Orthodontics for the handicapped child

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SUMMARY The broad spectrum of difficulties that exist in providing orthodontic treatment for handicapped children is well known and few practitioners offer such a service. The present article offers an analysis of the problems involved and provides some practical answers designed to overcome them. It describes some of the newer modalities that have become available to the dental profession over the last few years and shows how advantage may be gained by their exploitation, in orthodontic treatment. Additionally, some of the older and largely-forgotten methods, appropriately modified and updated, are represented in this context, where they find particular relevance. Guidelines are given to enable the orthodontic profession to gain therapeutic access to a section of the population that urgently requires treatment.

Introduction

For the handicapped over the past decade or so, throughout the western world, conditions have changed beyond recognition. These disadvantaged children and adults are now maintained on a high level of health and general welfare, and many are cared for socially, medically and psychologically, in the home environment. They now live much longer, some completing a basic educational programme and, depending on the particular disability, they may enter some form of occupational framework and be productive for many years. Others have a poorer social profile and a lower IQ, but they, too, are nevertheless seen in day-to-day interaction with the general population.

In Israel today, some, in their late teens and in small groups, are helped to be sufficiently independent to move away from home and into protected accommodation. Their entry into society, in general, has created a change in attitude on the part of those surrounding them and, in particular, on the part of those who are instrumental in their support. This has reached the level where, noticeably over the last 5-10 years, concern for facial appearance has become an item for discussion among the parents and this, in turn, has generated a demand for orthodontic treatment.

In the modern era and following the direction of development of their profession, paediatric dentists have become more expert at managing a child’s behaviour in the dental environment, both with normal children and with the handicapped. In the absence of an adequate level of compliance, they have several available approaches to the management of unco-operative children (Wright, 1975). This may involve using certain pharmaceutical preparations, as adjuncts to behaviour modification techniques, to sedate the child to allow them to complete the procedures that they have prescribed. As will be emphasized, home prevention is a key factor in reducing the need for treatment, but when treatment becomes necessary, there are ways of overcoming patient resistance.

The premise is that, while good patient cooperation is an advantage in the delivery of treatment in paediatric dentistry, it is by no means essential.

Orthodontic appliances act as sophisticated machinery, which remain in the mouth and are designed to work continuously, at least until the next visit. Maintenance of the working parts of this machinery requires the attention of the patient, after office hours, at home, at school and elsewhere, between one treatment visit and the next. This places considerable power and crucial responsibility in the hands of the patient/parent. Whilst the orthodontist will have prescribed treatment, the control of its outcome, at least partially, is forfeit to the wishes of the patient. Orthodontic clinicians are still search-
ing for the appliance that eliminates the patient factor.

The second premise, then, is that successful orthodontic treatment cannot normally be administered to the unwilling patient.

The orthodontic patient has to be prepared to co-operate fully with every aspect of the treatment. This carries with it an implied responsibility on the part of the practitioner, who must achieve some level of communication with the patient, in order to explain the need for the various tasks required of him and to generate the motivation required to encourage his active participation. Essentially, the patient becomes a member of the therapy-delivering team, for the duration of his own case treatment, along with the orthodontist, the ancillary/hygienist and the nurse.

The immediate pertinent question that needs to be asked is how the handicapped child may be brought into this scheme. The handicapped child may be, at best, passive and apathetic and, at worst, frightened, defensive, self-protective and hostile (Troutman, 1977), constituting a stark antithesis to the ideal orthodontic patient. Concerned and caring parents of such a child will have come to accept the inevitability of the child’s physical and/or mental condition. They may have accepted that they are not amenable to treatment and thus may turn their full attention to improving the remaining area where there is frequently severe disability, namely the facial appearance.

