

Evaluation of the Clinical Efficacy of Orthodontic Retention of Third Molars After Extraction of First or Second Molars

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Abstract: This paper explores the clinical efficacy of orthodontic retention of third molars after extraction of the first or second molars. Studies show that the use of the second molar near the movement to replace the first molar, retain the third molar although need a long treatment time and higher treatment cost, but promote the gap of tissue regeneration, preserve healthy natural teeth, restore occlusal stability, but also can avoid the late repair of the first molar or second molar. In addition, the second molar after moving near the third molar is also conducive to the eruption of the third molar, maximizing the use of the third molar, to form a healthy and complete functional tooth line. Therefore, For patients with severe removal of the first or second molars, poor prognosis, severe periapical disease, and loss of the first or second molars, the treatment method of replacing the second molar for the first molar and the third molar for the second molar can be an effective treatment option.

Keywords: First molar, Second molar midmobile movement, Orthodontic upright molars.

1. Introduction

Orthodontic treatment is an important technique in the field of modern oral medicine, aiming to improve oral function and aesthetics. In the process of traditional orthodontic treatment reduction tooth extraction first selection of premolars, in recent years, to remove the first or second molar orthodontic retention third molar treatment in oral field of attention, especially in the first molar due to caries cause serious tissue damage and unable to retain the case, the treatment shows more and more advantages. It can realize the application value of retaining the whole healthy tooth line, promoting tissue regeneration at the missing gap, and increasing the height of the missing tooth space bone. At the same time, there are also problems such as increased difficulty of orthodontic correction, longer course of treatment and occlusal instability. Therefore, the advantages and disadvantages of orthodontic retention of third molar treatment after removing the first or second molar, the problems to be noted in practice, and the development period and placement of the third molar still need to be explored and studied.

2. The Treatment Principle of Orthodontic Retention of The Third Molars After Extraction of The First or Second Molars

First, permanent molars sprout early, and there are many spots and grooves. Premature caries is often due to the lack of parents' awareness and the lack of necessary oral care for children, and then residual roots and even fall off. It has been reported that the clinical extraction of the diseased first permanent molars accounts for 12% of the total cases of orthodontic extraction[1]. With the change of children's diet structure, the daily diet is becoming increasingly refined, resulting in insufficient stimulation of the jaw by chewing pressure, and most clinical manifestations are a series of

malocclusion such as dentition crowding[1]. When necessary, it can also improve the coordination degree of lateral appearance and soft tissue in patients with malocclusion, and improve the cephalometric index and upper airway morphology[2].

Elimination of the first molar to move the second molar near medium means moving the second molar forward by orthodontic means to fill in the absence after removal of the first molar. The principle of this approach is to use the power of the orthodontic appliance to move the second molar to the missing position, while pulling and erect the third molar through the orthodontic device to achieve occlusal stability and aesthetic effects. The same goes for removing the second molar.

3. The Advantage of Orthodontic Retention of The Third Molars After the Extraction of The First or Second Molars

Compared with the traditional method of premolar extraction, the orthodontic retention of the third molar after the first or second molar extraction has the following advantages:

3.1 Promote tissue regeneration at the gap point: the extraction of the first molar will lead to the problem of bone absorption after tooth loss, Mao Yanmin and other scholars[3]The study confirmed that orthodontic movement of adjacent molars to close the missing space of the mandibular first molar does not cause severe loss of molar bone height and may form an increase in bone height. The amount of bone resorption in the missing tooth area does not indicate the treatment risk, and bone grafting is not required before this treatment, which is instructive for clinical practice,

3.2 Preserved healthy teeth: the first molars sprout early, have many pits and grooves, and have complex structure, and are prone to dental pulp disease and periodontal disease. In

the previous orthodontic tooth extraction, the preferred tooth position was often the familiar and healthy premolar. In the tooth reduction, the reduction of double apical teeth accounted for 94.6% of the total reduced tooth extraction[5]. The close to middle movement of the second molar can retain relatively healthy premolars, remove the sick first molar, and reduce the impact of the remaining affected teeth on oral health. Normal and healthy premolars should retain to exercise function. Similarly, when the second molar is sick, the third molar replace it.

