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The Influence of Fixed Orthodontic Treatment on Tooth Discoloration among Dental Students in Makassar, Indonesia

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ABSTRACT

The aims of fixed orthodontic treatment is to improve mastication function, aesthetics, prevent tissue damage and restore the normal function of oral cavity. Fixed orthodontic treatment could led poor oral hygiene for the patient because it could be a good place for residual food, led plaque accumulation under the appliance. Furthermore, plaque accumulation could led stain on tooth surface and tooth discoloration could develop. This research was to investigate the influence of fixed orthodontic treatment on tooth discoloration among Dental Students in Makassar, Indonesia. The research was conducting as an analytic observational with cross-sectional study design Sample of this research were 1st and 2nd year of dental students of Faculty of Dentistry, Universitas Muslim Indonesia in Makassar, Indonesia who were under fixed orthodontic treatment. Samples were devided into 2 groups, < 1 year and ≥ 2 years of fixed orthodontic treatment. Intraoral photograph from frontal view were taken, and outline of the labial surfaces of all the incisors were enlarged to scale (magnification × 4) and each tooth face divided into 4-mm squares. Labial surface of the incisors were drawn by the examiner on to the grid system using photoshop cc 2020. Data was statistically analyzed using Fisher exact test. The p-value of this research was less than 0.05, therefor the results of this research are statistically significant. Hypothesis was accepted and showed that there was an influence of fixed orthodontic treatment on tooth discoloration among dental students in Makassar, Indonesia.

Keywords: fixed orthodontic treatment, tooth discoloration, grid system

Introduction

The main aim of orthodontic treatment is to correct malocclusion, in order, whenever possible, to achieve functionally appropriate occlusion and optimum dental and facial aesthetics. “Orthodontic treatment need” can be defined as the degree to which a person needs orthodontic treatment because of certain features of his or her malocclusion, the functional, dental health or aesthetic impairment it occasions and the negative psychological and social repercussions to which it gives rise.[1]

The use of orthodontic devices today, both fixed and removable, has been widely used by the society, adults, and especially students. Amalia (2009) stated that patients with fixed orthodontic had less

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knowledge about the treatment. The patientswere not aware of the side effects of using fixed orthodontics, and those related to poor oral hygiene can worsen the root resorption and bone resorption, which can slow down the treatment. Lack of knowledge about the side effects of orthodontic treatment will cause the patients to be unaware of the side effects caused by the use of orthodontics devices. This will complicate the oral hygiene procedure in orthodontic patients. [2],[3],[4]

The benefits of a medical intervention must outweigh any potential harm. Apart from its benefits, orthodontic treatment can cause certain complications. During clinical orthodontic procedures, the use of various methods, devices, and materials can cause unwanted side effects, both local (e.g., tooth discoloration, decalcification, root resorption, and periodontal complications) and systemic (e.g., allergic reactions and crossinfections).[5]

Fixed orthodontic treatment can be a place for plaque accumulation due to increased biofilm formation after insertion. A research conducted by Jayanti (2017) mentioned that there was a relationship between the duration of the fixed orthodontic treatment and periodontal treatment needs. The effects of periodontal disease associated with fixed orthodontic use were gingivitis, periodontitis, gingival recession or hypertrophy, and alveolar bone loss.Periodontal complications that may appear during orthodontic treatment are gingivitis, periodontitis, gingival recession or hypertrophy, alveolar bone loss, dehiscences, fenestrations, interdental folds, and dark triangles. [6],[7],[8],[9]

Plaque also attacks the hard tissue of the teeth. This corresponds with the research conducted by Un-Bong (2017) stating thatthere was clinical development of dental discoloration during orthodontic treatment. Besides causing periodontal disease, plaque formed from fixed orthodontic devices could also leave colored marks on the surface of the tooth. This statement was supportedby the results of research conducted by Jufri (2017), stating that there was a relationship between fixed orthodontic treatment and dental discoloration.[10,[11]

Color alterations after orthodontic treatment are the result of several factors. More severe alterations occur when chemicallycured resins are used as bonding materials rather than lightcured composites. The resin tags cannot be removed by cleaning procedures without altering the enamel's surface. Irreversible changes occur to the enamel's surface morphology, rugosity, and texture, with negative consequences on its reflective properties, luminosity, and optical perception. Evidence shows that the adhesive resins used for bracket bonding do not present good color stability with time. Ultraviolet light and corrosion products from the orthodontic appliance combined with food dyes induce color alterations, with a tendency to move toward the yellow tones. Orthodontic forces induce variations in pulp vascularization. It is a possible factor for the premature aging of teeth, and it is an endogenous factor for discoloration too. In situations where white spots and lesions are present, even if remineralization occurs, the outcome may be different from the initial enamel structure. This is because of the differences in the minerals in the treated enamel surface compared to the untreated enamel.[12],[13],[14],[15],[16],[17],[18]

