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Open bite and treatment in growing patient

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Abstract

The aim of this study is presenting a review about the open-bite treatment in the growing patient in order to assess the effectiveness of the early treatment in reducing open bite.

Methods: Literature review has been conducted through PubMed, EMBASE, Cochrane Library, LILACS, VHL, and WEB OF SCIENCE.

Results and Conclusion: Vertical growth of the jaws continues throughout puberty. It is important to identify open-bite at an early stage because interceptive treatment might help in avoiding complicated therapy in the future.

Introducion

Anterior open bite is a vertical malocclusion characterized by a deficiency in the normal vertical overlap between antagonist incisal edges when the posterior teeth are in occlusion [1].

The prevalence of dental open bites is estimated to be 0.6% of 1.350.000 US citizens, in black children it is about of 16% and 4% in white population [12-13]; Cozza et al.[14] found 17.7% of prevalence on 1710 Italian children of 9 years old in mixed dentition. Proffit et al recorded a prevalence of approximately 3.5% in patients from eight to 17 years of age.

Open bite has skeletal and dento-alveolar features; skeletal open bite is characterized by increased goniac angle and lower anterior facial height, increased posterior dento-alveolar height and short mandibular ramps. Sometimes there is also traversal discrepancy [2].

However, in most cases, the distinction is not clear since malocclusion presents both dental and skeletal components [3]. Dental open bite is the result of a mechanical blockage of the vertical development of the incisors and the alveolar component while skeletal relationships are normal. In addition there are some aesthetic feature like lip incompetence, high incisor vestibular inclination and profile convexity.

Many studies show that anterior open bite is a major cause of phonatory and masticatory function alterations and it can also be cause of psychological issues in the affected people [4].

According to Dawson [15], the major causes of anterior open bite are: forces resulting from fingers or thumb sucking, lip and tongue habits, airway obstruction or situations of inadequate nasal airway, allergies, septum problems, enlarged tonsils and adenoids and skeletal growth abnormalities.

As reported by Mucedero et al., classification of etiology of open bite could be related to [5- 6]:

- Iintrinsic factors, such as mouth breathing;

- Extrinsic factors, such as parafunction (e.g. prolonged sucking habits);

- Parafunctional complex factors, such as both vitiated habit and intrinsic parafunction;

- Structural and skeletal factors, e.g. vertical growing pattern;

- Morphological and structural factors, such as macroglossia or typology of muscular orientation and tone;

- Dental factors, such aseruption abnormality.

Several authors emphasized that a skeletal open bite should be treated in the mixed dentition in order to take advantage of the active growth producing faster and more stable results and to reduce the burden of treatment in the permanent dentition [8-9-7]. Various approaches have been proposed to this purpose. Nevertheless, open bite is a difficult challenge for the orthodontics and long term stability, in relation to treatment, is not easy to establish [10-11].

The objective of this reviews is to evaluate the evidence on treatments of anterior open bite in the mixed dentition and confirm the real effectiveness of early treatment to increase stability of the results and prevent to relapse.

Materials and method

A first survey of all articles published on anterior open bite was performed using the following databases: PubMed, EMBASE, Cochrane Library and WEB OF SCIENCE.

The search strategy for PubMed was then improved according to Cochrane Collaboration guidelines using the Medical Subject Headings (MeSH) terms "early treatment" and "mixed dentition", crossed with combinations of the MeSH term "open bite". The key words used to identify the corresponding studies in the

other databases were: "open bite", "posterior discrepancy" and "mixed dentition". Duplicate reports were excluded.

The articles that were judged suitable for the final review analysis were read, and their relevant data were retrieved for pooling. The timeline of inclusion is February 2017

Data were collected on study design, treatment modalities, characteristics of the sample, methods of measurements, success rate, decrease of open bite and divergency, treatment duration, side effects and stability. At the end only 42 full article have been selected.

Discussion

The indications to treatment of open bite are functional and aesthetic. Patients with a severe open bite could have trouble regarding diet, speech problems and social difficulties life[16-17]. Owing to continuing growth changes, correcting an open bite in the deciduous dentition is not indicated. The ideal time to start orthodontic treatment is during the mixed dentition. Furthermore, the treatment must be carried out during the patient's growth to try to avoid surgery.

Treatment techniques can be categorized as habit education, orthodontic appliance or surgical. Simple techniques are those in which the etiologic factor is removed and the bite closes by the normal eruptive process, or closure is enhanced using orthodontic appliances. More difficult procedures are those in which intrusion (either active or relative intrusion achieved by inhibiting eruption of the posterior teeth) is attempted with orthodontic appliances. In some cases, surgery is the last and only solution. Often treatment approaches are combined when the etiology is unclear.

The analysis of the results suggests that early treatment is able to intercept and reduce dentoskeletal open bite, in particular when it is caused by an altered function. In some young patient, treatment consists of controlling the habit, which alone may be sufficient to allow the teeth to erupt to a normal position. Johnson and Larson [42] suggest that therapy should begin when the benefit to the patient outweighs the risks (dental, emotional and psychologic) of habit discontinuation.

If the open bite is associated to bad habits they must be eliminated and resolved using behavior-modification techniques, like speech therapy and if it is necessary removable functional appliance, such as a vertical crib, can be used.

Use of cribs has clinically significant improvement in the maxillar and mandibular vertical relationships by some authors [18-19], while by others authors reported only dental effects [21-22].

