methods of delivery. To make economic comparisons between providers there needs to be a measure of the complexity of care provided that can be applied retrospectively. For skill-mix planning, a measure that could be applied prospectively is desirable. There is need for an outcome measure that reflects health gain that can be used to make rational decisions on the relative value of orthodontics when compared with other health care programmes.

The inequities of unregulated access to specialist orthodontic treatment can be addressed in part by locally agreed systems of prioritising care. This has little cost implication but if access to care is excessively limited, it is likely to cause a high level of public complaint. The introduction of a scheme for rationing access to orthodontic care would have to be preceded by a campaign to inform the Dental Practitioners, Health Board Managers and the public of the scientific and economic basis for the decision. Otherwise excessive numbers of complaints are likely. Any prioritisation will cause some complaints and some form of appeal system may help. Such an appeal system could have lay member(s), possibly drawn from the Local Health Council, non-specialist dentist(s) and specialist advisers from outwith the unit where the treatment was originally refused. It should also be remembered that occlusions change with time, and that refusal of care cannot be considered a once-only decision. Such changes should be monitored by the primary care dentist and, if appropriate, the patient should be re-referred. The minimum level of service that can be defended on clinical grounds is:

Timely access to orthodontic advice on request. (The Patient's Charter out-patient waiting times targets are appropriate for most patients.)

The provision of treatment to those that wish it and who have an objective measure of treatment need (IOTN 4 and 5 on the Dental Health Component Scale and/or 8, 9 and 10 on the Aesthetic Scale) and no contraindications to the provision of that care, such as poor oral hygiene.

MONITORING

Targeting

Using IOTN prioritisation of access to care can be monitored.

Quality of care

Clinical audit using IOTN and PAR can be undertaken by the professionals delivering the service. These indices are more fully described in Appendix 1, along with their limitations. Patient satisfaction should also be taken into account so there is a need to develop socio-dental indicators that can be used as outcome measures. The results of such audit could be shared with commissioners or undertaken independently by them.

Population treatment need

Health Boards Dental Epidemiology Programme should include IOTN in the measures used for the survey of 12 year old children. To assess unmet need it should consider a similar examination of a 15/16 year old cohort.

COMMISSIONING ISSUES

The demand for treatment

For the foreseeable future, this will always exceed the possible supply of orthodontic care, even though uptake is less than measured need. Increased provision of services increases demand. Even Forth Valley Health Board, which has the best provision of specialist and consultant orthodontic services in Scotland per head of population, has long waiting lists for treatment. Some form of equitable rationing of access to orthodontic care is needed.

Recruitment of specialists

The scope for increasing provision of care by attracting specialists to work in primary care is limited by severe work-force shortages. There is a need to consider how to provide temporary support to help new practices to become established if the opportunity arises. Any such support should be linked to a contractual obligation to continue to provide, for a number of years, a minimum level of National Health Service treatment provision.

Increasing skills of non specialists

Postgraduate training for non-specialist primary care dentists, committed to the local area, to extend their skills and the scope of treatment they can offer may help address local skill shortages. This will require a recognition of the costs of providing such training as part of service agreements with consultant service providers. It may also require funding of adequate clinical facilities.

Consultant service

Increasing Consultant numbers may be the only way in which Health Boards can directly increase the provision of specialist orthodontic care.

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APPENDIX 1

OCCLUSAL INDICES IN ORTHODONTICS

Introduction

This appendix is intended to give a brief summary, in simple terms, of Occlusal Indices. The Occlusal Index Committee (1987) reported that Occlusal Indices should be developed to assess both the need for treatment and treatment outcome.

Definition

An Occlusal index is a rating or categorising system that assigns a numeric or alphanumeric label to a person's occlusion (Shaw et al. 1995).

The use of Occlusal indices in orthodontics provides the opportunity to reduce individual subjective bias and to standardise criteria on which judgements are made throughout the profession.

A number of different occlusal indices have been developed and can be classified as follows:

Classification

1. Diagnostic classification
2. Epidemiological data collection
3. Treatment need
4. Treatment outcome
5. Treatment complexity

Ideal Properties of an Occlusal Index

The ideal index should be:

1. valid (measure that which it purports to)
2. reliable (repeatable)
3. require a minimum of judgement
4. simple to use
5. acceptable to the profession
6. amenable to statistical analysis

Since the mid 1980s there has been particular interest, within the speciality of orthodontics, in indices developed to assess:

- a. the need for orthodontic treatment
- b. the outcome of orthodontic intervention.

