

Correction of anterior crossbite with inclined bite plane: a literature review Koreksi *anterior crossbite* dengan *inclined bite plane*: sebuah kajian pustaka

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ABSTRACT

Anterior crossbite is a condition that occurs due to discrepancy between the maxillary and mandibular anterior teeth in occlusion which the maxillary teeth are more lingual than the mandibular teeth. Anterior crossbite often occurs in children in the mixed dentition phase, so treatment is needed as early as possible to eliminate the causes of malocclusion and the need for more complex orthodontic treatment. There are various treatments for anterior crossbite, one of them is the inclined bite plane. This literature review aims to determine the treatment of anterior crossbite with inclined bite plane and the factors that influence the duration of treatment. The method used is to collect literature from search engines such as Pubmed, Scielo, Google Scholar, Science Direct, Elsevier, Ajodo.org which discusses the treatment of anterior crossbite with inclined bite plane, then reviewed. From the results of the journal search, 7 literatures relevant to the topic were obtained. From the results of the literature review, it can be concluded that the treatment of anterior crossbite with inclined bite plane is quite effective. The factors that influence the duration of treatment are motivation, cooperation, and the type of inclined bite plane that used by the patient.

Keywords: anterior crossbite, children, duration, inclined bite plane

ABSTRAK

Crossbite anterior adalah suatu kondisi ketidaksesuaian antara gigi anterior rahang atas dan rahang bawah pada oklusi gigi RA lebih lingual daripada gigi RB. *Crossbite* anterior sering terjadi pada anak saat fase gigi bercampur, sehingga diperlukan perawatan sedini mungkin untuk menghilangkan penyebab maloklusi dan kebutuhan akan perawatan ortodontik yang lebih kompleks. Ada berbagai perawatan untuk *crossbite* anterior, salah satunya adalah *inclined bite plane*. Pada kajian pustaka ini dibahas perawatan *crossbite* anterior dengan *inclined bite plane* dan faktor-faktor yang mempengaruhi lamanya perawatan. Dari *search engine* seperti Pubmed, Scielo, Google Scholar, Science Direct, Elsevier, Ajodo.org dikumpulkan pustaka yang membahas tentang penanganan *crossbite* anterior dengan *inclined bite plane* selanjutnya di-review. Dari penelusuran artikel didapatkan 7 pustaka yang relevan dengan topik tersebut. Disimpulkan bahwa perawatan *crossbite* anterior dengan *inclined bite plane* cukup efektif. Faktor-faktor yang memengaruhi lama perawatan adalah motivasi, kerjasama, dan jenis *inclined bite plane*-nya.

Kata kunci: *crossbite* anterior, anak, durasi pengobatan, *inclined bite plane*

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INTRODUCTION

The condition of dental and oral health of the Indonesian, especially children, is still in the category of concern. Children who are in a period of growth and development need more attention from parents and dentists on their oral health. The period of growth and development is a period of occurrence of various changes including in the oral cavity and has an important role for orthodontic science in determining the ideal treatment time. The growth and development of each child is different. The replacement of primary teeth into permanent teeth proves a process of growth and development. During this period, malocclusion can be found, including cases of crossbite. Each case of malocclusion has a different ideal orthodontic treatment time.¹⁻⁴

Crossbite is a condition that one or more teeth are positioned more buccally or lingually to the opposing teeth. This situation is an important thing that must be considered for parents regarding the growth and development of the early mixed dentition period in their

children. However, that thing gets less attention from parents.^{5,6}

The early mixed dentition period is a phase that often occurs in malocclusion, one of them is a posterior crossbite. Posterior crossbite has a prevalence rate about 8-22%. Based on a study on posterior crossbite that occurred in the mixed dentition phase, it was found that 7.5% of 489 people had posterior crossbite. This prevalence is slightly different from studies conducted in the United States where the results obtained are only 3%. Unilateral posterior is a type of posterior crossbite that often occurs with a prevalence about 80-97%. Cases unilateral crossbite posterior are usually accompanied by mandibular displacement during chewing.⁷

