Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

The Effectiveness of the Use of Fluoridated Toothpaste on Reduction of Plaque Score: A Systematic Literature Review

Sunomo Hadi[1], Ossy Amalia Julfani[2] (corresponding author), Bambang Hadi Sugito[3]
[1]Department of Dental Nursing, Polytechnic of Health Surabaya, Indonesia; sunomohadi@gmail.com
[2]Department of Dental Nursing, Polytechnic of Health Surabaya, Indonesia; ossyjulamalia6@gmail.com
[3]Department of Dental Nursing, Polytechnic of Health Surabaya, Indonesia;
bambanghadi_sugito@yahoo.com

Submitted: September 25, 2021 -Revised: December 8, 2021 -Accepted: December 16, 2021 -Published: December 31, 2021

ABSTRACT

Introduction: Plaque is a biofilm consisting of a group of bacteria that attached to the surface of teeth, dental restorations, and prosthetic teeth. Periodontal disease occurs in many developed and developing countries and accounts for about 20-50% of the world's population. In Indonesia, periodontal disease is a disease of the teeth and mouth that is mostly suffered by the population, namely 70%. Dental plaque is an etiological factor that causes periodontal disease. Brushing your teeth is the way most often used to perform oral hygiene. Fluoride is another antimicrobial agent that is combined in toothpaste and mouth rinses to prevent plaque buildup on the surface of teeth. **Purpose**: To know the effectiveness of using fluoride toothpaste in reducing the plaque score. **Methods**: Literature review was carried out based on the inclusion and exclusion criteria to be reviewed. Of the 11 studies used, all of them used experimental research methods with the type of original publication articles. The experimental population has a broad coverage. **Results**: Based on literature review results in 11 journals, other general compositions of fluoridated toothpaste was stannous fluoride and sodium fluoride, and there was effectiveness after routine use of fluoridated toothpaste in reducing plaque scores.
Keywords: fluoridated toothpaste; tooth brush; laque score

INTRODUCTION

Plaque is a biofilm consisting of groups of bacteria that adhere to the surface of teeth, dental restorations, and prosthetic teeth. Plaque is usually found in areas that are difficult or inaccessible for cleaning activities, if left unchecked it will be dominated by aerobic gram-positive bacteria and facultative anaerobes and its thickness will increase through bacterial cell division, then plaque will be dominated by filamentous gram-positive bacteria such as actinomyces and anaerobic gram negative if the plaque thickness increases [(1)]. Based on The Global Burden of Disease Study 2016 half of the world's population (3.58 billion people) have dental and oral health problems, especially dental caries. Periodontal disease is the 11th most common disease in the world. The results of basic health research (riskesdas) in 2018 stated that the biggest dental health problem in Indonesia was tooth decay/cavities/sickness (45.3%). Meanwhile, swollen gums and/or boils (abscesses) are oral health problems that the majority of Indonesians experience, which is 14% [(2)].

Tartar can appear as a result of improper and ineffective brushing methods, resulting in food residue that accumulates and is difficult to clean. You need to pay attention to how to brush your teeth, especially on the inner or back crowns [(3)]. The time factor in brushing teeth also affects oral hygiene, the longer the food residue sticks to the teeth, the faster the occurrence of tooth decay. Elementary school students in Surabaya mostly brush their teeth in the morning and evening shower. As many as 75% of elementary school students in Surabaya brush their teeth in the morning, 16.3% after breakfast, and 8.7% after lunch, while in the afternoon 53.4% of elementary school students in Surabaya brush their teeth in the afternoon, 16.3% after dinner, and 30.3% before bed. This has a significant effect on the amount of DMF-T or tooth decay [(4)].

Toothbrushing is the most frequently used way of performing oral hygiene, to enhance the anti-plaque action during tooth brushing, chemical control methods are used. Chemotherapy agents commonly used are chlorhexidine, triclosan, and various other antimicrobials. It is compatible with toothpaste components, such as fluoride and surfactants and it exhibits anti-inflammatory effects by promoting inhibition of the cyclooxygenase/lipoxygenase pathway. Fluoride is another antimicrobial agent that is incorporated in toothpastes and mouth rinses to prevent plaque buildup on the tooth surface [(5)]. Conventional toothpaste or fluoride toothpaste and herbal toothpaste are equally effective in reducing plaque and gingivitis [(6)].

Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

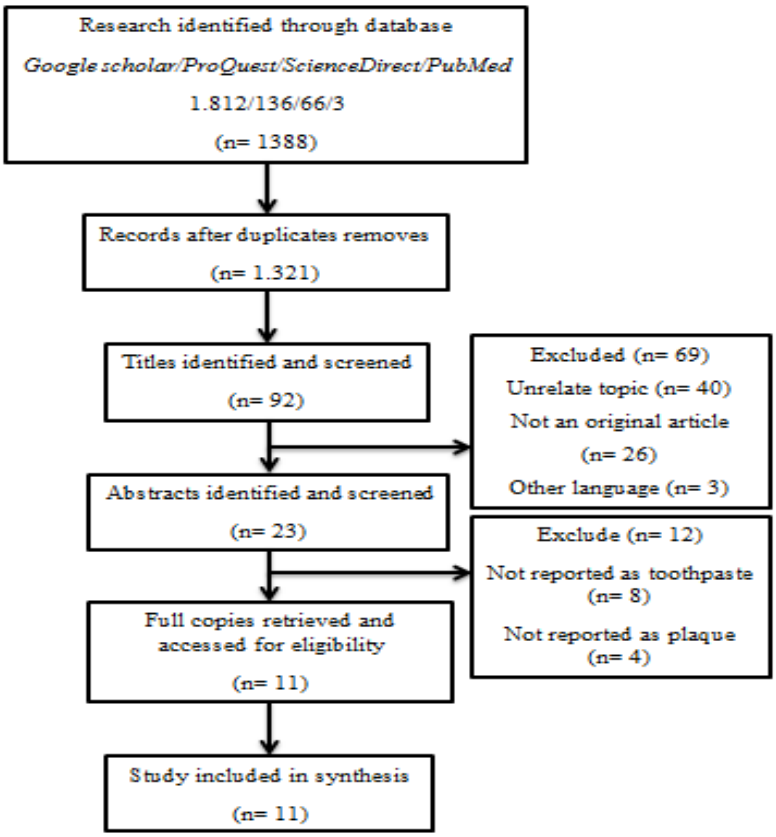
METHODS

This systematic literature review uses the PRISMA guidelines, Mendeley, and PICOS (Population, Intervention, Comparators, Outcomes, Study Design and Population Type, Publication Years, Language) on critical appraisal to comparing and summarizing all articles. The works of literature were obtained from 4 academic databases, Google Scholar, Proquest, ScienceDirect, and Pubmed. The minimum number of articles taken is 10. The updated articles taken are limited to the last 5 years. Search articles using the keywords "fluoridated toothpaste", "plaque", and "plaque growth". The way to use keywords is the "boolean searching" method, namely: fluoridated toothpaste AND plaque growth OR plaque. The time needed to search for literature is 2 months in October and November 2020.

Table 1. Inclusion and exclusion criteria PICOS

Criteria	Inclusion	Exclusion
Population	broad scope (public)	Narrow scope
Intervention	Intervention using fluoride toothpaste	Interventions other than fluoride toothpaste
Comparator	-	-
Outcomes	Preventing plaque growth or decreasing dental plaque score	In addition to preventing the growth of plaque or decreasing dental plaque scores
Study design and publication type	Experimental Type: original article	Non experimental Type: non original article
Publication year	2015 or later	Before 2015
Language	Indonesian and English	Other than Indonesian and English

A summary of the article selection process until eligible articles are obtained is presented in the form of a PRISMA flow diagram (Figure 1).



Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

Figure 1. PRISMA flow diagram

Literatures discussing the effect of fluoridated toothpaste on plaque growth were obtained from an academic database of 1,388 articles. Based on the source, the 1388 articles that have been obtained can be grouped as follows: 1). Google Scholar: 1,812 article; 2). ProQuest: 136 articles; 3). ScienceDirect: 66 articles; 4). PubMed: 3 articles.

Furthermore, screening is carried out to find out if there is duplication of articles, after screening for duplication of articles, found 62 article titles contained in 2 or 3 databases, thus the number of articles that passed the duplication screening was 1,321 articles.

The next stage is screening by title, from 1,321 article titles were then selected based on titles that matched the theme and found 92 article titles. Next is the selection based on abstract identification, found 40 articles that are not related to the topic, 26 articles that are not original articles, and 3 articles that are not in Indonesian or English, so there are 23 articles that match the identification of the abstract.