In about half of the patients, the habit ceases prematurely and the anterior open bite closes spontaneously. In fact, self correction of dental open bite occurs in 80% of patients when the habit is eliminated up until the phase of mixed dentition.

Various studies have compared different orthognathic treatments to close an open bite. From the analysis of the articles and the effect of orthodontics appliance, it can be concluded that functional devices in combination with orthopedic appliance, such as high-pull headgear, can be used in growing patients, where the open bite is associated with a class II malocclusion[32]. This combination of devices allows to solve the sagittal discrepancy checking the vertical dimension and to control the collateral effect of exclusive use of high-pull headgear such as the impossibility to obtain a pure vertical force .

The mostly used device is the Twin Block. This appliance has two bite blocks, one upper and one lower, that stimulate the mandible to assume a forward position.

Other functional devices useful in case of anterior open bite are the open-bite Bionator and the Frankel 4.

Open-bite Bionator is a removable functional device comprising posterior bite blocks with the function to intrude the posterior teeth [44].Open bite Bionator shows an improvement of vertical relationship - little less compared to Quad-Helix [23-24]. Bionator allows the treatment of class II open bite patients without maxillary prognatism, achieving vertical control and reducing facial convexity, ANB angle, maxillary molar extrusion and overjet.

Posterior bite blocks are usually used in the early treatment [32-33] of open bite.They are an option for intruding and controlling the eruption of posterior teeth. This is a non-invasive technique which does not require the patient's cooperation since the resin blocks are cemented on the posterior teeth. This appliance allows the counterclockwise rotation of the mandible and an improvement of vertical anterior relation. Bite blocks were found to improve the divergency[25]. Posterior Bite block is more efficient if used with vertical chin cup (VCC). Indeed, the mean change in overbite was 4.6 mm when used with VCC, while it was 3mm when used alone [26-27]. Iscan [26] found that higher posterior bite block was not more effective in improving overbite compared to shorter posterior bit block, but it had greater positive effects on the sagittal

growth and mandibular anterior rotation.

Three studies [28-29-30] reported that therapies employing Frankel 4 appliance resulted in a reduction of the open bite from 3 to 5 mm. Frankel 4 reported that when open bite was associated with an hyperdivergent skeletal pattern, relapse occurred in all treated cases unless a competent anterior oral seal had been achieved [28]. Haydar and Enacar used a Frankel appliance(FR4) to correct open bites, and showed that it did decrease the openbite significantly, but it produced mainly a dentoalveolar effect rather than skeletal.

Ortodontic fixed approach, such as straight wire appliance, may spontaneously correct mild or not serious open bite [44]. Some open bites can be treated by stepping the arch wires to close the bite combined with the use of vertical elastics. An interesting study of Arat and Iseri (1992) compared fixed appliance treatment with functional treatment to correct open bite. During fixed appliance therapy, marked increases in the maxillary and mandibular posterior dento-alveolar height were observed, and the mandible rotated backwards. With functional appliances, forward and upward rotation of the mandible was noted with the center of rotation at the premolars [45]. According to this study, if functional appliances are used for phase I therapy and followed by phase II fixed appliances, all the gains from phase I can be lost in phase II. On the other hand, removable bite blocks with fixed appliance therapy have shown success.

Another option to treat severe open bite is the multi loop Edgewise archwire (MEAW); the ideal arch is 16x22 in a edgewise bracket system and it operates extruding the anterior teeth and uprighting of molars, using heavy intermaxillary elastics.This technique is strongly dependent on patient compliance, and a possible risk is to have only an anterior extrusion without a posterior intrusion [40-41-35]. This option is not more utilized today.

Definitive treatment of skeletal open bite generally requires the combination of orthodontic treatment and orthognathic surgery. Surgical approach consists in performing a LeFort I osteotomy and, in some cases, mandibular ramus osteotomy, which repositions the maxilla allowing the counterclockwise rotation of the mandible [31-38].

However postoperative effect of surgery - such as pain, swelling, edema, altered nerve sensation, dangers of general anesthesia, costs, rehabilitation associated to the risks and price of surgical treatment- have lead to produce alternative procedures.

A new tipe of treatment of open bite is possible now through the use of titanium miniplates and miniscrews, to intrude the posterior teeth [35-36]. Microscrew implants are small enough to be positioned in any area of the alveolar bone. They are easy to insert and remove and inexpensive and they eliminate the need for patient compliance. TADs (temporary anchorage devices) are useful to avoid surgical therapy and, at the same time, they provide the maximum needed anchorage. Orthodontic treatment with TADs seems to not increase facial height and to preserve or improve aesthetic. Several studies report excellent results for open bite treatment with maxillary molar intrusion. The studies of Umemori et al demonstrated the effectiveness of the intrusion of mandibular molars by using titanium miniplates (L-shaped miniplates) for anchorage, without the undesirable side effects of extrusion of anterior teeth [37]. Through the use of intraoral elastics, the lower molars were intruded and open bite was closed. A month later, it was added the fixed appliance in both dental arches. Despite the intrusion had been completed after five months, the fixed appliance and the miniplates were removed after eighteen months.

Conclusion

The problem of open bite is multifactorial. It is very important to do an early diagnosis of open bite to avoid invasive procedure.

The best time to treat open bite is during the mixed dentition. As it results in rate of relapse lower than the case of treatment conducted during deciduous or definitive dentition. Nowadays there are many alternatives to surgery if the diagnosis is early.

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