A study conducted on primary school children in Brazil showed that 28.1% had a crossbite. The highest frequency of crossbite was 39.3% in elementary school children aged 13 years, then 32% occurred in children aged 14 years. Based on the type of crossbite, unilateral crossbite occurred in 45.9% of children and the occur-

rence of anterior crossbite was 34.4%.⁸

Anterior crossbite is a malocclusion that often occurs during growth and development of children during the period of mixed teeth. Incidence of anterior crossbite in children about from 7-10%. In a study that examined on orthodontic patients found that the prevalence of anterior crossbite was about 24-36%.⁹

As previously explained, anterior crossbite often occurs in the early mixed dentition period. It can cause the mandible move more anterior to the maxilla. If the anterior crossbite is not treated immediately, it will affect the growth and development of the child's jaw in a more severe direction such as the occurrence of skeletal class III malocclusion.⁶

Treatment of anterior crossbite is still rare in dental practice. One of the factors is that many parents still do not understand the importance of early treatment. In addition, children's fear of dental treatment makes it difficult for parents to take their children to the dentist. The responsibility of professional dentists, especially pediatric dentists and orthodontists, is important so that they can be checked as early as possible if they find abnormalities in their children to avoid the effects that may arise in the future.⁶

Treatment of anterior crossbite should be concern to both parents and dentists. As previously explained, anterior crossbite often occurs during the growth and development of children, so it is necessary to treat it as early as possible. The ideal age to treat anterior crossbite is 8-11 years. At that age, the roots are in the process of forming and the teeth are in an active eruption stage. Early treatment aims to eliminate the factors that cause malocclusion so as to prevent misaligned dental, skeletal, and functional development. If early treatment is carried out, it will minimize or eliminate the need for more complex treatment in the permanent dentition.^{10,11}

Currently, there are many types of treatment options that can be done for the correction of anterior crossbite. There are treatment options that use active or passive appliances. Types of active appliances used for correction of anterior crossbite such as upper Hawley appliance, heavy labial arch 2-by 4 appliance, upper light labial arch or upper lingual arch. As for the type of passive appliances used, it can be in the form of a tongue blade, inclined bite plane or reversed stainless steel crown. The inclined bite plane is one type of passive appliance that is often used for correction of anterior crossbite. As the name implies, this device is tilted to the occlusal plane. This bite plane is a useful plane for opening the bite temporarily, if there are upper anterior teeth in contact with lower anterior teeth. The duration of treatment required for correction of an anterior crossbite varies. This depends on the success rate of treatment which is influenced by the age of the patient,

the time of treatment, the severity of the case, the available space, and the cooperation of the patient.^{12,13}

Based on the description above, the idea arises to discuss the treatment of anterior crossbite with inclined bite plane.

METHODS

The design of this study is a literature review that collecting data related to a particular topic from various sources such as journals, books, internet, and other libraries. The inclusion criteria of this paper are literatures were published in 2011-2020, in Indonesian and English; the subjects were children in the mixed dentition phase. The literatures are case reports discussed treatment of anterior crossbite with inclined bite plane. The exclusion criteria are studies discussed the treatment of anterior crossbite but had previous orthodontic treatment and the subject has craniofacial abnormalities or cleft lip and palate.

The literature sources in this study mainly come from online research journals that provide free journal articles in PDF format, such as Pubmed, Scielo, Google Scholar, Science Direct, Elsevier (Scopus), Ajodo.org and other relevant sources with the keywords namely *crossbite anterior*, *inclined bite plane*, and *treatment crossbite anterior with inclined bite plane*.

RESULTS

Based on articles searching in Pubmed, Scielo, Google Scholar, Science Direct, Elsevier (Scopus), and Ajodo.org with keywords *crossbite anterior*, *inclined bite plane*, and *treatment of anterior crossbite with inclined bite plane* obtained 1,627 articles. However, after screening based on article titles that relevant to this study, 1,603 articles were excluded. After that, as assessment was made of the remaining 24 articles, so that 7 relevant articles were obtained based on the inclusion criteria.

Based on the literature search about the treatment of anterior crossbite with inclined bite plane, the results are shown in the table 1.

