TREATMENT OF ANGLE CLASS I MALOCCLUSION TYPE I AND III USING REMOVABLE ORTHODONTIC APPLIANCES: CASE REPORT

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ABSTRACT

Malocclusion is a dental and oral health problem that adolescents often experience. According to the World Health Organization (WHO), malocclusion is the third most common dental health problem after dental caries and periodontal disease. Malocclusion can cause several problems related to the face, including impaired facial aesthetics and dental issues such as difficulty moving the jaw, temporomandibular disorders, and problems with mastication, swallowing, and speaking. Malocclusion can appear in various forms, the most common being anterior teeth crowding, a condition reported by many patients seeking orthodontic treatment. Removable orthodontic appliances are a safe, easy, and aesthetically acceptable treatment alternative for mild crowding cases. This case report discusses the management of orthodontic treatment in the late mixed dentition period in a male patient with class I type I and type III malocclusion using a removable orthodontic appliance. A 13-year-old male patient came to RSGM Maranatha with complaints of crooked and crowded upper and lower front teeth, which made him insecure when smiling. The patient had never used a fixed or removable orthodontic appliance before. The patient reported no problems with chewing or speaking. There have been changes in the arrangement of the patient's maxillary teeth, but the resulting changes in the mandibular teeth have not been significant.

Keywords: Class I Malocclusion, Anterior Crowding, Anterior Crossbite.

INTRODUCTION

Malocclusion is an abnormal occlusion caused by a proper arrangement of teeth in an irregular curve and the absence of a harmonious relationship between the upper and lower teeth. Malocclusion occurs when the teeth, jawbone, and skull are not balanced, and the surrounding muscles do not provide functional balance, resulting in poor aesthetics. (Bhalajhi, 2004; Proffit et al., 2013; Singh, 2007)The prevalence of malocclusion in Indonesia alone reaches 80% of the population, becoming the third highest oral health problem worldwide after caries and *periodontal disease*. The presence of malpositions in the anterior teeth causes most patients to undergo orthodontic treatment. (Pambudi-Rahardjo, 2009).

Malocclusion can cause several facial-related problems, including impaired facial aesthetics, psychosocial issues, difficulties in jaw movement, temporomandibular disorders, chewing problems, swallowing problems, and speech problems. Malocclusion can appear in various forms, the most common being crowding, which is often complained of by patients seeking orthodontic treatment. (Alam et al., 2018; Riyanti, 2018). According to Graber, the purpose of orthodontic treatment is to prevent and correct malocclusion of the teeth and obtain a harmonious facial shape, so that the function of the masticatory apparatus becomes good and normal. For this reason, an analysis is needed to serve as a guideline for determining the appropriate diagnosis and treatment plan for orthodontic treatment. (Graber et al., 2004).

Crowding is a condition in which teeth are crammed outside the typical arrangement of the jaw curve. Anterior *crowding* (*mild to moderate) can be corrected with a detachable* orthodontic device. The most important thing is that removable orthodontic devices require the patient's cooperation in using them and in following the dentist's instructions. The success of treatment depends not only on the patient's cooperation during use but also on the operator's task of designing and manufacturing a device that the patient easily tolerates. (Erdinc et al., 2006; Graber et al., 2004).

The purpose of writing this case study was to describe orthodontic treatment in patients with type 1 and type 3 Angle malocclusion class I using removable orthodontic devices. The writing of this case study has received the patients' approval for publication for scientific purposes.

A 13-year-old male patient came to the Maranatha Dental and Oral Hospital with complaints of crowded upper and lower anterior teeth, felt since +/-5 years ago, and wished to have them aligned. The patient does not feel any disturbance in chewing or speaking. The patient has never had braces treatment before. The patient wants his teeth tidied. The results of the anamnesis regarding the history of the disease show that the patient has no history of disease, hospital treatment, surgery, drug use, dental trauma, or bad habits.