The personal experience of parents, who have approached orthodontists with the view to providing orthodontic treatment for their handicapped children, is likely to have been very disappointing. It is very difficult for the practitioner to discern how a successful outcome of treatment is possible to achieve, in these difficult circumstances and may offer stubborn resistance to the parents’ advances. This represents the third premise of this introduction. From this, it may be inferred that, although treatment need undoubtedly exists, the conditions are not conducive to its pursuit and its eventual successful outcome.

Defining the problem

A high level of technical expertise in paediatric dentistry usually guarantees a favourable treatment result, because, as has been pointed out, the patient co-operation factor may be effectively eliminated. It has been established that this is not possible in orthodontics and so, as a first step, it becomes essential to analyse the role played by the normal and healthy patient in a given, successful, routine orthodontic case treatment. The aim of this step is to try to discover ways of mitigating the importance of the patient co-operation factor. Such an analysis yields four basic requirements that a patient must demonstrate, in order for the clinician to advise treatment (Becker, 1993) and these are as follows:

1. motivation—the patient has to want improvement and this desire has to be translated into a willingness to comply with the demands of treatment;
2. oral hygiene—the presence of appliances will increase any existing tendency to dental caries and gingival inflammation (Grabert, 1972; Zachrisson and Zachrisson, 1972) so that, as a basic exercise in prevention of dental and oral disease, the level of oral hygiene has to be of the highest order;
3. behaviour management—the patient is required to submit to certain clinical procedures, which include clinical and radiographic examination, impressions, and the fitting and subsequent adjustment of removable and fixed appliances;
4. manual dexterity—a high degree of dexterity is needed for the placement of removable appliances and fixed appliance accessories, such as headgears and rubber bands.

The second step is the confrontation of a hypothetical handicapped patient with these basic requirements, in order to discover their shortcomings (Becker, 1993):

1. motivation—not only is motivation totally lacking, but it is frequently supplanted by exaggerated fear and apprehension, which is heightened when the mouth is ‘invaded’ by the orthodontist (Troutman, 1977).
2. oral hygiene—toothbrushing is usually not practised and food from recent meals can be seen stagnating around the teeth, the palatal vault, the sulcus, and the floor of the mouth. This is often due to a lack of clearance resulting from a lessened activity of the musculature of the tongue, lips, and cheeks or from a frank hypotonicity that is charac-
The problem has now been clearly defined. Since the clinician is dependent upon the fulfillment of each of these requirements to enable him to achieve the specific treatment objectives, it is evident that there is a difference in perception between orthodontist and patient. Additionally, the spectrum of handicapping conditions is broad, the individual variation of the presenting patients is infinite and the severity of handicap is critical when considering treatment possibilities.

The purpose of the present article is to show how successful delivery of treatment is, nevertheless, possible for many handicapped patients, by addressing each of the above-listed requirements.

General treatment principles

For each patient and following a detailed clinical examination, together with an examination of plaster models and radiographs, the orthodontic diagnosis should be made, as with any other orthodontic case (Proffit and Ackerman, 1992). Given the practical difficulties associated with the physical and mental limitations of these patients, it may prove impossible to obtain all the usual diagnostic aids. A cephalostat and a panoramic X-ray machine may not be sufficiently 'user-friendly' for many patients in this category, for a variety of reasons, which range from fear among the mentally retarded to the physical constraints that are seen with a wheelchair-bound patient. Alternative radiographic views may be necessary, such as oblique lateral jaw views.

An itemized 'Problem List' (Proffit and Ackerman, 1992) is then drawn up, on the basis of the diagnosis. From this list, a proposed optimum treatment result is visualized and the aims set down. The items appearing on the Problem List are then rearranged into a Treatment Priority List, by sorting the items in order of importance and in order of facility of treatment. Treatment is then planned with an eye to expediency and simplicity. For example, gross correction of the jaw relationship in a Class II malocclusion is given precedence over individual fine tooth alignment.

The decision to extract permanent teeth, in order to relieve severe crowding, must be undertaken with extreme care, since controlled space closure may not be possible. For this reason, alternative extraction sites should be considered, in the interests of simplifying or eliminating biomechanics and accepting that the final result may be less than ideal.

