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CLINICAL APPLICATION OF INVISIBLE ORTHODONTIC TECHNIQUE WITHOUT BRACKETS FOR MOLAR MESIAL MOVEMENT

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Abstract: Objective: To explore the clinical application of non bracket orthodontic technology for molars with mesial movement. Method: 20 patients with 4 second premolars were selected for extraction, and the extraction gap was closed by using a non bracket invisible orthodontic device to move the molars mesially. Observe the anchorage control during the process of molar mesial movement, and analyze the models before and after treatment and after molar mesial movement to evaluate the effect of molar mesial movement. Result: The non bracket invisible orthodontic technique can achieve overall mesial movement of the molars for the extraction of four second premolars. The removal of four second premolars requires good anchorage control to prevent the molars from tilting in the mesial direction. Conclusion: The use of a non bracket invisible orthodontic device can achieve good results in the treatment of mesial movement of molars in cases of extraction of second premolars.

Keywords: Invisible orthodontic technology without brackets; Molar proximal displacement; Dental extraction and correction; Anchorage control.

1. INTRODUCTION

Invisible orthodontic treatment without brackets is popular among patients and orthodontists due to its advantages of being removable, aesthetically pleasing, comfortable, convenient, and highly predictable. In the early days, it was believed that invisible orthodontic treatment could only solve simple cases such as scattered gaps, mild crowding, and individual tooth torsion. In recent years, with the rapid development of technology, invisible orthodontic treatment has gradually been applied to complex situations such as tooth extraction cases. The overall movement of the molars in the near middle is a difficulty in orthodontic treatment, and it is more challenging for non bracket invisible orthodontic devices. Although following the basic principles of orthodontic treatment, there are significant differences in indication selection, tooth movement sequence, anchorage design, follow-up control, and patient management between invisible tooth extraction cases and fixed orthodontic treatment. This experiment used a concealed orthodontic appliance without brackets to reduce the second premolar and move the molars mesially. Specific studies were conducted on the expression rate of the first and second molars' proximal movement before and after the orthodontic treatment, whether the molars tilt or rotate, and the control of anterior and posterior anchorage.

2. MATERIAL AND METHOD

2.1 Case Selection

Select 20 patients who received invisible orthodontic treatment without brackets in the hospital from January 2020 to October 2022. Among them, there are cases of male bimaxillary protrusion patients and cases of female patients. The minimum age is one year, the maximum age is one year, the average age is one year, and the average correction period is months. Inclusion criteria: (1).

All patients and their families are aware of the content of this study and voluntarily participate; (2) After imaging examination, it was found to have a mean angle; (3) The crowding degree of the upper and lower teeth is $\geqslant$ 4 mm. Exclusion criteria: (1) There was a history of correction before enrollment; (2) Periodontal diseases; (3) Concomitant systemic organic diseases; (4) Infectious diseases; (5) No obvious symptoms of protrusion of soft tissue in the jaw.

2.2 Corrective methods

The selected cases in this study were all treated with a hidden and beautiful bracket less orthodontic device, with the second premolar removed for correction. Before treatment, the patient took a panoramic film, made a model of the head side film, and had an oral scan. The orthodontic method was designed based on the actual situation of their dentition, the patient's orthodontic plan was designed, and the orthodontic device was processed. The first molars and first premolars use interactive anchorage to move relative first, while the remaining teeth remain stationary. The first molars move mesially by 1/2 before starting to move mesially by the second molars. After the first premolars move distally by 1/2, they begin to move the canines. The canines move distally by 1/2 before moving the incisors. It is recommended to control the movement of the molars in the mesial direction within 0.25mm per step, and to

pause for every 3 steps or tilt 0.1° towards the distal direction to prevent mesial inclination.
The correction of severe molar crown tilt often exceeds the therapeutic ability of invisible orthodontics. A long traction hook made of 1925 orthodontic stainless steel wire that can be bonded near the gingival side of the molar lip surface through an auxiliary device. Long traction hook and opposing teeth or orthodontic appliance are used for traction to correct the inclination of the molars in the mesial region.
Cooperate with implant anchorage traction to move molars mesially.

3. TYPICAL CASES

After initial consultation, this patient underwent facial, intraoral, curved tomographic, and lateral cranial imaging. After measurement and analysis, a detailed treatment plan was developed, and after about 20 months of treatment, the correction goal was ultimately achieved.

3.1 Pre treatment information

Patient, female, 15 years old, with uneven teeth and a 'heaven and earth' condition. Past history: Denial of systematic medical history and denial of allergic history. The pre-treatment examination showed that the patient was a straight faced type, with a smile that did not reveal the gums; The profile is normal, with normal chin labial sulcus and normal chin development. The frontal, smiling, and lateral photos are shown in Fig. 1.

Fig.1 Typical case photos

Oral examination: The dentition is 7-7 in the upper jaw and 7-7 in the lower jaw; 12. 22, 24 reverse combination; Neutral relationship of right molar, mesial relationship of left molar, mesial relationship of bilateral canine; 1.5mm to the right of the upper centerline. Model analysis: Crowding degree: upper arch 6mm, lower arch 4mm; Bolton's ratio: front tooth ratio 75.55%, full tooth ratio 89 36%; Speed curve curvature: 2mm on the right and 2mm on the left. The intraoral image before treatment is shown in Fig. 2.

Fig.2 Intraoral irradiation before treatment

Curved surface tomography shows 18, 38, and 48 teeth remaining.
Head to side X-ray shows: Type II, Class I; Mean angle; Slightly labial inclination of upper anterior teeth; Lower anterior lingual inclination; The upper lip soft tissue is located 1.5mm behind the E-line, while the lower lip soft tissue is located on the E-line. The panoramic and cephalic films before treatment are shown in Fig. 3.