Treatment need

The Index of Orthodontic Treatment Need (IOTN) (Brook and Shaw, 1989) was developed in an attempt to grade the need for orthodontic treatment. This index has two components:

Aesthetic component (AC)

Dental health component (DHC)

Aesthetic Component

The Aesthetic Component (Evans and Shaw, 1987) scores the need for orthodontic treatment on the grounds of aesthetic impairment. By inference this may reflect the socio-psychological need for orthodontic treatment.

It consists of a 10 point scale of numbered photographs that are used as a yardstick against which to rate dental attractiveness. The front teeth of the individual are viewed and the scale of photographs used to assign the appropriate rating. A score of 1 represents the most attractive arrangement of teeth and 10 the least attractive arrangement. It has been suggested that the 10 point scale can be grouped as follows (Richmond et al., 1995)

Grades 1,2,3,4 no or slight need

Grades 5,6,7 borderline need

Grades 8,9,10 need

Some modifications to the scale have been suggested in an attempt to increase its reliability but were not found to be helpful. (Burden, D 1995)

Problems with The Aesthetic Component of IOTN

Despite being reasonably reliable, any measure of attractiveness such as this is susceptible to the user's own personal subjective views on appearance. For this reason it is probably the least robust of the indices described. It is not appropriate for use in the mixed dentition when there are many normal developmental changes taking place. Additionally, it measures only one aspect of dento-facial appearance. Despite these problems the Aesthetic Component is needed to identify those patients who, although not having malocclusions that pose a threat to dental health, have a significant level of dental disfigurement.

Dental Health Component

This component grades the various traits of malocclusion that may jeopardise the long term health of the teeth and supporting structures.

It was developed by Brook and Shaw (1989). It uses a list of criteria, conventions and a measuring ruler to allocate the individual to the appropriate grade. This is done using the single most severe feature of the malocclusion. The DHC has five grades of treatment need and these have been grouped as follows (Richmond et al., 1995):

Grades 1,2	no or slight need
Grade 3	borderline need
Grades 4,5	need

Problems with the Dental Health Component of IOTN

The validity of this index has been criticised as it is doubtful whether an index can be validated against subjective opinion. The need for treatment on the grounds of dental health may only be assessed in absolute terms with accurate information regarding the long term effects of malocclusion. At present there is, however, only limited scientific knowledge in this area. Without this evidence it does, however, seem reasonable to use a structured index to give a defined approach to assessing treatment need. This can of course be modified if new research based evidence regarding the long term effects of malocclusion becomes available.

Although the index has been shown to be reliable, when assessing individual cases there is the possibility of measurement error.

The Dental Health Component has also been criticised because it assesses the need for treatment on only the single most severe feature of the malocclusion and not on a cumulative assessment of features.

Additionally, it must be remembered that the treatment need grade does not necessarily reflect the complexity and cost of treatment.

Treatment outcome

The Peer Assessment Rating (PAR) Index (Richmond et al. 1989) is applied to models of the patients teeth taken before and after treatment to score the change in alignment of the teeth.

To apply this index there are measuring criteria, conventions and a measuring ruler to help score five aspects of the malocclusion.

Having measured and scored each aspect, weightings are applied and a total PAR score calculated for the pre treatment study models and for the post treatment models. The degree of success is most commonly determined by working out the percentage reduction in PAR score for the treated case.

Problems with the PAR Index

a. The PAR index scores only one aspect of the outcome of orthodontic treatment. No account is taken of features such as facial profile, occlusal function or iatrogenic damage resulting through treatment.

b. In its assessment the PAR index is relatively crude and takes no account of tooth inclination or angulation both of which are important factors in assessing the success of treatment.

c. It does not measure posterior arch alignment.

d. The PAR index does not assess the arch width before and after treatment. Treatment based upon marked expansion of the dental arches is often unstable and will relapse, yet, at the time of completion of treatment may produce a significant improvement in PAR score.

e. It is not appropriate for use in the mixed dentition (Kerr and Buchanan, 1993).

In summary, the PAR index can give an objective rating of the change in tooth alignment. This is, however, not the only aspect of orthodontic treatment that needs to be assessed. Also, in its area of assessment the PAR index has shortcomings.

How have these indices been used?

Despite controversy and debate, there has been widespread use of the indices in this country in the past five years. Interest has been such that courses of teaching and training in the use of these indices have attracted several hundred participants. Many orthodontists in the UK are calibrated in the use of these indices (Richmond et al., 1995).