A plan of treatment is formulated, which takes the form of a series of distinct and self-contained phases or stages. This represents an attempt to divide orthodontic mechanotherapy into modules, in the same way as with paedodontic restorative treatment.

At the completion of each treatment module, a reassessment should be made to see if the next stage in the plan may be attempted. In a few cases, initial fear, and apprehension slowly dissipate, patient co-operation improves and oral hygiene remains good. Treatment may then continue, in stages, until the optimum result is achieved. For some, the optimum for the patient reaches the level of the ideal that may often be planned for the normal patient.

Case 1

N.E. (Fig. 1.) was mentally retarded with a mild physical handicap due to birth trauma. She was acutely frightened and apprehensive early on, and treatment of her Class II division 1 malocclusion (Fig. 1a,b,c,h,i) began with the extraction of maxillary first premolars and a removable appliance. Slowly, her confidence improved and her devotion to her role in the treatment became almost an obsession. At each re-evaluation stage, the patient's positive response indicated the desirability of performing further treatment, which included the extraction of mandibular first premolars and full multi-banded appliances (Fig. 1d), with the final aim of an ideal result. Her mechanotherapy then passed over to a graduate student who...
completed the case with little difficulty (Fig. le,f,g,i,k), but the patient N.E. was the exception rather than the rule.

In most cases, however, a point is reached where the advantages of continuing the treatment are outweighed by the disadvantages of prolonged appliance wear. Sometimes, an unfavourable change in the patient's behaviour or in oral hygiene compliance occurs with the onset of puberty or with a change in the drug regimen. At this point, treatment must be stopped and the results retained, as for any other case.

A modus operandi
The role of the parent

There are several key principles or guidelines that warrant further discussion and the first of these relates to the transfer of responsibility for certain important functions to the parents (Becker, 1993). By their willingness, their availability, and their demonstrable ability to carry out these responsibilities, the parents actively declare the required motivation. The tasks that they must be recruited to take full responsibility for are:

1. oral hygiene;
2. caries-prevention prophylaxis (diet control, fluoride application, etc.);
3. appliance care.

It is probably true to say that adherence to an oral hygiene regimen, employing fluoride dentifrices, exists in most parts of the developed world today and that this is one of the principal factors in the dramatic reduction of caries in...
Western society (Hicks et al., 1985). However, success has been based on the fact that each person, above a certain minimum age, has been responsible for brushing their own teeth. Handicapped patients, by definition, cannot be expected to comply with this tradition. They exhibit a relative absence of understanding of the reasons for the exercise and they lack the skill to perform the procedure, particularly when taking into consideration the relative magnitude of their plaque accumulation.

For the handicapped child, oral hygiene has a special meaning. Their teeth are characteristically covered with large quantities of plaque, frequently causing hyperplastic gingival inflammation, generalized cervical decalcification, and caries.

The parent must be taught how to brush the teeth, while achieving a good working position and approach to the teeth. This is probably most efficiently performed with the child in the horizontal position. It is to be recommended that this be done preferably on the child’s own bed (Nowak, 1976; Casamassimo, undated) with the head of the child lying in the parent’s lap and held firmly by the left arm. The parent uses the left hand to retract the lips and cheeks while brushing with the right. In this way, the head is supported posteriorly on the parent’s lap, lateral movement is restricted and the teeth are adequately exposed. Good access and a good brushing position are then easily attained. A rechargeable, cordless, electric toothbrush is particularly helpful under these conditions.

In the best cases, with well-motivated parents, one may see complete elimination of the gingival inflammation in 2–3 months. Others require further instructional visits, particularly to encourage the parent not to be afraid to push the toothbrush gently into the gingival sulcus. A word of caution is relevant in this context. Following an initial visit for oral hygiene instruction, there is improvement in toothbrushing and a much lower level of plaque accumulation results. It is essential to ensure that the standard of gingival health is adequate before the placement of appliances and that this level is maintained during treatment, since the presence of an orthodontic appliance increases the propensity for iatrogenic plaque accumulation (Mizrahi, 1983; Artun and Brobakken, 1986).