Fig.3 Pre treatment panoramic and cephalometric films

3.2 Diagnosis and treatment plan

The diagnosis of this patient is a Class III subclass malocclusion; Bone type III malocclusion; Mean angle; Crowded upper and lower teeth; 12, 22, and 24 are reversed, with uneven centerline. The treatment goal is to relieve the crowding of the upper and lower teeth, slightly retract the upper and lower anterior teeth, achieve a neutral relationship between the molars and canines, and adjust the alignment of the upper and lower midline.
Treatment plan: (1) Extract teeth 15, 25, 35, and 45; (2) Use the extraction gap to align the upper and lower jaw dentition; (3) Slightly retract the upper and lower anterior teeth to establish normal overbite coverage; (4) The remaining space is used for the mesial movement of the molars.

3.3 Treatment Process

Stage 1 Clincheck design: 50+3 steps for the appliance.
1. Bonding the attachment, starting from Step 2: Extracting and moving the teeth.
2. Maxillary design: Extract 15 and 25 teeth, use the extraction gap to relieve crowding of the maxillary dentition, and slightly retract the upper anterior teeth. Refer to the position of 22 teeth to achieve 1mm coverage of the anterior teeth, and the remaining gap is used for mesial movement of the molars.
3. Mandibular design for extraction of 35 and 45 teeth to relieve crowding; Align the lower centerline with the upper centerline; Cooperate with Class III traction of 17-43 and 27-33 to move the maxillary molars mesially and slightly retract the anterior teeth.
4. The inclination of the adjacent roots on both sides of the upper and lower extraction spaces has been designed and corrected. Prevent the molars from tilting towards the middle during the clearance closure process.
5. The lower anterior teeth increase the coronal torque adduction through the power ridge and lingual pressure zone to prevent tongue tilting during the process of lower anterior tooth adduction. The design of the upper and lower front teeth is slightly depressed.

6. After the 16 and 26 teeth move in place, move 17 and 27 teeth closer to the center. After the 36 and 46 teeth move in place, move 37 and 47 teeth closer to the center
7. Design of attachments: 12, 13, 14, 22, 23, 24, 34, 44 teeth optimized attachments, 16, 17, 26, 27, 36, 37, 46, 47, 33, 43 teeth rectangular attachments.
At the 5th month of treatment, the crowns of teeth 36 and 46 in the lower jaw were tilted mesially, so power arms were attached to the teeth 36 and 46, tongue buttons were attached to the teeth 14 and 24, and Class II traction (3/16 3.5oz) was applied to the teeth 14-46 and 24-36, and the teeth 36 and 46 were vertical. After five months of treatment, the intraoral photos are shown in Fig. 4.

Fig.4 Oral radiation for five months of treatment

The eleventh month of treatment: 16, 26, 36, 46 teeth moved in place and began to move 17, 27, 37, and 47 teeth. On the 17th and 27th teeth, there are Class III traction (3/8 3.5oz) for the 17th and 27th teeth, Class II traction (1/8 3.5oz) for the 46th teeth, and Class II traction (1/8 3.5oz) for the 14th and 46th teeth. After eleven months of treatment, the intraoral photos are shown in Fig. 5.

Fig.5 Oral irradiation after 11 months of treatment

The 20th month of treatment: The upper and lower molars move in place in the mesial direction, the extraction gap is closed, the anterior teeth overlap is normal, the posterior teeth have a slightly poor occlusion relationship, and the lower midline is 1mm to the right. After 20 months of treatment, the intraoral photos are shown in Fig. 6.

Fig.6 Oral radiation after 20 months of treatment

Stage 2 Reboot Fine Adjustment: Clincheck Design: Orthopedic Steps 27+3.
1. The above centerline is for reference, adjust the lower centerline to align with the upper centerline.
2. Level and align the upper and lower teeth, and finely adjust the occlusal relationship.
After fine tuning, the intraoral view is shown in Fig. 7.

Fig.7 Fine tuned intraoral photography

The final panoramic film and head side film are shown in Fig. 8.

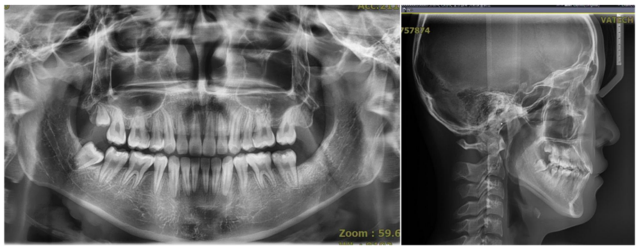

Fig.8 Final panoramic film and head side film

4. CONCLUSION

The average active treatment time for all cases was about 28 months, achieving the expected treatment effect. After the correction is completed, the teeth are arranged neatly, the extraction gap is completely closed, the anterior teeth overlap and cover are normal, the upper and lower midline are aligned, and the relationship between the molars and canines on both sides is Class I occlusion. The average time for maxillary closure is 18 months, with the first maxillary molar moving at least 2mm and at most 4mm, with an average of 3mm; The average time for closing the mandibular gap is 18 months, and the mandibular first molar moves at least 2mm, at most 4mm, and on average 3mm.
Non bracket invisible orthodontic technology, such as the Invialign system, can effectively control the movement of molars in the mesial region as long as it is properly designed. Invisible orthodontic treatment can be used alone or in conjunction with fixed orthodontic techniques and implant anchorage to achieve faster and more accurate orthodontic treatment goals.

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