

SYSTEMATIC REVIEW

Orthodontic Toothbrush Versus Conventional, Which One is More Effective for Fixed Orthodontic Patients: Systematic Review

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ABSTRACT

Aims: The use of fixed orthodontic appliances causes food impaction by increasing the risk of caries. The simple and effective plaque control is by brushing teeth. The toothbrushes that are often chosen by fixed orthodontic patients are orthodontic and conventional. The purpose of this study is to know the effectiveness of using an orthodontic toothbrush compared to a conventional toothbrush in fixed orthodontic patients. **Design:** Systematic review. **Data source:** Three databases- Google Scholar, PUBMED, and Science Direct were searched from December 20, 2020, until April 23, 2021. **Methods:** Databases were searched for the predefined keywords of "orthodontic toothbrush", "conventional toothbrush", "teeth brushing method", "fixed orthodontic appliances". The method used in this literature review is a search sourced from the database of journal providers, Google Scholar, PubMed, and Science Direct using keywords. This study's literature was collected from the database with the *Boolean Search method*, determining the keyword, then selected and evaluated for review. **Conclusion:** Orthodontic toothbrushes are more effective than conventional toothbrushes in fixed orthodontic patients. Based on 13 articles about the effectiveness of orthodontics compared to conventional toothbrushes, can be found that the patients who used orthodontic toothbrushes had good oral and dental health status, healthy gingiva, and lower caries rates than the patient who used conventional toothbrushes. Fixed orthodontic patients are recommended to use a toothbrush with soft bristles and also to brush their teeth using the Modified Bass technique.

Keywords: Orthodontic toothbrush; Conventional toothbrush; Teeth brushing method; Fixed orthodontic appliances.

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is reported that 60% of fixed orthodontic appliance patients have poor oral and dental hygiene due to prolonged use and lack of maintenance in oral and dental hygiene (2 p.2).

INTRODUCTION

Fixed orthodontic appliances are the most commonly used appliances for orthodontic treatment in use today. Nowadays it is growing in popularity and is used in a wide range of ages of patients, from children to adults. Patients use it not only for their oral health benefit, but it had also become an important part of their daily lives. Fixed orthodontic appliances have a complex design, which allows dental plaque to attach easily, and therefore increases the risk of cavities, gingivitis, and periodontal disease. Fixed orthodontic appliances are trickier to be cleaned properly compared to removable orthodontic appliances due to their unique design. Food impaction may also occur in fixed orthodontic appliances, resulting in plaque retention (1 p.32). It

One of the indicators by which we can assess one's oral hygiene is by evaluating the amount of dental plaque in the oral cavity. Plaque is a soft deposit that forms a biofilm on the teeth's surface or other rough surfaces in the oral cavity, for example, removable or fixed orthodontic appliances. When a patient failed to clean their oral cavity properly, dental plaque may adhere to the tooth surface (3 p.200).

Dental plaque can be removed by performing plaque control. Plaque control is a way to clean dental plaque regularly to prevent dental plaque accumulation on the tooth surface. Plaque control can be done in two ways, chemically and mechanically. Chemical plaque control is cleansing the oral cavity with mouthwash and toothpaste, while mechanically it can be done by toothbrushing and using dental floss. Among the

numerous types of plaque control, toothbrushing is the simplest, safest, and most effective technique. The effectiveness of toothbrushing itself depends on several factors, such as the frequency of toothbrushing, the types, and shapes of the toothbrush, as well as the technique being used (4 p.2).

There are three types of toothbrushes: conventional, electric, and orthodontics toothbrush. The vast majority of people use conventional toothbrushes daily. A standard toothbrush is made up of a brush head, bristles, a brush neck, and a brush handle. Dental plaque removal with conventional toothbrushes is reported to be effective (5 p.2). Patients with fixed orthodontic appliances are suggested to use an orthodontic toothbrush with a special design, in which the bristles in the middle are shorter than the bristles on the edges to ease dental plaque removal around the brackets. The selection of toothbrushing techniques is also crucial to maintain the hygiene and health of the oral cavity, especially for patients with fixed orthodontic appliances (6 p.5).

Based on the facts stated above, the author aims to compare the effectiveness of toothbrushing using an orthodontic toothbrush and a conventional toothbrush in a patient with fixed orthodontic appliances.

METHOD

Database search

The method used in this literature review is a search sourced from the database of journal providers, Google Scholar, PubMed, and Science Direct using keywords. The data search was carried out using the Boolean Search method. Articles or journals that meet the inclusion and exclusion criteria are taken, then analyzed.

