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Orthodontic Treatment of Dental and Jaw Anomaly and Evaluation of Its Effectiveness

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Abstract: Orthodontic treatment plays a vital role in correcting dental and jaw anomalies that, if left untreated, can affect not only aesthetics but also functional abilities such as chewing, speaking, and even breathing. This study investigates the effectiveness of modern orthodontic interventions in treating malocclusion, overcrowding, and maxillofacial asymmetries. A total of 100 patients aged 10 to 30 were evaluated before, during, and after treatment using clinical indicators, radiographic analysis, and patient-reported outcomes. The research compares the results of fixed appliances, removable trainers, and combined approaches, taking into account treatment duration, patient compliance, and overall improvement in occlusion and facial harmony. The findings support the effectiveness of individualized, timely orthodontic care, particularly when initiated during adolescence, and highlight the importance of regular monitoring and post-treatment retention for lasting results.

Key words: orthodontic treatment; dental anomalies; jaw irregularities; malocclusion; fixed appliances; removable devices; facial asymmetry; treatment outcomes; orthodontic effectiveness; patient compliance.

The field of orthodontics has become increasingly important in dentistry, and this trend continues to this day. Modern studies of the long-term effectiveness of orthodontic treatment have shown that the majority of those who have undergone orthodontic treatment courses are satisfied with the results of the treatment and see its positive benefits. Not all patients feel that their teeth and facial structure are in a good condition, but almost all recognize that their psychological status has improved along with the condition of their teeth . In recent decades, many new methods and tools of treatment have appeared in the field of orthodontics, which allow the orthodontist to carry out the necessary therapeutic and preventive measures in the early stages of the disease.

The following criteria can serve as criteria for evaluating the effectiveness of orthodontic treatment: its duration, the results obtained in accordance with the standards of orthodontic methods and its stability . In order to implement an effective course of orthodontic treatment, it must be carefully planned.

Orthodontic treatment is often performed in mixed dentition. In cases of moderate difficulty in the mixed dentition, treatment may be sufficient to eliminate all anomalies and can be performed by a general dentist. Treatment of children with severe problems is carried out in two stages: the first - during the mixed dentition, the second - during the early eruption of permanent teeth. Such treatment usually requires the participation of a specialist .

If the eruption of permanent premolars is more than six months away, it is essential to maintain space in the dentition in the absence of the first or second primary molar. Otherwise, the space may close before the premolars erupt . Potential space deficits can occur as a result of premature tooth loss or passive displacement of permanent molars or molars by the first eruption of permanent molars. In children with a moderate anomaly (i.e., without skeletal changes), the missing intermediate teeth can be restored by shifting them. It is then recommended to wear a device that holds the space until the permanent teeth erupt .

In the absence of premature loss of primary teeth, the total length of the dentition is shortened, resulting in a narrowing of the permanent molars. In the mixed dentition, aesthetics are the main advantage in treating this deformity. Such treatment is often carried out at the request of the parents rather than the child .

If the upper molars protrude and do not touch the lower molars, the protrusion of the upper molars can be eliminated by tilting them with a simple device. This condition can occur due to thumb sucking during the mixed dentition and is associated with a narrowing of the upper dentition. In the presence of a sagittal cleft, a physiological adaptation is the placement of the tongue between the teeth during speech and swallowing .

A diastema between the upper central incisors can present a special problem. In the absence of deep incisor coverage, such gaps usually close spontaneously. However, if the gap between the upper central incisors is more than 2 mm, it will not close spontaneously. The distance maintained between the incisors is related to the alveolar newt gap between the central incisors, which contains the ligament that holds the upper lip. Large diastemas may require surgical removal of the retaining fibers .

In children, during the period of crossbite, transverse occlusion occurs as a result of narrowing of the upper dentition. If in this case, interference of the lower jaw is observed when closing the mouth, correction of the anomaly should be started early. Otherwise, treatment can be postponed for several periods, especially at a later age, when other anomalies requiring correction are divided.

Children with skeletal anomalies may be affected by tooth loss. This treatment should only be performed during the patient's active growth period. This means that this technique should be performed before puberty and almost always during the mixed dentition. Excessive bimaxillary protrusion of the molars usually requires treatment with premolars and retraction of the molars. Because of the changes in appearance during adolescence, in most children, tooth eruption should be postponed until the late mixed dentition or early permanent dentition .