Leftover food, ultraviolet light, and corrosion products that come from fixed orthodontic devices affect discoloration with the tendency for teeth to turn into the yellowish color. According to the theory,

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the orthodontic treatment period varies according to the difficulty of the case. The average of estimated treatment time is 2 years but in fact the treatment time is often 50% longer than the predicted time, and it usually occurs in adolescents.[19],[20]

Based on the above, the researcher intends to conduct a research on **"**The Influence of Fixed Orthodontic Treatment on Tooth Discoloration among Dental Students in Makassar, Indonesia"

Research Methods

This research used observational analytic study design with cross-sectional study. This research was conducted at FKG-UMI Makassar in October-November 2019. The samples used were 23 people using fixed orthodontics in the upper and lower jaws with a purposive sampling method in accordance with the criteria determined by the writers. The data were processed by using SPSS version 25 with the use offisher exact test.

Research Result

A research has been conducted about the Influence of fixed orthodontic treatment on tooth discoloration among Dental students in Makassar, Indonesia. The data obtained from this study consisted of 23 samples of fixed orthodontic treatment users. The data obtained are as follows:

Table 5.1.1 Average Length of Fixed Orthodontic Treatment

Duration of Treatment (month)	Frequency	Percentage
> 12	15	65.2
≤ 12	8	34.8
Total	23	100

Table 5.1.1 showsthe average length of fixed orthodontic treatment of 23 samples. There are 15 users of fixed orthodontic treatment with treatment duration >12 months (65.2%) and 8 users of fixed orthodontic treatment with treatment duration ≤12 months (34.8%).

Table 5.1.2 Degrees of Dental Discoloration

Dental Discoloration	Frequency	Percentage
0	9	39.1
1	12	52.2
2	2	8.7

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3	0	0
4	0	0
Total	23	100

Table 5.1.2 shows the degrees of dental discoloration of 23 samples. 12 samples (52.2%) have the discoloration degree of 1, and 2 samples (8.7%) have the discoloration degree of 2.

Table 5.1.3 The Influence of Orthodontic Treatment on Dental Discoloration

Duration of Treatment (month)	**Dental Discoloration**						**Total**		**P-value**
	0		**1**		**2**				
	N	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
> 12	3	20	10	66.7	2	13.3	15	100	0.033
≤ 12	6	75	2	25	0	0	8	100	
Total	9	39.1	12	52.2	2	8.7	23	100	

Table 5.1.3 shows that out of 15 samples with treatment duration >12 months, 10 samples (66.7%) are in discoloration degrees 1, and 2 samples (13.3%) are in discoloration degrees 2. Meanwhile,out of 8 samples with treatment duration ≤12 months, 6 samples (75%) are in the discoloration degree 0, and 2 samples (25%) are in discoloration degree 1.

From table 5.1.3, the P-value obtained from statistical result fisher exact Test is0.033, or less than 0.05 which means that there is a significant influence between the duration offixed orthodontic treatment with dental discoloration.

Figure 1. An example of tooth discoloration on maxillary and mandibular incisors.

Discussion

The results of this study with P-value obtained from statistical result fisher exact test equal to0.033 indicate that there is a significant influence to the results of thisresearch. Thus, the alternative hypothesis (H_a) is accepted and the null hypothesis (H_0) is rejected. The highest level of dental discolorationis those with treatment duration >12 months with discoloration degree 1 (table 5.1.3). This

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correlates with Jufri's research (2017), which stated that there was a significant relationship between fixed orthodontic treatment and dental discoloration.

In tabel 5.1.1, it is found that the average length of fixed orthodontic treatment >12 months isused by 15 people (65.2%). Theoretically, the duration of fixed orthodontic treatment varies according to the difficulty of this case. The estimated average treatment periodis 2 years but in reality it might take 50% longer than expected that usually occurs in adolescents and may be longer in adults due to more difficult cases. This is supported by the research conducted by Yovela (2009) at Faculty of Dentistry, Universitas Indonesia which showed that adult patient needed longer period of treatment. [21],[22]

In fact, the question reveals a strong desire, especially by adult patients, for shorter treatment, since theanti-aesthetic look provided by orthodontic bracketsin addition to longer correction time are the majorfactors responsible for demotivating patients to havetreatment began.[23]

In the literature, no consensus has been reachedabout orthodontic treatment time. A recent systematic review revealed mean treatment time with fixedappliances of 19.9 months. However, there was significant variation among studies (with mean valuesranging from 14 to 33 months), and the quality oftreatment outcomes was not assessed. Whenevercases were assessed under the American Board of Orthodontics (ABO) standards, one-phase orthodontictreatment mean time was 24.6 months.[24],[25],[26]

On the other hand, orthodontic treatment meantime seems to be beyond patients' expectation. Whenasked about how long they would like treatment tolast, 40.8% of adolescent patients answered less than6 months, while 33.2% of them answered between6 and 12 months. Among adult patients, 42.9% answered between 6 and 12 months, while 26.5%answered between 12 and 18 months.[27]