A range of the studies employing indices have been carried out.

Estimation of Treatment Need in British Schoolchildren

The Index of Orthodontic Treatment Need was used to assess this in two separate studies that produced very similar findings (Brook and Shaw, 1989, Holmes, 1992). These studies applied the Dental Health Component of IOTN to 12 year olds. They found one third of children were categorised as being in need of treatment (grades 4, 5), one third were placed in the borderline need group (grade 3) and the last third in the no or slight need group (grades 1, 2).

Estimation of Treatment Need in Patients Referred for Orthodontics.

A number of studies have looked at this. For example, Brook and Shaw (1989) found that of referrals to an Orthodontic department in North-west England 74.4% were in grades 4 and 5 (need), with a further 19.7% in grade 3(borderline). A similar study carried out at Glasgow Dental Hospital and School found 67% of patients referred to be in the clear need for treatment category with 26% in the borderline group. Only 7% of referrals were rated as falling in the no or slight need for treatment group.

Some orthodontic departments now routinely record the grade of treatment need for any orthodontic referral. A pilot study is also being undertaken at the Dental Practice Division, Edinburgh to assess the need for treatment within the General Dental Services in Scotland.

Estimation of Treatment Outcome

A number of studies have looked at the outcome of treatment using the PAR index. The Index of Orthodontic Treatment Need has also been used to indicate the success or otherwise of treatment. O'Brien et al. (1993), in a survey of treatment carried out in Hospital Orthodontic Departments found that before treatment 87.5% of cases were in grades 4,5 indicating a need for treatment. At the end of treatment 11.1% still remained in this category, but, 72.3% were now in the little or no need for treatment grades.

Richmond et al. (1993) carried out a survey of cases treated in the General Dental Service of England and Wales. In this study, when cases that had been given prior approval by the Dental Practice Board were considered, it was found that 32.4% of patients were still in the need treatment category after treatment. A similar situation was found for those cases treated without prior approval. The most successful results were found in both this and O'Brien's (1993) study when treatment was carried out using fixed appliances in both upper and lower dental arches.

Both of the above studies also used the PAR index to assess the treatment outcome. Comparison of results showed a high level of treatment failure (21%) for cases treated in the General Dental Service as compared to 8% in the Hospital service. An assessment of standards in the Norwegian publicly funded orthodontic service (Richmond 1993) found only 5% treatment failure.

The studies mentioned in this section do not take into account the differences in case mix between the different care providers and there is continuing debate as to how this may have influenced these findings.

Benefits of Occlusal Indices

Shaw et al., (1995) listed the benefits of occlusal indices as follows:

a. Resource allocation and planning

An index of treatment need can be used to direct resources to the most needy. It may also be used to estimate levels of need in the community as a whole.

b. Monitoring and promoting standards

The PAR index is designed to do this and, despite shortcomings, is a useful tool. It does however need modifications if it is to be better accepted as a measure of treatment outcome.

c. Patient identification and referral

The use of an index of treatment need may help general dentists to identify those in need of orthodontic advice.

d. Informed consent

The index of orthodontic treatment need may be helpful in pointing out the limited need and benefits of orthodontic treatment for those with a minor malocclusion.

APPENDIX 2

Crowding	There is insufficient space for the teeth to be well aligned and as a result the arrangement of the teeth is irregular, with individual teeth out of line and often twisted.
Ectopic Canine	An eye tooth so far displaced from the normal developmental position that it cannot erupt into normal alignment without intervention.
Gate Keeper	Access to Orthodontic Specialists and the Consultant Orthodontic Service is by referral from primary care dentistst and not by self referral by the patient. The role of the referring practitioner in controlling access to specialist sevicees is called “gate keeping”.
Malocclusion	Deviation from normal occlusion
Newton’s Third Law	For every action there is an equal and opposite reaction.
Normal occlusion	Is the relationship of the first permanent molars so that the mesiobuccal cusp of the maxillary first permanent molar occludes with the buccal groove of the opposing mandibular first permanent molar. If this relationship exists and the teeth are arranged in a smoothly curving line then normal occlusion results (Prophet 1986).
Occlusion	(Of teeth) - the way in which the upper and lower sets of teeth meet. This may be more specifically defined in terms of muscular function and jaw position.
Socio-dental indicator	A measure of the extent to which dental and oral disorders disrupt normal social role functioning.