3.3 Improve occlusal stability: after the first molar loss, if no intervention is applied, the adjacent teeth will tilt to the missing side and the elongation of the jaw teeth will occur[6], Affect the occlusal relationship, and then affect the masticatory function of the missing tooth side. The near-middle movement of the second molar can fill the loss after the first molar extraction, improve occlusal stability, and reduce the impact of masticatory and occlusal function.

3.4 Avoidance of subsequent restorative treatment: The available restorative schemes for the loss of the first or second molar are removable partial dentures, fixed partial dentures, implant dentures, etc. However, the removable local denture parts have large volume and poor comfort, and the fixed local denture has high requirements on the abutment tooth itself. After the dental preparation, if the edge sealing is poor, it will increase the risk of caries and even pulpitis. The price of implant denture is high, and the bone mass in the tooth loss area is high. If the tooth loss time is long, the teeth on both sides of the gap are inclined to the middle, which will lead to insufficient implant gap, and often need orthodontic means to introduce enough gap. The orthodontic retention of the third molar after the extraction of the first or second molar avoids the treatment of the first or second molar such as root canal treatment for the dental pulp periodontal disease, and also avoids the denture repair of the gap after the loss of the first or second molar, and extends the service life of the dentition[7].

4. The Disadvantage of Close Movement of Second Molars

Although the advantages of second molar movement are obvious, there are also some disadvantages, such as difficult operation, prolonged treatment cycle, high technical requirements for doctors; the high degree of stimulation of the pulp, increasing the complexity of treatment. Some studies have shown that the removal of molars can effectively remove and relieve crowding and improve the inclination and coverage of the buccal and tongue, but the occlusion relationship is not close and the height of the marginal ridge is not uniform. Especially for the posterior tooth arrangement, the height of the marginal ridge and the dental contact, the adjacent tooth contact relationship is less influence[7].

5. The Method of Orthodontic Retention of Third Molar After First or Second Molar Extraction Requires the Following Issues in Clinical Application:

5.1 Indications: This method is suitable for cases where the missing needs to be filled after the first molar extraction, but it considers factors such as the patient's dental status and oral health status. If the patient has severe dental periodontal

disease, the corresponding disease should be treated first, followed by orthodontic treatment. In the case of Sun-Hyung Park[8], The 11-year-old patients third molar Nolla fourth stage, due to the first molar low resistance caused vertical bone defect, the first molar extraction, traction the second molar instead of the first molar, 23 months of orthodontic treatment, the second molar near the movement promoted the first molar bone regeneration, make the original missing bone back to normal state, then wearing a maintainer to observe the eruption of the third molar. At the age of 16, the third molars emerge naturally and are in contact with the far middle surface of the second molar. In this case, the crown had 7mm mesial movement, and the root had 15mm mesial movement, in Lee[9]Scholars of similar case report, 15, the first molar low resistance, third molar in Nolla fourth stage, remove the first molar, by orthodontic near moving second molar to repair the first molar resistance to the vertical bone defect, eventually crown near moving 3mm, the root move 12mm, and establish a normal occlusal relationship. So, the second molar movement of the method instead of removing the first molar is suitable for the third molar embryo, the second molar instead of the first molar, the third molar, otherwise, the third molar tooth embryo congenital missing, even if the second molar replace the loss of the first molar, in the future to repair the gaps in the second molar. When the development of the third molar is in the fourth stage of Nolla, it can achieve the third molar to the proper position and establish a normal occlusal relationship. There is a study[10]it shows that the third molar is in the sixth to seventh stages, that is, the crown of the third molar is complete, but when the development of the root is less than 1 / 3, after the advance of the second molar, 63% of the third molar sprout out, closely adjacent to the adjacent teeth, and establish a good occlusal relationship with the jaw teeth. Although the remaining 37% have significant near and medium movement, the dental axis is near and medium tilt, so further adjustment is needed in the later stage. If the third molar root is fully developed, it should be arranged to the normal arch by orthodontic traction. There are no significant contraindications to the height of vertical bone in the first molar.