The results of the extraoral examination showed that the patient had a symmetrical face with a standard face type and a flat face profile (Figure 1), typical lip shape and lip relations, and a right-sided deviation of the TMJ by +/- 2mm when opening the mouth. The results of the intra-oral examination are shown in Table 1; the patient's odontogram is shown in Figure 2; and dental malposition is shown in Table 2.

Figure 1

Figure 1. Extra oral photos of patients before treatment

Table 1. Results of Intra-Oral Examination

1	OH (*oral hygiene*)	Good RA:-
2	Plaque	RB:33-43
3	Calculus	RA:- RB:-
4	Frenulum Labial	RA: normal RB: normal
5	Tongue	Usual
6	Palatum	Usual
7	Tonsils	Usual
8	Median line	Inappropriate
9	*Overbite*	2mm (standard)
10	*Overjet*	2mm (standard)
11	*Crossbite*	Previous (11x42, 21x42, 21x31)
12	Diastema	None
13	Curve of Spee	Usual
14	Eruption	Usual
15	Number of teeth	Usual
16	Mandibular Closure	Deviation to the right 2mm

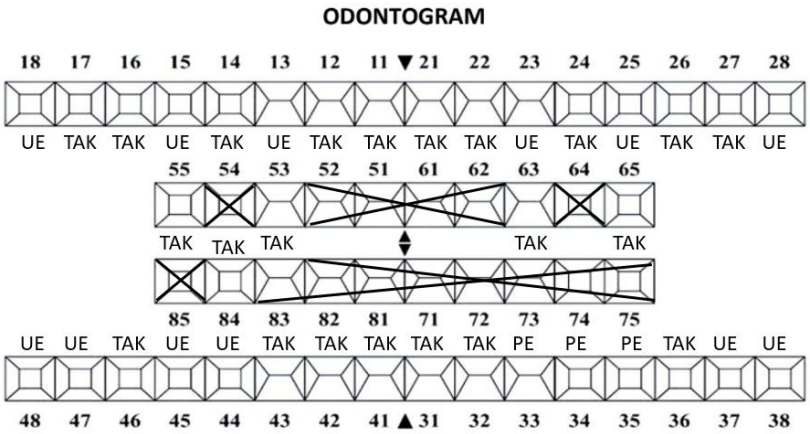

Figure 2. Patient Odontogram

Table 2. Dental Malposition

Tooth	Malposition	Tooth	Malposition
11	Palatoversion	21	NOT
12	Dystolabioversion	22	Mesiopalatoversion
13	PE	23	PE
14	NOT	24	NOT
15	NOT	25	NOT
16	NOT	26	NOT
17	-	27	-
18	-	28	-
41	Labioversion	31	Dystolinguoversion

42	Dystolinguoversion	32	Mesiopalatoversion
43	Dystolinguoversion	33	Dystolinguoversion
44	PE	34	PE
45	NOT	35	NOT
44	-	36	-
47	-	37	-
48	-	38	-

Figure 3. Intraoral photos of the patient before treatment

LITERATURE REVIEW

For patients presenting with a crowded arch, there is debate as to which treatment method (extractionor non-extraction) is the most effective in attaining long-term stability. To correct the crowded arch, premolar extraction has been a recognized practice. But even with retraction in extraction treatment, teeth may return to their pre-treatment position. As now-a-days the aesthetic of soft tissue profile and growth changes are becoming main factors during treatment planning, orthodontic treatment methods are favoring non-extraction with that in mind10. Different studies have found that relapse of anterior crowding is common in patients who are treated via the extraction method (Inchongolo, 2022).

Crowding, or crammed teeth, is the most common and widely observed, especially in the anterior region. Some of the factors that contribute to the occurrence of *crowding* include the effect of soft tissue pressure and the position and size of the tongue, pressure from the cheeks that affect the inclination of the teeth, characteristics and morphology of the mandible, anterior movements due to eruption of the molar, *anterior component of force*, and anterior occlusion, such as *overjet* and *overbite*. Due to limited space, crowding is divided into light (1–3 mm), medium (4–6 mm), and heavy (>6 mm) categories. (Alam et al., 2018). In this case, the patient's crowding is moderate. (Alhazmi & al., 2022).