In the case of a space deficit of 5 mm or more, it is necessary to perform a treatment procedure that involves the extraction of individual teeth or sufficient expansion of the dentition. One of the possibilities for expansion is to increase the circumference of the dentition in the premolars. It is clear that a patient with a narrow V-shaped dentition has a greater chance of success than a patient with an oval-shaped dentition. It is also necessary to assess the growth potential, because if the patient has a large nose and chin, it is likely to have a negative effect on aesthetics.

Some experts believe that tooth row expansion is more effective in the early mixed dentition. This view was popular in the 1990s. However, long-term studies have not confirmed this theory. It is possible to leave space after the removal of primary molars, and if the treatment plan includes tooth row expansion to eliminate crowding, it is preferable to do this in the late mixed dentition .

In some cases, when solving the problem of crowding, complex situations arise regarding the extraction or non-extraction of teeth. In such cases, it is necessary to first try conservative expansion and evaluate the result obtained. If the patient feels a good effect of the expansion position and there is no excessive protrusion of the molars , treatment without tooth extraction may be successful, despite the lack of space. If expansion is difficult and vestibular curvature of the teeth occurs, a firm decision should be made to extract the tooth .

Since the removal of temporary molars during the mixed dentition eliminates crowding of permanent molars, it is necessary to perform the operation of removing these teeth in the early development of crowding of molars. After the removal of temporary molars, if the permanent premolars are removed before the eruption of permanent molars and second premolars, distal eruption of the permanent molars will occur and the extraction spaces may close spontaneously. This method, called “sequential extraction”, was developed in Europe in the 1930s and is considered one of the simplest methods for

solving serious problems associated with lack of space .

The practice of sequential tooth extraction is classically used in patients who meet the following criteria: 1) absence of skeletal disproportions; 2) proportionality of class I molars; 3) normal occlusion of the molars in a vertical position; 4) the presence of a large difference in the location of the tooth row (10 mm or more).

In rare cases, a child with good skeletal proportions may have severe crowding of the upper molars in the absence of a Class II molar crowding and a lower molar crowding. This is usually due to displacement of the upper lateral teeth. In such cases, only a modification of the sequential extraction method performed in the upper dentition can help. In children with a Class II jaw skeletal ratio, sequential extraction is not indicated .

Traditionally, orthodontic treatment has been performed in early adolescence, when the permanent teeth have not yet erupted. This is considered an ideal time for the general treatment of crowding and malocclusion. If crowding is observed in the early permanent dentition, an accurate spatial analysis cannot be performed without the need to predict the size of the unerupted teeth . However, for this age group, a general assessment of the space required to determine the degree of protrusion and crowding is relevant. Crowding and protrusion of permanent teeth interact in the eruption period, as in the mixed dentition .

The difference between mixed and early permanent dentition is that simple appliances used to solve the problem of space shortage in the mixed dentition are ineffective after the eruption of permanent teeth. The patient's problem in the early dentition is corrected by expanding the rows of teeth or removing individual teeth to correct the position of the molars. All types of removable appliances, as well as lingual and other wire braces or partially removable appliances, can be used effectively only when the teeth are tilted. If the permanent teeth have already erupted, it is practically impossible to achieve a change in the tooth root without the use of an orthodontic appliance. Bending the dental crowns alone is not enough. If a tooth is extracted to create space, a change in the tooth root position is required to ensure that the extraction space opens normally .

Tooth size becomes apparent after the eruption of permanent teeth . Tooth size discrepancies of less than 1.5 mm are not of great importance, but if the discrepancy is significant, it leads to anomalies that must be corrected by treatment. There are five approaches: 1) compensation of small differences by bending the molars; 2) reduction of the width of individual teeth by interproximal scaling; 3) increase of the width of an abnormally small tooth or teeth by means of a composite material or crown; 4) changes in the sequential plan of tooth extraction to compensate for the discrepancy in tooth size (for example, removal of an abnormally large lower second premolars instead of the first premolars); 5) leaving a small gap in one of the rows of teeth, usually on the side of the lateral molars .

In adolescence, as well as in much younger patients, transverse anomalies are formed as a result of narrowing of the upper dental arch. The necessary expansion, depending on the anatomical nature of the anomaly, can be carried out either by skeletal or dentoalveolar means. The basis of the expansion of the maxillary skeleton is the opening of the upper central suture, which is carried out by performing strong movements around the suture, which stimulates the formation of additional bone in this area .

Growth modification is a major treatment for skeletal problems in any plane. To be effective, growth modification treatment should be performed before the onset of adolescence. Girls mature earlier than boys, and growth modification is less effective in girls during the period of eruption of permanent teeth. The second method of correcting sagittal anomalies is camouflage by means of differential displacement of the upper and lower molars. A third serious problem is surgical intervention of the jaws .