It is a matter of principle that, regardless of the fact that the teeth may be clean on the day of examination, complete elimination of the gingival inflammation is mandatory before orthodontic treatment may begin. Indeed, one of the required diagnostic skills of a clinician is his ability to distinguish between a dentition which has been efficiently brushed twice daily over a significant period of time, from one which has been brushed specially for the dentist, only on the day of the visit!

Regular daily toothbrushing has one further and very important function, in that the patient learns to accept foreign objects being manoeuvred around his mouth by a third party. Since the third party is the parent, the child’s perceived threat from this activity is minimal and he quickly adapts. This is a vital step towards successful patient management later on, when other foreign objects, such as radiographic films, impressions and, finally, orthodontic appliances, will need to be introduced into the mouth, by the clinician.

The role of the orthodontist

There are also key principles and guidelines for the orthodontist, who, for his part, has several areas to consider.

1. There is the need to aim for realistic treatment goals, which must be adapted to the individual patient’s needs and capabilities (Willard and Nowak, 1981).

Case 2. H.B.R. (Fig. 2) was a mentally normal and well-motivated patient, who suffered from congenital myopathy, a progressively deteriorating muscle-wasting disease. The prognosis was very poor and these patients become more incapacitated with time, becoming eventually confined to a wheelchair and requiring tracheal intubation. The myopathy produces a long and narrow face (Fig. 2j,l) with an obtuse-angled mandible, open bite, and gross lip incompetence. Marked crowding and lateral jaw constriction was evident (Fig. 2a,b,c).

Whilst there were obvious indications for orthognathic procedures in this patient, her reduced resistance to infection (particularly lung infection), the expected steady deterioration in her condition and the markedly reduced general prognosis dictated the limiting of treatment to simple alignment of the anterior teeth only. This involved the extraction of a premolar tooth in each dental quadrant and the application of a simple fixed appliance (Fig. 2d,e,f) in the maxil-
lary arch to achieve levelling and alignment. The teeth in the mandibular arch were allowed to drift into a more acceptable alignment, without the need for appliances (Fig. 2g,h,i). No attempt was made to reduce the facial height nor to close the anterior open bite (Fig. 2j,k,l,m). A fixed maxillary lingual bonded retainer was advised to permanently hold the position of the anterior teeth in this more aesthetic, but unstable treatment result.

2. It is advisable to use a simplified appliance design to make activation independent of the patient (Becker, 1993).

Case 3. D.U.'s condition has never been diagnosed, but was characterized by her small stature, marked retardation, poor balance, and difficulty in walking. Control of motor activity was very limited and she had a strong forward tongue thrust, which was evident during swallowing and in facial expression. Her vocabulary consisted of less than a dozen words and she was unable to understand more than the simplest of conversations. Her orthodontic diagnosis was a mild Class II division 1 dental relationship on a mild Skeletal II pattern, with severe anterior flaring and spacing of the teeth in both arches, and a very large anterior open bite, related to the tongue posture (Fig. 3a,b,c,j,l). Using conscious sedation for three successive visits:

(a) impressions and radiographs were taken and separating elastics were placed mesially and distally to the first molars;
Figure 3 Patient D.U. Diagnosis unknown. (a, b, c) Right, centre and left views of the initial malocclusion, showing the extreme flaring of the incisors and the wide open bite. (d, e, f) A Johnson-type twin-wire appliance, modified by using multistrand wire, has been placed under general anaesthetic. The maxillary appliance has a soldered palatal arch, and the mandibular lingual arch carries soldered spurs anteriorly. At the same time, four deciduous teeth have been removed on the left side. (g, h, i) The completed result. Note the missing maxillary left lateral incisor, which was avulsed in a fall. (j, k) Profile view before and after treatment. (l, m) En face view before and after treatment.