DISCUSSION

Based on the results of literature analysis, it was found that the average length of treatments were 1-4 weeks. Based on these results, it can be seen that younger age has no guarantee of being able to complete treatment in a shorter time, and vice versa. However, based on the literature, the ideal age to treat anterior crossbite is 8-11 years. During this period, the roots of the teeth are in the process of forming and the teeth are in an active eruption stage. Moreover, a child's motivation is also important to support the success of treatment. Other factors of growth and development of teeth are also ta-

Table 1 Treatment result of anterior crossbite with inclined bite plane

References	Age (y.o)	Gender	Overjet (mm)	Overbite (mm)	Duration (week)	Teeth are corrected	Appliance
Christiono S, Agusmawanti P (2018) ¹⁴	8	F	-2	3	4	21, 31	Removable
Utari TR, Abdillah N (2012) ¹⁵	10	F	-2	5	16	11, 21	Removable
Santoso D, Sutardjo I (2012) ¹⁶	11	F	-1	0,5	7	11, 21, 22	Removable
Santoso D, Sutardjo I (2012) ¹⁶	11	F	-3	4,8	5	11, 21, 22	Removable
Tiwari N, Tiwari S, Sharma D (2020) ¹⁷	8	M	-	-	1	11, 21, 31, 41	Fixed
Tiwari N, Tiwari S, Sharma D (2020) ¹⁷	8	F	-	-	1	21	Fixed
Tiwari N, Tiwari S, Sharma D (2020) ¹⁷	9	F	-	-	1	21, 31	Fixed
Baharin F, Hassan R (2019) ¹⁸	6	M	-	-	4	11, 21, 12	Fixed
Prakash P, Durgesh BH (2011) ¹⁹	9	F	-	-	3	21	Fixed
Prakash P, Durgesh BH (2011) ¹⁹	9	M	-	-	3	21	Fixed
Yildirim C, Akgun OM, Basak F(2014) ²⁰	8	M	-	-	3	12	Fixed
Yildirim C, Akgun OM, Basak F(2014) ²⁰	12	M	-	-	3	21	Fixed

ken into consideration such as crowding of the mandibular incisors, TMD, and maxillary deficiency. Other things to consider in case selection are the availability of space to restore the position of the teeth, sufficient overbite, and occlusion of the teeth.^{10,20,21}

A literature written by Borrie and Bearn recommends to do treatment as early as possible for correction of anterior crossbite. It is to reduce the rate of root resorption. Described in the literature, the rate of root resorption can be reduced due to the presence of pre-eruptive and pre-eruptive protective mechanisms in the young apex. It can be attributed that the duration of treatment had a significant correlation with post-treatment root resorption with an increase in treatment time leading to more severe root resorption. In addition to reducing the rate of root resorption, early treatment also aims to maintain muscle balance, balanced occlusal development, and prevent abnormal tissue growth of the skeletal and dentoalveolar components.^{22,23}

In the results of the literature analysis, it was found that male and female children of the same age achieved treatment outcomes with the same duration. Based on the results of the literature analysis, it can be seen that girls are more likely to treat anterior crossbite. This can be attributed to the greater enthusiasm of girls to carry out treatment than boys. In addition, the supporting factor for the success of treatment anterior crossbite is the communication and cooperation relationship between dentist and patient. By having a great spirit, girls also tend to be more cooperative. In addition, parents also tend to pay more attention to the aesthetics of their daughter's face.¹⁵

Things related to aesthetic is gingival recession. In cases of anterior crossbite, the anterior region of the mandible is more susceptible to the development of recession, especially in the presence of more occlusal loads due to malpositioned teeth. By considering aesthetic factors and preventing gingival recession, it is necessary to treat anterior crossbite as early as possible.