Inclusion and exclusion criteria

The inclusion criteria for articles were as follows: 1) English-language journals; 2) Indonesian-language journals; 3) Indonesian-language journals, and 4) Indonesian-language journals. 2) The kind of article used Original research, randomized controlled trials, and full-text literature 3) Maximum search period of ten years (2011-2021); 4) All countries' geographies; 5) Google Scholar, PubMed, and Science Direct all use an online database. 6) The study area includes an orthodontic toothbrush, a conventional toothbrush, a brushing method, and a fixed orthodontic appliance; 7) Patients with fixed orthodontic appliances are the subject of the study. The following journals were excluded from this study: 1) Journals other than English and Indonesian 2) Article types: literature review, handbook, thesis, abstract, literature that cannot be accessed in full text; 3) Search date outside of the last ten years; 4) Other than stainless steel, patient subjects use fixed orthodontic material.

All the papers from the databases were imported into Mendeley® and duplicates were removed (8.307 studies). Initially, title/abstract screening was done using primary sorting. Later, the author screened all the studies using the following criteria (Table I).

Journals are critically evaluated and adjusted according to inclusion and exclusion criteria. The author evaluates the journals selected based on study focus, such as Orthodontic toothbrush, Conventional toothbrush, Teeth brushing method, and Fixed orthodontic appliances were summarized in a table. The summary table was created based on the researcher, chapter, purpose, data analysis, and journal result (Table II).

Table I : The Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Language	English, Indonesia	Other than English and Indonesia
Article Type	Original article, Randomized control trial, full text literatur	Literatur review, handbook, thesis, abstract, literatur that cannot be accessed full text
Time period	2011-2021	Outside of those years
Geography	All countries	-
Study focus	Orthodontic toothbrush, Conventional tooth brush, Teeth brushing method, Fixed orthodontic appliances.	etc
Subject	Patint with fixed orthodontic appliance	Patient with fixed orthodontic materials other than stainless steel

Table II: Review Results Table

No	Researcher, Year	Chapter	Purpose	Data Analysis	Result
1	Pandey (2016)	Impact of dental neglect score on oral health among patients receiving fixed orthodontic treatment	To assess neglect and oral health status in orthodontic treatment patients	<i>Chi square</i>	This study revealed that 63% of the orthodontic patients studied brushed their teeth once a day, 26% brushed their teeth twice a day, and 11% brushed their teeth three times a day. About a quarter use a toothbrush with soft bristles, only 9% of respondents use dental floss.
2	Lee J (2016)	Oral hygiene practices among fixed orthodontic patients in a university dental setting	To identify self-reported oral hygiene of fixed orthodontic patients	Description	The mean age of the participants was 21.6 ± 5.5 years, with females dominant (70.9%). Most of the patients were Malays (77.8%). More than half stated that they had higher education (58.5%). Almost all of them were non-smokers (95.8%). Most patients brush their teeth twice a day (42.5%) or three times a day (44.4%). The most preferred toothbrush is the type of toothbrush with soft bristles (54.4%), pointed tip bristles (82.0%), and a diamond-shaped head (82.7%). Other oral hygiene measures used every day were interdental toothbrushes (68.6%), mouthwash (64.4%), dental floss (29.9%), and toothpicks (22.2%).
3	Potnis (2018)	Plaque Removal Efficacy of Two Types of Toothbrush in Patients Undergoing Orthodontic Treatment with Fixed Appliance	This study aims to determine whether orthodontic toothbrushes are more effective than conventional toothbrushes in reducing dental plaque microbes on brackets and in maintaining periodontal health in patients aged 15 to 25 years using fixed orthodontic appliances.	Anova Test	The results of the study did not find a significant difference between orthodontic toothbrushes and conventional toothbrushes in the age group of 15 years to 25 years using fixed orthodontic appliances.
4	Kurniati (2019)	The Effectiveness Of Different Toothbrush Type On Plaque Removal In Orthodontic Patients	To determine the effect of orthodontic treatment using an orthodontic toothbrush, soft and flat bristle toothbrush, and a zig-zag toothbrush to reduce plaque index for patients with fixed orthodontic appliances.	Mann-Whitney	The effectiveness of using an orthodontic toothbrush is better than a zigzag bristle toothbrush in reducing plaque index against fixed orthodontic users