RESEARCH METHOD

After extra-oral and intra-oral examinations, tooth printing is performed to obtain a study model for model analysis. From the study

model, an overjet of 2 mm and an overbite of 2 mm are observed. There are no *crossbites and diastemas on the upper and lower jaws*. Right molar relationship: class I; left: class I. Right canine relationship class I and left class I. Median line of the lower jaw shifted to the right by 1 mm.

In the sagittal examination of the upper jaw, region 1 is farther from the median line than region 2; in the transverse examination, region 1 is more anterior than region 2. The sagittal examination of the lower jaw in region 3 was farther from the median line than in region 4, and the transverse examination of the lower jaw in region 3 was more anterior than in region 4. The analysis of the difference in the length of the jaw curve and the teeth (ALD) showed a lack of space of 2 mm in the upper jaw, and in the six anterior teeth of the upper jaw, there was a lack of space of 2 mm. In the lower jaw, there is a lack of space of 8.5 mm in the upper jaw, and in the six anterior teeth of the upper jaw, there is a lack of space of 8.5 mm.

Bolton's analysis showed a ratio of 6 anterior teeth to 71.8, where the proportions of the 6th anterior teeth in the maxillary and mandibular arches were not appropriate (error in the upper jaw). The ratio of 12 teeth in total was 88.76, where the proportion of the size of the 12 maxillary and mandibular teeth was not appropriate (elasticity in the upper jaw teeth). Howes' analysis shows that the Howes index is 73.52%, indicating the need for expansion to meet space requirements. The width of the tooth arch is greater than the width of the jaw arch, so that it can be expanded laterally. Pont's analysis showed that regions 14–24 and regions 16–26 experienced constriction.

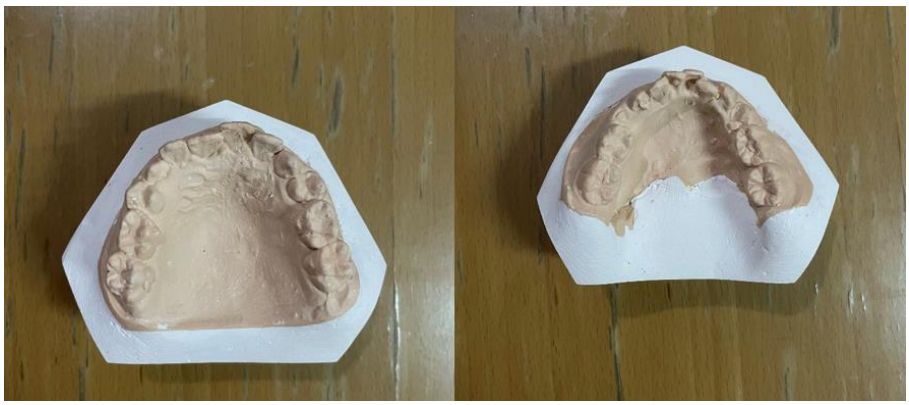

Figure 4. Patient Study Model Photos Before Treatment

List of Problems According to Proffit Classification – Ackerman

The patient's facial proportions and aesthetics are symmetrical, with a standard face type and a flat face profile. In the alignment and curve of the teeth, there is *anterior crowding* of the upper and lower jaws. In the transverse alignment, there is a shift of the midline of the lower jaw to the left by 2 mm. In the sagittal relationship, the right molar relationship of class I and left class I, the right canine relationship of class I and left class I, and *the right overjet* of 2mm, left 2mm. In the vertical connection, there is *a 2 mm right* spee curve and *a 1 mm left* spee curve.

RESEARCH RESULTS

Diagnosis, Aetiology, and Treatment Objectives

The diagnosis of this case is type 1 and type 3 Angle malocclusion class I. The etiology of malocclusion in this case is hereditary, as well as the mismatch in the size of the jaw and tooth arches. The purpose of treatment in this case is to correct dental malpositions in the upper and lower jaws.