(b) molar bands were adapted and a compound impression was made in each jaw, followed by the extraction of several deciduous teeth on the right side of each jaw;
(c) extraction of several deciduous teeth on the left side was undertaken and then molar bands, with soldered lingual and palatal arches were cemented, followed by the bonding of brackets on the incisor teeth and the placing of a modified Johnson twin-wire arch (Johnson, 1934; Shepard, 1961; Fig. 3d,e,f).

A twistflex segmental wire comprised the anterior portion of the arch, which was used to level and align the teeth. This segmental arch was held into the fine tubular posterior part of the Johnson archwire by a friction fit, while this in turn was free-sliding in the molar tubes. A light horizontal elastic module was stretched between the molar bands and the canine hooks on each of the archwires, which quickly retracted the anterior teeth and closed the spacing. In this way, retraction and alignment were efficiently performed together and the result was achieved in only 3 months, without the need for major adjustments or changes of archwire. In an attempt to change the behaviour of the tongue, soldered spurs were placed on the anterior portion of the mandibular lingual arch (Fig. 3e), which acted as an impediment to the forward posturing. In the event, the tongue...
behaviour was eliminated and the present result (Fig. 3g,h,i,k,m) has held for over a year, with infrequent and irregular night-time wearing of a maxillary retainer only. There is absence of the maxillary left lateral incisor in the final treatment photographs, which was due to trauma sustained during a fall.

3. Conscious sedation is a pharmacologically-induced state of relaxation in which the patient remains conscious, but with significant alteration of mood and co-operativeness throughout the dental treatment. This has played an increasingly important part in the orthodontic treatment of handicapped children, in our Centre (Becker, 1993). The paedodontist has probably become the best person available today to judge what type of sedation needs to be used and is also the most practised in its administration. Although occasions present where it is irreplaceable in the efforts needed to provide quality care for the difficult-to-manage patient, it has been our policy to limit the use of general anaesthesia, preferring to work on the conscious child, who has been sedated to the point where he is apprehension- and fear-free, but where the normal reflexes are unaltered (Pediatric Dentistry, 1993). The several different available methods of conscious sedation (Wright, 1975) have widened the scope of procedures that may be undertaken in dentistry for the unco-operative, difficult or frightened patient and this, in turn, opened the way for the orthodontist to provide treatment in some of the most resistant cases, which were previously considered impossible to treat. It is particularly relevant to mention the new benzodiazepine, Midazolam (Versed, Roche Laboratories of Hoffman La Roche, Nutley, NJ) for use in conscious sedation in paediatric dentistry.

The application of Midazolam, in the form of nose drops (Wilton et al., 1988), together with its potent pharmacodynamic properties (Tolia et al., 1991), makes this drug particularly useful in the dental setting with handicapped patients. Administered just 7-10 min prior to treatment, it is simple and painless (no needles are used) and less patient co-operation is required. Midazolam has anxiolytic, sedative, and amnestic effects, and is a muscle relaxant (Kupietzky and Houpt, 1993). It is quickly absorbed through the nasal mucosa into the blood stream and its rapid onset, distribution, and elimination are very short. This encourages its use in the dental office, where the patient may be discharged and sent home shortly after the sedation procedure. Since Midazolam can produce sedation, but not analgesia, its combined use with nitrous oxide, with its known analgesic and relaxing effects, can provide the operator with an ideally relaxed patient. All the studies reviewed to date (Fukuta et al., 1993; Kupietzky and Houpt, 1993; Sievers et al., 1991; Tolia et al., 1991) indicate the relative safety of the drug, however, as with all sedative agents, children should be observed carefully and all necessary precautions should be taken during administration and recovery.

