

Interceptive Orthodontics: A Synthesis of Clinical Versus Public Health Methodology

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Abstract

Introduction: This paper focuses on Interceptive Orthodontics as a measure to halt the progress of a developing malocclusion in the dentition in order to minimize the likelihood of development of a complex malocclusion in the dento-facial complex. It critically analyses the historical background, importance, indications, contraindications, advantages, disadvantages, risks, timing, aetiology, diagnosis, and various clinical situations that require interceptive orthodontics.

Methods: The paper embraced a desktop review technique guided by Pubmed, Cochrane database and hand searching with the aim of describing interceptive orthodontics as an intervention for correcting problems in the developing dentition

Results: All the eleven articles reviewed seven from Pubmed and four from the Cochrane database met the inclusion criteria. The results indicate that some studies suggested a reduction in the cost of treatment, while a majority supported the need for early treatment for psychological reasons.

Conclusion: The paper concludes that, indeed a public health approach to interceptive orthodontics would seem ideal to reduce the cost and prolonged treatment time. However, due to inadequacy of orthodontist, the clinical approach poses a challenge hence more specialists are required.

keywords: Interceptive; Orthodontics and Synthesis

Introduction

Oral diseases qualify as a major public health concern owing to their high prevalence and incidence in all regions of the world. Literature show that both children and adult populations have unmet dental caries and gum related treatment needs. This is largely attributed to poor oral health seeking behaviour and quality of life, which is adversely affected by oral diseases/conditions that exist. This paper sought to describe how some dental anomalies can be addressed using Interceptive orthodontics.

Historical Background of Interceptive Orthodontics

Interceptive orthodontics is any technique employed to eliminate potential irregularities of the dentition [1]. Literature has demonstrated that there are various aetiological factors that contribute to the anomalies of eruption and exfoliation [2]. However, removable or fixed appliances have been considered to be appropriate for interceptive orthodontics [3]. The clinical conditions that require interceptive orthodontics are grouped as skeletal, dental, soft tissue and local factors [3]. In 1980, Ackerman and Proffit introduced interceptive orthodontics as a means of correcting problems in the developing dentition [4]. The method was considered efficient for improving oral hygiene, speech, masticatory efficiency, reduction of periodontal disease, the relief of tempo-mandibular disorder (TMD), resistance to trauma, and offer psychological benefits [3]. However, the significance of the provision of interceptive orthodontics for oral hygiene purposes remains contentious because, with good practices and a low refined sugar intake, regardless of the tooth alignment, chances of development of caries and periodontal disease will be significantly reduced [3]. Whereas, provision as a means of speech improvement, especially for anterior open bite and lisp, does not guarantee resolution of the problem [3].

There is a wealth of evidence to support the need for early treatment for psychological reasons. A case in particular, would be for those with cleft lip and palate [5,6], and not only for the child with an increased overjet, where it has been shown that when an early surgical repair is done, it not only improves the child's self-esteem later in life, but also reduces the duration of treatment [3,7,8]. The most preferred interceptive measure therefore is the use of functional appliances during adolescence for the correction of anterior open bite, thumb sucking as well as skeletal pattern [9, 10, 11]. Other literature also alludes that a cost reduction to the National Health Service (NHS) would occur with this treatment as was demonstrated in Germany [7, 8].

Relationship between Interceptive orthodontics and growth/development

Interceptive orthodontics is mostly administered in the mixed dentition and this is because it takes advantage of the growth pattern and development that will occur in adolescence [3]. Although some authors argue that it should be undertaken when the permanent dentition has been established [2], others propose that it should be instituted as soon as an irregularity has been observed in the dento-facial complex [12]. This would eliminate the need or simplify later treatment even in the mixed dentition [2]. It is therefore of paramount importance to regularly screen the developing dentition in a systematic way so as to intervene at the appropriate time in the child's growth, and have clear objectives [2].

The main indications are those that produce skeleto-facial changes, palatal expansion, align the dental arches by use of the physiological spaces as well as crossbite correction. Interceptive treatment is however, contraindicated where there is anodontia, dilacerations and Angle's Class I malocclusions with minimal space deficiency [12, 13].