Treatment Plan

Before initiating orthodontic therapy, preliminary management included oral hygiene instruction and dietary guidance, scaling, observation, restorative procedures, fabrication of working models, and planning of removable orthodontic appliance design appropriate to the patient's needs. In the upper arch, analysis of the arch length discrepancy indicated a 2.0 mm space deficiency, which was addressed through staged lateral expansion achieved by activating the expansion screw by a quarter turn each week. Correction of individual tooth malpositions was facilitated using 0.7 mm stainless-steel z-springs: tooth 11 was moved labially to address palatoversion; tooth 12 was similarly repositioned to correct distolabioversion; and tooth 22 was advanced labially to resolve mesiopalatoversion, with each spring positioned mesially for optimal force direction. Partial eruptions of teeth 13 and 23 were managed by further activating the expansion screw to create additional space, supplemented by closed springs to encourage eruption. Tooth 21 was stabilised against palatal displacement using a z-spring configured to maintain its position. Retention for the upper arch was provided through Adams clasps on teeth 16 and 26, complemented by a labial bow incorporating U-loops at teeth 13 and 23.

In the lower arch, assessment of the arch length discrepancy revealed an 8.5 mm space deficiency, with the tooth arch notably narrower than the basal arch. This shortage was managed through incremental lateral expansion, achieved by activating the expansion screw by a quarter turn each week until the required 8.5 mm increase was obtained. Labial movement of several teeth presenting with linguoversion was facilitated using 0.7 mm stainless-steel z-springs positioned mesially: tooth 33 for distolinguoversion, tooth 32 for mesiolinguoversion, tooth 31 for mesiolinguoversion, and teeth 42 and 43 for distolinguoversion. A partial eruption involving tooth 44 was addressed by further activation of the expansion screw to provide additional space, supplemented with a 0.7 mm stainless-steel T-loop to guide eruption. Adams provided retention for the lower arch clasps on teeth 36 and 46, together with a labial bow incorporating U-loops at teeth 33 and 43

Figure 5. Upper and Lower Jaw Removal Orthodontic Appliance Design

Treatment Progress

Before insertion into the patient's oral cavity, the orthodontic apparatus is prepared and examined. At the first visit, the patient is introduced to the orthodontic device and its components, and the device is then inserted into the patient's oral cavity. When the device is installed in the patient's oral cavity, an evaluation is performed to determine whether there are sharp parts or excessive pressure on the teeth or mucosa. All active components must be in a passive state, and the retention components are adjusted so that the appliance does not come off. After the orthodontic appliance is adjusted, the patient is then taught how to put on and remove the appliance and is given instructions for maintaining the oral cavity and orthodontic devices, as well as instructions for their use.

One week after appliance delivery, the patient returned for review and activation following a period of adaptation. After confirming that no discomfort or adverse symptoms had occurred during the first week of wear, activation proceeded according to the planned protocol. The first five activations involved weekly adjustment of both upper and lower expansion screws by a quarter turn. From the sixth activation onward, each visit included not only a further quarter-turn activation of both expansion screws but also reactivation of the z-springs in the upper and lower arches to ensure continued alignment and controlled tooth movement. This combined approach was maintained consistently through the tenth activation.

The patient has been wearing the device for approximately 9 months of treatment. During those several months, the patient admitted to having used the device for approximately 12 hours per day. The patient added that the device is most often worn at night before going to bed. In the morning and throughout the day, patients sometimes use their tools if they don't forget to take them to school. Patients also maintain oral cavity cleanliness by brushing their teeth before using the tool and cleaning it regularly.

Figure 6. Intraoral photos of patients after treatment

DISCUSSION

According to the WHO, malocclusion is the third most common dental health problem after dental caries and *periodontal disease*. Malocclusion is one of the dental and oral health problems that adolescents often experience. However, malocclusion is not a disease but rather a condition in which the arrangement of the upper and lower teeth is not harmonious and can have psychological effects on a person. (Ryan, 2019).