4. Strategic extractions that will allow spontaneous corrective movements of adjacent teeth. This will often minimize the need for and extent of mechanotherapy.

Case 4. Y.B.R (Fig. 4) is the brother of H.B.R. and suffered from the same progressive muscular wasting of congenital myopathy, but he was older and his condition was more advanced. His facial pattern and dental findings were very similar (Fig. 4a,b,c,d,e). The very high and forward displacement of the roots of the ectopic maxillary canines encouraged us to consider the unusual extraction of maxillary lateral incisors, together with the mandibular first premolars. Alignment (Fig. 4f,g,h) occurred rapidly and simply within a short time, with good axial relationships between the canines and central incisors being achieved by simple tilting (Fig. 4i,j,k). Maxillary first premolar extractions would have tripled the treatment time, due to the considerable root movement that would have been required to place the canines in their ideal site. In the mandibular arch, adequate alignment was produced by natural drifting of the teeth following the extractions.

Case 5. S.A. (Fig. 5) was diagnosed as suffering from severe retardation, with muscle hypotonicity and he can neither walk, talk, understand, nor co-operate. He was confined to a wheelchair. When first seen, his Class II division 1 malocclusion was judged to require the extraction of four premolar units. He exhibited incompetent lips and was constantly drooling saliva. Given the circumstances and the severity of his disability, it was considered inappropriate to offer treatment. Four months later, he arrived in the emer-
Figure 4 Patient Y.B.R. Congenital myopathy. (a, b) Profile and en face views of the patient before treatment. N.B. long narrow face, obtuse gonial angle, open mouth posture and lack of muscle tonus. (c-k) Right, centre and left views, before during and after treatment. (c, d, e) The dentition showing maxillary contraction, dental crowding and severe open bite. The mandibular arch is wider than normal. Note cervical decalcification in several areas. (f, g, h) Maxillary lateral incisors and mandibular first premolars have been extracted and a simple maxillary aligning appliance is used. (i, j, k) The final alignment, with no mandibular appliance having been used. N.B. the open bite is progressively worsening due to abnormal jaw growth.

The overjet was eliminated by moving the lateral incisors and the canines into the place of the missing central incisors (Fig. 5g,h). The orthodontic result has allowed a good lip seal to be achieved and has largely eliminated the drooling (Fig. 5m,n). While the overjet reduction appeared stable (Fig. 5i,j,k), there was a tendency for a reopening of the midline double extraction space, which was resolved by placing linked and enlarged artificial crowns on the lateral incisors, to make them appear more like the missing central incisors. At present the child is wearing a maxillary removable retainer. The parent refused the limited-objective treatment that was planned in the lower arch and which included the asymmetric extraction of the right
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Figure 5 Patient S.A. Severe retardation and muscle hypotonicity. (a, b, c) Right, centre and left views of the initial condition on the day that the maxillary right central incisor was avulsed and the left severely traumatized. (d, e, f) Right, centre and left views of the initial appliance with two hemi-arch wires connected across the midline by an elastic module. (g, h) Anterior view showing rapid progress following good patient acceptance, with the lateral incisors being approximated and uprighted. (i, j, k) Right, centre and left views of the final result. The parent refused treatment in the mandibular arch. (l, m, n) En face photographs show the resting relationship of the lower lip to the teeth, before and after treatment. The profile view is post-treatment and shows improved lip posture.

5. In the use of en bloc extra-oral removable appliances, we have found excellent acceptance and rapid results with the full-time wearing of removable, en bloc, extra-oral appliances (Bass, 1975; Thurow, 1975), on the part of normal children with severe Class II malocclusion. This simple, robust, and fairly unbreakable appliance requires no fine adjustment and is inserted and removed with ease. There is every reason to use these for the handicapped. Where the parents co-operate with this, the results may be truly dramatic.