Treatment duration would be almost 25 months if there were no missed appointments, no repairs were required, and only 1 instructor supervised the treatment. For any missed appointment treatment duration increased 2.67 months; for every orthodontic appliance issue/breakage treatment time increased 1.14 months; and for each different instructor it increased 6.6 months.[28]

Extremely long treatment time has been associated with greater susceptibility to iatrogenesis, whichin turn are associated with orthodontic appliances.This is the case of root resorption, white spots, carious lesions, and gingival inflammation.[29]

Table 5.1.2 regarding the degree of dental discoloration shows that it is on the degree of discoloration 1 in which 0.01% to 25% of the area is discolored. This result corresponds with Amalia's research (2009) which stated that the level of patient knowledge about fixed orthodontic treatment is categorized aslow. The patients wereunaware of the side effects from the use of fixed orthodontics,

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especially those related to poor oral hygiene that can worsen the root resorption and bone resorption, which can slow down the treatment. Lack of knowledge about the side effects of orthodontic treatment will cause the patients to be unaware of the side effects caused by the use of orthodontics devices. This will complicate the oral hygiene procedure in orthodontic patients. Fixed orthodontic treatment can be a place for plaque accumulation due to increased biofilm formation after insertion. A research conducted by Jayanti (2017) mentioned that there was a relationship between the duration of the fixed orthodontic treatment and periodontal treatment needs. The effects of periodontal disease associated with fixed orthodontic use were gingivitis, periodontitis, gingival recession or hypertrophy, and alveolar bone loss. Plaque is the most important factor in the initiation, development, and recurrence of periodontal disease. [2],[3],[4],[6],[30]

A research conducted by Sepideh Arab, et. al. in (2016) found that the intricate design of fixed orthodontic devices affects oral hygiene by influencing several factors, such as changes in salivary pH. Changes in salivary pH in the oral cavity cause demineralization in the enamel layer of the tooth which increases susceptibility to dental caries. Discoloration after fixed orthodontic treatment is influenced by multifactorial. Leftover food, ultraviolet light, and corrosion products that come from fixed orthodontic devices affect discoloration with the tendency for teeth to turn yellowish. Some of the variables causing dental discoloration are directly related to orthodontic treatment techniques. [11],[19],[31],[33],[34]

The frequency of dental discoloration can be much higher depending on the severity of the malocclusion, and fixed orthodontic devices have greater effects than removable orthodontic devices due to the use of resin material used to attach the brackets to the enamel. A research conducted by Huang et al (2013) stated that there werefew data related to the incidence of dental discoloration. A researchconductedby Un-Bong (2017) showed that there was a clinical development on dental discoloration during the orthodontic treatment. Besides causing periodontal disease, plaque formed from fixed orthodontic devices could also leave color marks on the surface of the tooth. [10],[19],[31],[32],[34]

A research conducted by Sandison (1981) and Fleming (1982) showed that enamel discoloration was influenced by enamel bonding and debonding procedures. The change in color of the enamel could originate from the post-debonding resin removal protocol, and the penetration of theresin taginto the enamel structure at depths reaching 50 mm. Impregnation of the resin into the enamel structure could not be reversed by debonding and cleaning procedures, and enamel discoloration could occur by direct absorption of food coloring and products from corrosion in orthodontic devices. [35],[36]

The relationship between dental discoloration and fixed orthodontic treatment is still controversial. Some researchers have concluded that performing bonding and debonding procedures do

not seem to have a significant effect on dental enamel color. Other researchers have shown that dental discoloration will occur when using this procedure. This systematic review is to evaluate the dental discoloration on enamel after the use of orthodontic resin and its cleaning procedures, and it is an interesting thing to learn. [36]

According to Rammadhan et al. (2016), one of the efforts to prevent and overcome dental health problems was through the dental health education approach. Dental health education delivered to someone is expected to be able to change his/her behavior and gain more knowledge about individual dental health from unhealthy behavior towards healthy behavior. Good dental health and oral hygiene are also influenced by the role of the dentist in providing motivation and instruction during fixed orthodontic treatment. Dentists need to provide proper motivation and instruction from the beginning to the end of fixed orthodontic treatment so that the patients are more concerned about the health of their teeth and mouth. In this study, however, the degree of dental discoloration of most students at Faculty of Dentistry, Universitas Muslim Indonesiais generally good because of the influence of knowledge acquired while undergoing their studies in the dentistry program. This can also increase students knowledge about dental care and dental discoloration, especially when having orthodontic treatment. [37],[38], [39], [40], [41], [42], [43]

Conclusion

Based on the research that has been done, it can be concluded that there is a significant influence between the duration of fixed orthodontic treatment on dental discoloration among dental students in Makassar, Indonesia.

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