According to the WHO, malocclusion can result from abnormalities of the teeth and jawbones, the combination of teeth and jaws, the chewing muscles, and other factors, such as bad habits and genetics. Moyers and Profitt have classified the etiology of malocclusion. Moyers classifies the etiology of malocclusion into six categories: hereditary, causes of unknown origin, trauma, physical agents, bad habits, and disease. Meanwhile, Profitt classifies the etiology of malocclusion into three categories: specific causes, environmental influences, and genetic influences. Although the etiology of malocclusion in patients cannot be eliminated, it can be prevented and reduced by initiating treatment as early as possible and at the right time to minimize its progression. (Rapeepattana et al., 2019).

Malocclusion can affect a person's appearance. For adolescents, facial appearance and tooth arrangement are highly meaningful, especially during a rapid period of psychosocial development. Studies show that facial appearance not only affects others' perceptions of themselves but also shapes their own perceptions. Good self-perception will increase self-esteem and generate satisfaction with appearance. While self-satisfaction can improve social functioning, malocclusion can also cause unwanted things, such as abnormalities in the *temporomandibular joint* (TMJ) (Riyanti, 2018).

In 1908, Angle introduced a classification system for malocclusion based on the anteroposterior relationship of the teeth, a framework that continues to underpin contemporary orthodontic diagnosis (Bhalajhi, 2004; Proffit et al., 2013; Singh, 2007). In Class I malocclusion, the mesiobuccal cusp of the maxillary first permanent molar aligns correctly with the mesiobuccal groove of the mandibular first permanent molar. However, other dental irregularities may still be present. Class II malocclusion is defined by a distal positioning of the mandibular molar, such that the distobuccal cusp of the maxillary first molar occludes with the buccal groove of the mandibular

first molar. Conversely, Class III malocclusion is characterised by a mesial positioning of the mandibular molar, where the mesiobuccal cusp of the maxillary first molar occludes between the mandibular first and second molars.

Removable orthodontic devices are orthodontic devices that can be removed and installed by the patient themselves. Detachable orthodontic devices consist of three components: a force component, or active component, consisting of a spring, screw, or elastic; a fixation component, or retention component, in the form of a commonly used clasp; and a base plate or framework made from self-cured or heat-cured acrylic. It is filled with parts called *clasps* (Hafizi & Gemilang, 2022).

Removable orthodontic appliances present a safe, easy, inexpensive, and aesthetically acceptable treatment alternative for mild *crowding cases*. There are several advantages, namely that the patient can release it without affecting aesthetics and that it is easy to clean, allowing proper oral hygiene to be maintained. According to Profit et al., detachable orthodontic devices have the advantage of being affordable for patients and easy for clinicians to adjust. Although the use of removable orthodontic appliances provides advantages, the success of removable orthodontic treatment is influenced by the accuracy of the treatment plan, patient coordination in both device use and routine control, and dental condition in the oral cavity (Hafizi & Gemilang, 2022; Ryan, 2019).

Malocclusion treatment with a removable device can only produce limited tooth movement, i.e., tipping. Rotational movements may be made if the force of the couple is used, but the movements bodily, torquing and up-righting are very difficult or impossible to produce by the tool using this tool to correct malocclusion is more complex, so to improve its ability, in some cases it can be expanded by the addition of several fixed tool components combined with the use of a detachable tool. The detachment device can be used simultaneously or alternately on one or both jaws, depending on the case and the desired correction.

In this case, the patient was diagnosed with Class I Angle malocclusion type 1 and type 3. Space procurement due to crowding can be done in several ways, including jaw expansion, tooth extraction, and slicing, followed by gradual activation of the active orthodontic device. Based on the analysis, the room is obtained by expanding the upper and lower jaws, and the movement of the active z-spring and labial bow helps correct tooth malposition.

CONCLUSION

A 13-year-old male patient with class I type 1 and type 3 angle malocclusion was treated with a detached orthodontic device. Removable orthodontic devices can correct mild malocclusion, but treatment success depends on cooperation, timely follow-up, patient adherence to using the device for at least 8 hours/day, and other factors. In this case, the patient's teeth have not been fully corrected, so the patient is advised to continue orthodontic treatment until the ideal tooth curve and occlusal alignment are achieved.

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