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5	Kudir kaite (2016)	Age and gender influence on oral hygiene among adolescents with fixed orthodontic appliances	To compare oral hygiene between different age groups and sexes in fixed orthodontic appliance patients	<i>Chi-square</i>	Statistically significant results when comparing differences between women and men: women tooth brushing more often than men ($p < 0.005$). Statistically significant results can also be observed when comparing different age groups: patients aged 16 to 18 years reported more frequently brushed teeth three or more times a day ($p < 0.005$), reported more intensive changes in them oral hygiene after starting orthodontic treatment ($p < 0.005$), and received more recommendations from their orthodontist regarding oral hygiene measures ($p < 0.005$)
6	Giri (2018)	Effectiveness between two tooth brushing methods on removing dental plaque	To compare the effectiveness of the modified bass technique with the normal brushing technique	Ancova	Average PI scores were found for the regular brush technique and the modified bass technique at baseline examination ($P < 0.05$). The modified Bass technique is more effective in remove plaque than normal tooth brushing ($P < 0.05$)
7	Wilis (2019)	Pengaruh Penggunaan Sikat Gigi Khusus Ortodontik Terhadap Status Kebersihan Gigi Dan Mulut Pemakai Ortodontik Cekat Pada Siswa SMK Negeri 3 Banda Aceh	The purpose of this study was to determine the effect of using a special orthodontic toothbrush on the status of dental and oral hygiene in fixed orthodontic users at SMK Negeri 3 Banda Aceh.	t-test (Wilcoxon)	There was a significant difference in the PHP-M Index after the intervention (post-test) between the treatment group (tooth brushing using a special orthodontic toothbrush) and the control group (tooth brushing using a conventional toothbrush), this was shown statistically $p < 0.05$.
8	Afni (2018)	Hubungan Pemakaian Jenis Sikat Gigi Dengan Status Gingiva Pada Siswa Pengguna Alat Orthodontik Cekat di Sekolah Menengah Atas	The purpose of this study was to determine the relationship between the use of a toothbrush and the gingival status of students using fixed orthodontic appliances.	<i>Chi square</i>	Respondents using fixed orthodontic appliances using orthodontic toothbrushes were 60.5%. Respondents using fixed orthodontic appliances had a healthy gingival status of 57.9%. The results of statistical analysis obtained a significant level value = 0.029 < 0.05 . . The use of this type of toothbrush is related to the gingival status of students using fixed orthodontic appliances.

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9	Sari (2019)	Status karies mahasiswa non kedokteran gigi pengguna alat ortodontik cekat di Universitas Udayana	To determine the caries status of non-dental students using fixed orthodontic appliances at Udayana University.	Description	The study showed that 57 respondents were exposed to caries (77%) and 17 respondents were caries-free (23%). The caries status showed that the average number of DMF-T was 3.6 and according to the WHO DMF-T index category, it was in the moderate category.
10	Purnomowati (2017)	Efektivitas Sikat Gigi Orthodontik Dan Sikat Gigi Konvensional Terhadap Nilai Ohi-S Pada Pasien Fixed Orthodontic Appliance	To determine the effect of the effectiveness of orthodontic toothbrushes and conventional toothbrushes on the OHI-S value in fixed orthodontic appliance patients.	Anova Test	Special orthodontic toothbrushes have a better role in lowering the OHIS index compared to conventional toothbrushes
11	Ingrid P (2017)	Perbandingan Efektivitas Sikat Gigi Konvensional Dengan Sikat Gigi Khusus Ortodonti Terhadap Penurunan Indeks Plak Pada Pemakai Piranti Ortodonti Cekat Menggunakan Metode Charter	To compare the effectiveness of conventional toothbrushes with special orthodontic toothbrushes on the reduction of plaque index in fixed orthodontic appliance users, the charter method was used.	<i>Independent t-test</i>	The results of the analysis using the independent t-test statistical test showed that there was a significant difference in the decrease in plaque index ($p < 0.05$) in fixed orthodontic users who used special orthodontic toothbrushes and conventional toothbrushes.
12	Sukmawaty (2011)	Efek Sikat Gigi Konvensional dan Sikat Gigi Khusus Ortodonti Dalam Penurunan Indeks Plak Pasien Ortodonti Piranti Cekat	The purpose of this study was to determine the difference in the decrease in plaque index before and after brushing with a conventional toothbrush and a special orthodontic toothbrush.	<i>Unpaired-samples-t-test</i>	The results showed that there was a significant difference in the mean plaque index score before and after brushing the teeth in both the special and conventional toothbrush groups ($p < 0.05$).
13	Gomes (2012)	L Randomized clinical controlled trial on the effectiveness of conventional and orthodontic manual toothbrushes	To compare the effectiveness of two manual toothbrushes (conventional and orthodontic)	Kolmogorov-Smirnov	The results showed no statistically significant difference between the two groups (conventional toothbrushes and orthodontic toothbrushes).