5.2 The choice of anchorage: according to the specific situation of the patient choose appropriate anchorage, such as micro screw implant anchorage in the treatment of effective, orthodontic and periodontitis, abscess, loose teeth are superior to oral anchorage, safe, high efficiency, recovery of oral function and the overall beauty better, is widely used in orthodontic clinical work[10][11]. And the microscrew implant anchorage can achieve a more stable effect, less anchorage loss[12][13]. The effect of orthodontic treatment is significant, which can significantly improve the soft tissue, dentition and maxilla, improve the chewing function and bite force of patients, and have no obvious postoperative complications[14]. It can make some difficult cases that apply conventional methods to achieve satisfactory results, and do not need to rely on the cooperation of patients too much as the previous traditional anchorage methods, which is worth widely promoted in clinical practice[15].

5.3 Treatment time and effect: The near and mid-range movement of the second molar requires some treatment time, but a stable effect can be obtained after treatment. The course of vertically impacted third molars was 6 to 9 months longer than the conventional orthodontic extraction[16].

6. Treatment of Nearly Impacted Second Molars or Third Molars

At present, there are many kinds of treatments for near-middle impacted molars, such as surgical upright, orthodontic upright, surgical-orthodontic upright, surgical reduction, extraction and so on can get good results[16].

6.1 Surgical methods can be applied clinically, preserving the third molar, standing upright and transplanting instead of the first or second molar. Studies have shown that the success rate of autologous tooth transplantation is 70% -90%[18][19]. Although surgical reimplantation is simple and convenient, it may cause the loss of dental pulp vitality, root resorption and root bone adhesion[20]. The use rate of autologous tooth transplantation is not high because of the large variability of the third molars, and the unpredictability of the transplantation process can affect the postoperative success rate of autologous tooth transplantation[21][23]. At present, the application of 3D printed autologous tooth transplantation model can significantly shorten the donor tooth implantation time, reduce the damage to the periodontal membrane cells of the transplanted teeth, and improve the success rate of tooth transplantation[24].

6.2 Many orthodontic devices and techniques have been suggested to correct impacted molars. The design and production of the improved tongue arch is relatively simple, and it has a better upright effect for impacted molars[25] However, it only has unidirectional traction for impacted molars. For reversed molars, while the traction is in place, the cheek tube of the molar needs to further align to adjust the occlusion.

6.3 The segment arch upright impacted molar is simple to operate and less traumatic, short course and less risk, which is accepted by the majority of orthodontists[26][27]. The combined application of transparent pressure membrane holder and fragment arch provides patients with a more beautiful and comfortable, reasonable designed, and functional clinical treatment, which can be widely used to treat the maxillary third molar instead of the second molar, and re-establish a complete and healthy natural dentition[27].

6.4 Orthodontic band with multi-curved push spring[28][29] to erect impacted molars with small size, weak occlusal discomfort and strong applicability. Tu Jingqiu, scholars, et al[26] It was reported that a 13-year-old patient used the 36 ring push spring to remove the 37, and the own ring. After that, the 37 gradually strengthened the position, and the far middle arm push position was adjusted to 37 completely upright, with a total time of 4 months. Miu Yaoqiang, Scholar et al[30] six cases of upright impacted molar with ring attached spring were reported, which concluded that the space occupied by the original impacted crown was repaired by normal alveolar bone tissue, and the vertical time of mandibular impacted molar was 5 to 14 months, with an average of 8.63 months. The time required for standing erection was related to the molar development period, tilt angle, location, patient fit, etc.

6.5 Some scholars have designed the ring-frame molar erectors[31] The orthodontic device is mainly composed of the following three parts: bilateral abutment band ring, lingual arch, and ring frame with ligation wire bond area. The ring frame molar is placed in the patient's lower row with a binder. The traction knob is then bonded to the appropriate position of the lower second molar crown. An elastic chain ring is placed between the traction button and the pull hook

of the vertical device for traction. The traction force is about 200g. Change the elastic chain ring once every 2 weeks until the affected tooth is righted for an average course of 4 months. However, this setting requires bilateral abutment adhesive band ring, and whether the abutment anchorage is sufficient and reasonable indications should be selected.