Case 6 O.B. (Fig. 6) suffered from an extreme form of cerebral palsy, with a severe wasting of all his muscles. His legs and arms were thin and emaciated, with splints supporting his legs. He could not support himself and had to be transferred bodily by the parent from...
Figure 6  Patient O.B. Severe cerebral palsy with muscle hypotonicity. (a, b, c) Severe Class II division 1 malocclusion with gross labial incisor flaring and open bite. (d, e) This full acrylic coverage removable appliance with high-pull headgear was fitted, after initial space closure in the maxillary arch was performed using a simple Hawley plate. Class III elastics are placed between this appliance and a fixed lower, to close lower spaces. (f, g, h) The final result. (i, j, k, l) Profile and en face views show the dramatic change.

his wheelchair to the dental treatment chair. His face was long, narrow, and hypotonic (Fig. 6i,k), the tongue was postured forward, and an extreme labial flaring and spacing of the anterior teeth existed, along with an anterior open bite (Fig. 6a,b,c). His lips were grossly incompetent and there was continuous drooling of saliva. He had occasional epileptic seizures. He was very susceptible to recurrent infections and ortho-surgical treatment was ruled out for medical reasons.

Initially, an upper removable expansion appliance was used, with good clashing, and full and thick posterior acrylic coverage, to prevent accidental dislodgement, and to thereby safeguard the child and his appliance, in the event of a seizure occurring. The aim of this appliance was to achieve some lateral expansion posteriorly, together with retraction and alignment of the flared and spaced incisors. At the conclusion of this short stage, the maxillary dental arch was of ideal form to suit its projected
final and more posterior position, vis-a-vis the mandibular arch.

An en bloc removable appliance (Fig. 6d,e) was then placed on the maxillary teeth, with an extra-oral headgear cured into the occlusal acrylic coverage of the posterior teeth. This was a very simple appliance to insert and it held the achieved arrangement of the maxillary teeth. To the outer bow, heavy elastics were attached to a high pull headcap.

This appliance was worn full time and was placed and removed by the parent for purposes of toothbrushing and bathing only. It was robust, virtually unbreakable and the patient adapted to it very quickly and easily, including during meals. After a few weeks with the appliance and under general anaesthetic, a fixed lower multibanded appliance was placed and initial aligning and levelling wires pinned into place. Once it was possible to insert a more substantial 0.018' wire, Class III elastics were added, to retract the severely flared and spaced lower incisor teeth (Fig. 6e). These Class III elastics were tied to the 'bridge' of the Adams' clasp on each molar, using a simple 'half-hitch' knot, before inserting the en bloc appliance into the mouth. The appliance was then replaced in the mouth, with the parent passing a finger towards the Adams' clasp, seizing the elastic and stretching it to the loop mesial to the canine tooth in the lower archwire.

The remarkable dental and facial changes (Fig. 6f,g,h,j,l), that are evident in this case, bear witness to the potential of the appliance. In the absence of this rather unconventional type of therapy for this patient, surgery would be the only way in which a result could be satisfactorily achieved and this was vetoed on medical grounds.

No retention appliance was placed in the mandibular arch, which has remained stable for a 2-year period. Because of the widely incompetent lip morphology, the open mouth, and forward tongue posture, it was considered that the reduced overjet would not remain stable. Accordingly, the patient was instructed to wear the same en bloc appliance for 12 hours daily, reducing to nights only, after 1 year. Presently, 2 years after completion of treatment, he wears the appliance alternate nights, which adequately maintains the treated result. There was a considerable clinical reduction in salivary drooling.

Conclusions

Many different adjunctive treatment modalities are available to the profession of dentistry today, several of which have not been previously exploited in the orthodontic speciality. By familiarizing themselves with these, orthodontists can plan a varied combination of modalities. In this way, they may broaden the therapeutic options for many of the more difficult cases, hitherto denied professional attention. This will enable them to offer orthodontic treatment to that compromised section of the juvenile public, which manifestly needs it, but for whom its delivery has previously not been made available.

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