RESULTS

The results obtained from each researcher have different conclusions. The difference in the results in this study could be due to the variation in the respondent's skills in tooth brushing, willingness, motivation, and the method of tooth brushing used

(7 p.52). Although there was no significant difference between the use of orthodontic toothbrushes compared conventional toothbrushes in patients with fixed orthodontic appliances in the Potnis and Gomes study. However, the statement on the results and discussion in the journal Potnis said that the shorter shape of the toothbrush bristles in the center

of the orthodontic toothbrush showed good plaque removal results in the bracket area (8 p.5). The short length of the orthodontic toothbrush can reach the bracket so that food remnants on the bracket can be cleaned so that the results of brushing your teeth are maximized. And also a statement about conventional toothbrushes, where the bristles on conventional toothbrushes are the same length, so the bristles cannot reach the bracket area. This causes the results of tooth brushing to be not optimal in patients with fixed orthodontic appliances (9 p.4). In addition, Afni and Sari's research stated that fixed orthodontic appliance patients who used orthodontic toothbrushes had better condition gingiva and lower caries rates than those using conventional toothbrushes. Where the lack of the use of fixed orthodontic appliances can increase the accumulation of plaque that causes gingivitis and triggers dental caries (10 p 5,11 p 4).

of toothbrushes, such as conventional toothbrushes, electric toothbrushes, and orthodontic toothbrushes that are specifically designed for patients with fixed orthodontic appliances. The Public Health Department of the Republic of Indonesia recommends using a conventional straight-shaped toothbrush, with a straight handle in line with the brush head, and flat bristles. Conventional toothbrushes are effective in plaque removal (13 p.3). In contrast to patients with fixed orthodontic appliances, it is recommended to use an orthodontic toothbrush with a specially designed toothbrush, with a "v" shape in the middle of the bristles to help clean plaque around the bracket (14 p.2).

There are similarities in the results of research conducted by Willis, Kurnianti, Purnomowati, Afni, Sari, Ingrid, and Sukmawaty. The Wilcoxon test in the Willis study which aims to determine the effect of using a special orthodontic toothbrush on the status of oral and dental hygiene in fixed orthodontic users obtained the results of data analysis with a value of $p = 0.000$ ($p < 0.05$) which means that there is a significant difference between the treatment groups (tooth brushing using a special orthodontic toothbrush) with the control group (tooth brushing using a conventional toothbrush) (15 p.3). In Kurnianti and Purnomowati's study, the results of data analysis showed a p -value = 0.000 ($p < 0.05$) which means that there is a significant difference in plaque reduction in patients with fixed orthodontic appliances. A significant decrease in plaque with a T count index of 31,524 in Kurnianti's study stated that the orthodontic toothbrush was an effective toothbrush used for fixed orthodontic patients 8 and the ANOVA test in Purnomowati's study stated that there was a significant difference between OHIS before and after tooth brushing using a brush. Orthodontic teeth with a conventional toothbrush in fixed orthodontic patients (9 p.4). Statistical tests in Sukmawaty and Ingrid's study showed the results of data analysis with a value of $p = 0.001$ ($p < 0.05$) which showed a significant difference in the decrease in plaque index in patients with fixed orthodontic appliances using orthodontic toothbrushes compared to conventional toothbrushes (1,20). In Ingrid's study of calculating the plaque index using the Orthodontic Plaque Index (OPI), the plaque index score before tooth brushing using an orthodontic toothbrush was 65.59% (poor category) and the plaque index score after brushing using an orthodontic toothbrush was 23.74% (good category). This means that there is a decrease in plaque index by as much as 41.85% from the category of bad plaque index score to the category of good plaque index score (5 p.5). In Afni's study with the Chi-square test, it was found that most of the respondents who used orthodontic toothbrushes had healthy gingiva (44,7%), and respondents who used a conventional toothbrush