Advantages and disadvantages of interceptive orthodontics

The advantage of interceptive orthodontics is that treatment is dependent on physiological growth, hence eliminates complicated fixed orthodontic treatment in the future and, achieves more stable results because the tooth and arch length are in harmony [12]. However, the main disadvantage of interceptive orthodontics is that there is no single universally accepted approach. The other disadvantage is that since treatment may last between two to three years, the patient may develop a tongue thrust habit due to the spaces created as a result of space creation [12].

Interceptive orthodontics is also associated to risks that are broadly classified into primary or secondary and localised or generalised. The primary risks occur as a direct result of the appliance when it has been placed while secondary risks involve the treatment itself [3]. On the other hand, the general risk may involve the tempo-mandibular joint and facial profile by over-retraction of the incisors. However, there is minimal evidence in the literature to support this theory and, that found is weak. Other risk effects are relapse and treatment failure [3]. Further to this, orthodontic appliances can cause detrimental effects to the teeth, periodontium and soft tissues (Localised risks) [3].

Methodology

The paper embraced a desktop review technique guided by Pubmed, Cochrane database and hand searching with the aim of describing interceptive orthodontics as an intervention for correcting problems in the developing dentition.

Results and findings

The reviewed literature has demonstrated that there are aetiological factors that requiring Interceptive Orthodontics. They include; dental and local anomalies, habits, skeletal discrepancies as well as soft tissue related factors [3]. In regards to dental, the premature eruption, delayed eruption, premature exfoliation and delayed exfoliation anomalies. The premature eruption may be due to syndromes (Down's or Turner's), hereditary or related to clefts of the lip and palate. While, premature exfoliation can be due to caries or trauma related [2]. The delayed exfoliation can be attributed to congenitally absent or early exfoliation of a permanent successor due to trauma of the permanent tooth or severe infections of the deciduous tooth from peri-radicular origin [2].

The Local factors found to result in delayed tooth eruption are; ectopic crypt position, supernumeraries, odontomes, congenital absence, retention, failure of eruption and dilaceration of a primary tooth as well as crowding [2]. The other anomalies includes habits such as non-nutritive digit sucking depending on the frequency and intensity, will affect the dental arch warranting interceptive orthodontics [2]. The recommended diagnosis for the above mentioned is clinically assessing whether there are any abnormal changes and only take an orthopantomogram as a confirmatory indicator to the diagnosis bearing the ALARP principle (as low as reasonably practicable) [10].

The other aetiological factor that requires orthodontic interceptive treatment is skeletal, clinical situation that includes increased facial height, skeletal II and a high palate [9,10,15]. The transverse, antero-posterior or vertical skeletal discrepancies are referred early to the orthodontist, for possibility of interceptive orthodontics or orthognathic surgery [10]. Class III treatment for the growing patient is not successful due to the growth that takes place during puberty, hence it is best to observe, orthodontically camouflage or consider orthognathic surgery in adult years [10]. The skeletal class III correction is done when the patient is below ten years, by use of a protraction headgear [11]. For the treatment, Extra-oral headgear and intra-oral functional appliances are usually used for the treatment of malocclusions by orthopaedic approaches, while palatal expansion uses heavy or-

thopaedic forces to separate maxillary sutures [3]. Palatal expansion can be achieved by either slow or rapid method and this is done to correct skeletal crossbite that occur due to narrow maxillae [3]. This method However, is not suitable for adults hence it is preferable to use this method in young patients since they have sutures that are not interlocked compared to adults, producing more predictable transverse skeletal changes [13].

Literature also revealed that, for dental treatment an overjet of greater than 6mm predisposes that patient to incisal trauma is the best interception in the late mixed dentition where a functional appliance is used. Functional appliances are used to guide growth in the pre-pubertal stage [14]. Anterior open bite treatment is complicated in that it may be caused by a habit and it would therefore require several methods to achieve acceptable results. One, would be to accept the condition as it is, or intercept by use of a habit breaker, modify growth, apply orthodontic camouflage or orthognathic surgery [14]. The facemask was found be useful in retroclining the lower incisors. This was however, found to be short acting since no evidence could be found to indicate that it could be sustained to adolescence [11]. Deep bite is treated in the late mixed dentition by use of an upper removable orthodontic appliance with an anterior bite plane [10].