In addition to preventing problems that can arise in the gingiva, early diagnosis and treatment of anterior crossbite is also useful for preventing tooth wear, anterior tooth fractures, TMD and restoring better functional occlusion. Early diagnosis and treatment is also important for the physiological and psychological development of patients, especially in children.^{24,25}

Anterior crossbite is an abnormal labiolingual relationship on one or more maxillary anterior teeth to the mandibular anterior teeth. Anterior crossbite has a negative overjet. Based on the results of the literature analysis, it was found that the overjet and overbite values in the cases above did not affect the length of treatment. It means that the shorter overjet does not determine the shorter duration of the treatment, and vice versa. For example, based on the results of the literature analysis in one case, it was found that the duration of treatment lasted for 7 weeks with -1 mm initial overjet and there was a case with a larger overjet value (-3 mm) lasting a shorter time (5 weeks).²⁶

Reverse overjet or negative overjet exists because one or more anterior teeth are more lingual to the opposing teeth. Therefore, this can cause the patient to be insecure and uncomfortable with the condition of his teeth. Condition of the anterior teeth which are more lingual to the opposing teeth causes the patient to also have difficulty speaking and chewing food, so treatment is needed to correct this condition. Overjet can be caused by genetic factors, so that it can be passed on to their offspring. This can be seen in Indonesians who tend to have wide and square heads who belong to the same race, namely the paleomongoloid race (the Malay race). The existence of these racial differences can affect the growth pattern of the upper and lower jaws as well as excessive overjet. If excessive overjet was not treated for a long time, it can cause TMJ abnormalities and more severe malocclusion.^{27,28}

Conditions of crossbite and negative overjet value will not be changed without any treatment. As perma-

ment teeth grow and develop, to avoid further dysfunction and severity, initial treatment for correction anterior crossbite is indicated. It also stimulates balanced occlusal growth and development.²⁹

Based on the results of literature analysis, the success of treatment anterior crossbite in correcting overjet and overbite is closely related to patient compliance in using orthodontic appliances. If the patient obeys the doctor's instructions, it will be able to speed up the treatment time. On the other hand, if the patient does not comply with the doctor's instructions, it will slow down the treatment time and get unsatisfactory results. Determination of starting treatment early affects treatment. Ghislanzoni stated that the difference in treatment time during growth period plays an important role in dento-skeletal changes and occlusal contacts changes. The growth period depends on the sex. The age of 10-12 years is a period of growth acceleration in women while for men the acceleration period starts from the age of 12-14 years. In girls, the start of the growth spurt period is marked by menstruation, while in boys it is marked by a change in voice. At the limit of their respective age periods, growth will slow down at the age of 18-20 years.^{30,31}

In selecting an appliance for correction anterior crossbite is necessary to consider the number of vertical overbites. The use of a removable inclined plane is recommended if the number of vertical overbites in the case of an anterior is $\frac{1}{2}$ - $\frac{2}{3}$ or more of the crown length and involves $\frac{3}{4}$ of the front teeth. The inclined plane is indicated when there is sufficient space to align the proclined maxillary teeth. The tooth movement is

the result of the resultant force during muscle movement and inclined plane.¹⁴

These overjet and overbite values correspond to the number of teeth corrected. Based on the results of the literature analysis, the number of teeth corrected in the treatment anterior crossbite did not determine the length of treatment. For example, there were cases with the same sex and age but different number of corrected teeth, it was found that children with two corrected teeth achieved a shorter treatment duration about 1 week than children with 1 corrected tooth achieved a treatment duration about 3 weeks.^{17,19}

Based on the results of the literature analysis, it was found that the treatment of anterior crossbite with inclined bite plane fixed type relatively shorter than removable type. Based on the literature written by Tiwari et al; it is explained that the treatment of anterior crossbite with inclined bite plane fixed type requires less patient cooperation than removable type so that the treatment performed with inclined bite plane fixed type is shorter. This is consistent with literature written by Baharin et al that treatment anterior crossbite with inclined bite plane fixed types which is inclined bite plane is cemented in the mandibular incisor so that the treatment does not depend on patient cooperation.^{17,18}

Based on analysis of some literature about treatment of anterior crossbite with inclined bite plane, it can be concluded that the treatment of anterior crossbite with inclined bite plane is quite effective. Treatment time is influenced by motivation, patient cooperation, and type of inclined bite plane.

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