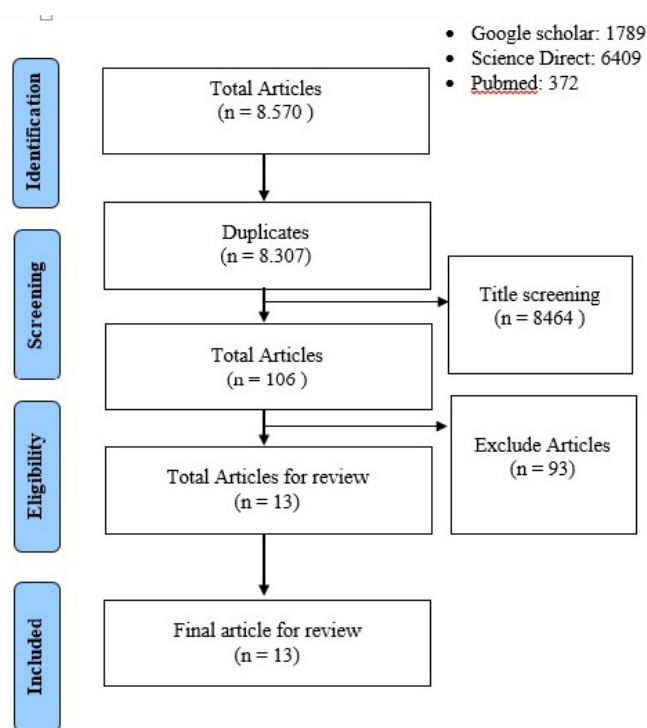


Figure 1 : PRISMA chart for screening, article selection and evaluation.

DISCUSSION

One of the prevention efforts that can be done to prevent dental and oral problems is plaque control. Tooth brushing is a simple and effective plaque control. The effectiveness of tooth brushing depends on several things, such as the shape of the toothbrush, the frequency of tooth brushing, the time of tooth brushing, the technique of tooth brushing, and the type of toothbrush (12 p.1). Some journals reported that most of the effectiveness of brushing depends on the type of toothbrush. There are several types

with mild inflammation (15.8%) (10 p.5). Then, the results of data analysis in Sari's study showed that fixed orthodontic appliance patients using orthodontic toothbrushes had a lower caries rate (35.1%) than those using conventional toothbrushes (64.9%) (11 p.3).

An insignificant difference between the use of an orthodontic toothbrush compared to a conventional toothbrush in fixed orthodontic patients was found in the Potnis and Gomes L study. The results of data analysis obtained with a value of $p = 0.416$ ($p > 0.05$) mean that there is no significant difference between the use of orthodontic toothbrushes and conventional toothbrushes in fixed orthodontic patients (8 p.5). And also in Gomes' research, the results of data analysis $p = 0.689$ ($p > 0.05$) which means that there is no statistically significant difference in the decrease in plaque index when using a conventional toothbrush compared to orthodontic toothbrushes in patients with fixed orthodontic appliances (16 p.5).

Many researchers have discussed conventional toothbrushes and orthodontic toothbrushes for patients with fixed orthodontic appliances. But, the effectiveness of tooth brushing does not only affect the type of toothbrush. Effectiveness in tooth brushing also affects the shape of the toothbrush and brushing technique. In some research a search for journals, toothbrush manufacturers make innovations regarding the shape of a toothbrush from various toothbrush bristles and the shape of the toothbrush head (17 p.2). Toothbrush bristles are divided into three types based on the degree of stiffness of the bristles, such as soft, medium, and hard. The effectiveness in removing plaque from each degree of stiffness of toothbrush bristles is also different (18 p.2). According to the journal Pandey, it is recommended that patients with fixed orthodontic appliances brush their teeth using a toothbrush with soft bristles and use dental floss after eating (19 p.4). A toothbrush with soft bristles minimizes the occurrence of gingival abrasion compared to a medium-bristle toothbrush (20 p.3). And also supported by Potnis's research, with low pressure on the tooth surface, a toothbrush with soft bristles can reach the interproximal and inter bracket areas (21 p.5).

Techniques in tooth brushing also affect the effectiveness of tooth brushing. There are many techniques for tooth brushing such as Stillman, Charter, Modified Bass, and Fones techniques (22 p.2). From the results of a search for journals, the best brushing technique for fixed orthodontic patients is the Modified Bass technique (21 p.2). According to the journal Kudirkaite, tooth brushing using the Modified Bass technique is the most effective technique used by patients with fixed orthodontic

appliances because it can clean dental plaque not only from the tooth surface and gingiva but can also reach the sub gingiva (23 p.2). Therefore, tooth brushing using the Modified Bass technique can minimize the occurrence of gingivitis in patients with fixed orthodontic appliances. Supported by Giri's research, the Modified Bass technique is efficient in cleaning interdental plaque and plays an important role in controlling dental caries and periodontal disease (24 p.4).

Based on the discussion, orthodontic toothbrushes are more effective than conventional toothbrushes in patients with fixed orthodontic appliances. In addition to better results in reducing plaque index, patients using orthodontic toothbrushes had better condition gingiva and lower caries rates. And also the selection of toothbrush bristles and techniques for tooth brushing needs to be considered. The use of a soft bristle toothbrush and the Modified Bass technique is good for patients with fixed orthodontic appliances.

CONCLUSION

Based on the results of journal reviews that have been carried out, it can be concluded that orthodontic toothbrushes are more effective than conventional toothbrushes in patients with fixed orthodontic appliances.

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