Anterior crossbite need to be treated immediately by selective grinding to reduce the potential of tooth wear and periodontal destruction [8]. In cases where this does not resolve the problem, correction can be achieved by use of a removable appliance with capping on the posterior region or 2 x 4 appliance [10]. The Unilateral dental crossbites on the other hand are treatment carried out between 10-13 years & in the mixed dentition [3] while posterior crossbites are treated with the use of an expansion screw in the midline or quadhelix [14]. The bilateral crossbites be best treated before the age of 15, by use of rapid maxillary expansion [14].

In case of anomalies of eruption, the buccal sulcus can be palpated for the unerupted canines and the lateral incisors will flare out, indicating this. A right parallax, upper standard occlusal or OPG may be taken to assess the favourability. It may be helpful to guide the path of eruption by extraction of the primary canine if the permanent one does not erupt by 10 to 13 years [10].

Other methods to accommodate the impacted permanent canine involve 'surgical exposure with orthodontic alignment or autotransplantation' [3]. The unerupted molars may at times resolve. However, if this does not occur within 6 months

from the time the contralateral tooth erupts, it can be separated orthodontically by use of stainless steel wire or by selective reduction or the primary molar can be extracted. This is done in the mixed dentition [10]. For first molars poor prognosis can be managed by planned extraction. However, if there is infection and pain, this should be first resolved prior to any tooth extraction. The second premolars and third molars should be examined for potential carious lesions [10]. Where the dental arches are un-crowded or the first permanent molar is missing in the opposing quadrant, it is best to avoid extraction [2]. However, if the first molars are of poor prognosis, consider compensating extraction of the first permanent molar [2]. Thereafter, it is important to regain the lost space by either use of a removable appliance with expansion screws or springs to achieve expansion [14] or by fixed appliances [12]. This is achieved by 'sectional fixed appliance with bands on the teeth and compressed coil spring or open coil spring between edentulous spaces' [12].

The literature also shows that, the infra-occluded teeth need close observation and if does not resolve, extract the offending tooth [5, 8, 13]. Literature also reveals that that a two-stage approach to treatment by use of twin blocks was superior to a one-stage approach. However, this study was found to be clinically inapplicable much as it was statistically significant [15]. When the overjet is increased, it is also advisable to use functional and fixed appliance therapy [3].

For Habits as an aetiological factor that requires orthodontic interceptive treatment, the Digit sucking can be discouraged when it occurs past the age of 9 [7, 8] and use non-invasive techniques such as a glove and aversive liquid applied to the finger [7, 8]. However, if it persists a removable orthodontic appliance with a palatal crib should be fabricated [5, 6, and 16]. However, when crowding of up to 21mm in the lower and 22mm in the upper segments occurs at the canine to premolar region, the best intercept is by extraction, maintaining the space or distalising with an upper removable appliance. This is usually done at 10 years [10]. The disking of the mesial surfaces of the primary molars to prevent lower anterior crowding can be done, while this can be done in the second primary molar to create space for the eruption of the maxillary permanent canine [12].

The planned sequence of extraction of primary teeth and the first premolar to allow alignment of permanent teeth is an important means of interceptive orthodontics [5,6]. It is achieved by guiding the teeth into normal occlusion by a three-stage process. Stage one involves extraction of the primary canine (Cs) at 8.5 -9.5 years. One year later, the primary first and second molars (Ds) (Stage three) are extracted and finally, the

first permanent premolars as the canines are erupting [2]. This mode of interceptive orthodontics has to however be planned very well and works best in children with Class I malocclusion at 9 years of age. Such a child should also present with 'moderate crowding, average overbite, full complement of teeth and no long-term poor prognosis of the first permanent molars' [2]. In other circumstances, extraction of the upper first permanent molar of poor prognosis can be delayed until the incisor crossbite is corrected in class III or until the second molars erupt (class II division I) or in severely crowded mouths [2].

Conclusion

In summary, this article has analysed the various treatment modalities for various skeletal, dental and soft tissue anomalies that contribute to malocclusion and require interceptive orthodontics. The paper reveals that Interceptive orthodontics is a good measure to reduce cost of treatment to the National Health Service (United Kingdom), and yet it provides the much needed treatment for the most severe orthodontic anomalies bearing in mind the inadequacy of Orthodontist is currently being experienced.

Based on the findings of the papers, recommends that there is need to change interceptive orthodontics from the 'health approach' to the 'public health approach'. This would require further orthodontic trials [9], dissemination to clinicians, public, policymakers especially health economists to justify treatment costs and the need to train more orthodontists [17], to make the transition.

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