6.6 Some scholars apply microimplant nails to erect molars[32][33] This method is a traumatic operation, soft tissue damage in the implant area increases the risk of infection, there are problems such as implant loosening and insufficient implant space, and increases the overall cost of the patient, so it is necessary to consider the patient acceptance. And scholars[34][35] It shows that the application of microimplants makes up for the deficiency of other anchorage methods. It is a simple, comfortable, stable and effective anchorage form of erect inclined molar, and the application is flexible, which can make the corresponding anchorage design according to the actual situation of the patient's mouth. When application, it was noted that the MIT value of the implant nail controlled at 5N · cm-10N · cm has good stability and prognosis[36] High implantation force is not conducive to improving the success rate of planting nails[37].

6.7 Vertical impacted teeth[38], Small trauma, easy to wear, it has good efficacy for patients who cannot bond the ring or buccal tube. It is also applicable for patients who only require upright impacted molars without full oral correction, when late stage of treatment alignment of molars with orthodontic segments arch, which can not only meet the demands of patients, but also save cost. The most appropriate correction method can be selected according to the patient's own situation.

6.8 Deng Weihuang and Hu Chun scholar have reported on 20 patients with mandibular first molar loss[39] sticking the adhesive groove on the second molar, sticking the buccal tube on the third molar, with a 0.018 inch bend "boot shape" between the second molar and "backward bend" on the third molar, and in the implant in the second premolar, with the "sliding method" and the implant nail traction to close the gap. Each method can not only be used alone, but according to the specific situation to choose the appropriate correction plan, and then to achieve the purpose of correction.

7. Treatment of the Third Molar After the Close-middle Movement of The Second Molar

In the developing dentition, extraction of the lower part of the first permanent molar promotes medial motility and the developing third molars are erect, which may raise the possibility of future third molar eruption. Zhu Ye and other scholars[40] the studies have confirmed that in patients with a molar loss or extraction, especially adolescents, by evaluating the curved tomography and CBCT, the third molars have growth potential or intact teeth, and the morphology can stand upright and move the third molars to keep the dentition intact. In the Ian Murphy[41] in the study of other scholars, the retrospective radiographic analysis of 62 developing third molars aged 8-11 years showed that removing the first permanent molar with poor prognosis in childhood could reduce the possibility of mandibular third molar obstruction in the future.

The orthodontic treatment after the removal of the mandibular first molar facilitates the increase of the eruption

space and the improved eruption angle of the third molar, especially after the change of the third molar continues to develop in a favorable direction[42]In addition, there are differences between the upper and lower jaw. The removal of the first molar can significantly increase the removal of the third molar and improve, and there is no significant difference between the third molars[43]. However, the third molars can eventually sprout to an ideal position and still require long-term and regular observation. When designing orthodontic treatment plans, doctors should fully consider the effects of various extraction modes and keep cautious about the treatment of third molars. It should be noted that the gingival crevicular depth is deep after the third molar is upright and moving near the middle, and the periodontal condition of the patient needs to be evaluated in time before and during treatment[44].

8. Conclusions and Suggestions

Second molar mobile treatment has a high application prospect in the restoration of first molar loss, and shows the advantages of promoting tissue regeneration at the missing place, preserving healthy natural teeth, improving occlusal stability, and avoiding the periodontal treatment in the diseased first molar teeth. At the same time, there is difficult operation, treatment cycle, high technical requirements to the doctor, and occlusal relationship is not close, edge ridge height not neat, however, for the treatment of care and technical details and careful consideration is crucial, doctors must be careful operation when the application, pay attention to the patient periodontal tissue health, in addition to the treatment of the third molar patients should also be combined with the patient condition, with the corresponding appliance, make the best correction scheme, make it smooth and healthy near shift instead of the second molar. In conclusion, the mobile treatment of second molars in the first molar is worth popularizing, etc. We orthodontists should pay attention to the treatment effect, and efficacy of this method, and conduct more in-depth research and discussion on this method.

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