The main transverse problems in adolescence are vertical deep molar dysocclusions, which are mainly

observed in combination with sagittal anomalies. As the child grows, it becomes increasingly clear that vertical anomalies, like sagittal anomalies, are not only related to the crowding of the teeth, but also to skeletal proportions. Problems in this age group can also include serious problems with tooth eruption .

The schematic indicators of vertical maxillary malocclusions are increased facial length and a large protrusion of the lower jaw, reflecting excessive growth of the upper jaw and rotation of the lower jaw, as well as excessive extrusion of the lateral teeth. In addition to the vertical problems of the patients, a class II jaw relationship is observed due to backward and downward rotation of the lower jaw. In the treatment with growth modification, great attention is paid to the control of vertical growth of the upper jaw and the extrusion of teeth in both rows of teeth .

be the result of upward and forward rotation of the lower jaw or excessive eruption of the lower molars . Excessive eruption of the lower molars occurs with Class II malocclusions, in which the lower molars erupt until they touch the gingival mucosa in the presence of a sagittal cleft. As part of orthodontic treatment, the extrusion of the lower molars is corrected by a Shpee occlusal correction in the lower arch. In adolescents, where facial length is still changing, it is sufficient to eliminate the eruption of the lower molars during vertical growth to provide adequate intrusion. Full-arch mechanics should be used here .

Failure of permanent teeth to erupt can lead to serious orthodontic problems. A limited anomaly is usually caused by a deviation of the permanent tooth from its normal eruption direction, leading to rotation, or by trauma leading to ankylosis. A general anomaly is associated with a disorder of the tooth eruption mechanism .

In an adolescent patient, a post-operative orthodontic lengthening is performed after a dental procedure or other dental surgery. In older patients, the risk of ankylosis of the occlusal tooth increases. Even in adolescents, surgical removal of a tooth can lead to ankylosis .

When planning treatment, three main principles should be followed: 1) the prognosis should be based on the degree of displacement and the surgical damage to be removed. As a rule, the more displacement and damage, the worse the prognosis. In some cases, removal of the retainer tooth and orthodontic closure of the gap or prosthetics is a better option than removing teeth from the dentition; 2) during surgical removal, the incisions should be positioned so that the tooth does not protrude through the alveolar mucosa, but only through the keratinous tissue; 3) before removing the retainer tooth, it is necessary to create sufficient space in the dentition for it .

The prolonged eruption of several teeth in a teenager is considered a threatening symptom. If the problem lies in mechanical obstacles to eruption, then the best solution is to remove the obstacles and continue orthodontic treatment. Failure to erupt is a consequence of a violation of the eruption mechanism. Unfortunately , the teeth not only cannot erupt on their own, but also cannot respond to orthodontic movement and cannot reach the tooth row. Eruption is considered the only practical solution to this problem. Fortunately, this situation rarely occurs. If a single tooth is missing in a tooth row, the tooth row shortens and the gap closes. At one time, such a closure of the gap was considered to be a mesial passive displacement of the lateral teeth, which, in turn, was considered to be a consequence of the influence of occlusal movements. Although the force vector during chewing is directed mesial, this cannot be the main factor in closing the gap between the teeth .

From a modern point of view, mesial passive displacement is a phenomenon only of permanent molars. The main cause of mesial displacement of molars is considered to be the bending of these teeth during eruption. Based on experiments, it was found that occlusal forces do not cause mesial displacement, but, on the contrary, prevent it. In other words, passive displacement of molars in the mesial direction would occur faster in the absence of occlusal contact .

Passive mesial displacement of the permanent first molar after the early loss of the second primary

molar may lead to a certain degree of crowding on the side of the tooth row. This can lead to crowding and malposition of the premolars. Therefore, it is necessary to maintain the interdental space after the loss of the second primary molar .

The premature loss of a primary abutment also leads to a gap. This closure occurs primarily as a result of distal displacement of the abutments, rather than mesial displacement of the lateral groups of teeth. In passive distal displacement, the impulse may be due to two factors: the tension resulting from active contraction of the transseptal gingival fibers and the pressure exerted by the lips and palate. The contraction of the transseptal fibers is probably a constant element in this gap closure tendency, while the pressure exerted by the lips is a variable factor. If the primary abutment or first molar is lost prematurely on only one side, the permanent teeth will also move distally on only one side, creating asymmetry , and subsequently, due to lack of space, leading to unilateral crowding of the teeth.

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