The next stage is to look at *full text*and analyzing the feasibility, found 12 articles that did not meet the inclusion criteria due to different interventions and outcomes, so that 11 articles were found that matched the inclusion criteria. Then from the 11 articles that passed the selection, 11 articles were used for further studies.

RESULTS

Respondents in this study were from various age groups ranging from children, adolescents, to adults, both men and women. Based on the results *literature review* in 11 journals, five of them journals several other common compositions of fluoride toothpaste have been obtained, namely stannous fluoride and sodium fluoride.

Table 2. Other common compositions of fluoride toothpaste

No	Other common ingredients of fluoride toothpaste	Related article
1.	Stannous fluoride	a. Mason S, Young S, Qaqish J, Frappin G, Goyal C b. Geidel A, Kruger M, Schrodl W, Jentsch H
2.	Sodium fluoride	a. Habashneh AR, Khader Y b. Cheng CH, Hu TH, Chang CY c. Daly S, Seong J, Newcombe R, Davies M, Nicholson J, Edwards M, West N

Based on the results *literature review* in 11 journals, it can be seen that the effectiveness of brushing teeth with fluoride toothpaste on reducing plaque scores is quite significant. The effect of brushing teeth with fluoride toothpaste is also various, namely preventing the growth of dental plaque, and decreasing plaque scores.

Table 3. Effect of brushing teeth with fluoride toothpaste on plaque

No	Effects of brushing with fluoride toothpaste on plaque	Related article
1.	Prevents the growth of dental plaque	a. Mason S, Young S, Qaqish J, Frappin G, Goyal C b. Cheng CH, Hu TH, Chang CY c. Pedersen LMA, Darwish M, Nicholson J, Edwards IM, Gupta KA, Belstrom D d. Vincent S, Thomas MA
2.	Decreased plaque score	a. Mason S, Young S, Qaqish J, Frappin G, Goyal C b. Geidel A, Kruger M, Schrodl W, Jentsch H c. Cheng CH, Hu TH, Chang CY d. Baeshen H, Salahuddin S, Dam R, Zawawi HK, Birkhed D e. Singh KP, Prasad VVK, Kotian A f. Nadar GB, Usha VG, Lakshminarayan N g. Habashneh AR, Khader Y h. Daly S, Seong J, Newcombe R, Davies M, Nicholson J, Edwards M, West N i. Chaurasia DP, Vajawat M, Rao CPD

Based on Table 3 it can be concluded that of the 11 reviewed journals, one of the most effective journals for reducing plaque score is a journal entitled “The Effect of a Triclosan/Copolymer/Fluoride Toothpaste on Plaque

Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

Formation, Gingivitis, and Dentin Hypersensitivity: A Single-Blinded Randomized Clinical Study", the study was conducted by Rola Al Habashneh, Rawan Farasin, and Yousef Khader in 2017. The results of the study were that the average plaque index of 50 patients decreased from 3.09 to 1.27 after 6 months of brushing their teeth using a toothbrush and fluoride toothpaste [7].

Table 4. Effectiveness of using fluoride toothpaste on plaque

No	Journal title	Research time range	Initial plaque score	Final plaque score	Effect on plaque
1.	Stain control with two modified stannous fluoride/sodium tripolyphosphate toothpastes: A randomized controlled proof of concept study	4 weeks			Prevents plaque growth
2.	Comparative Evaluation of Efficacy of 4% Tulsi Extract (Ocimum sanctum), Fluoridated and Placebo Dentifrices against Gingivitis and Plaque among 14–15 years School Children in Davangere City, India – A Triple Blinded Randomized Clinical Trial	21 days	Average dental plaque score 0.73	Dental plaque score average rating 26.79	Reduces plaque growth
3.	Control of Plaque and Gingivitis by an Herbal Toothpaste – A Randomized Controlled Study	24 weeks			Prevents plaque growth
4.	The Effect of a Triclosan/Copolymer/Fluoride Toothpaste on Plaque Formation, Gingivitis, and Dentin Hypersensitivity: A Single-Blinded Randomized Clinical Study	6 months	Average PI = 3.09	Average PI = 1.27	Reduces plaque score
5.	Eeffectiveness of Enzyme Dentifrices on Oral Health in Orthodontic Patients: A Randomized Controlled Trial	12 weeks	Average VPI = 0.34	Average VPI = 0.17	Reduces plaque score
6.	Comparison of Fluoridated Miswak and Toothbrushing with Fluoridated Toothpaste on Plaque Removal and Fluoride Release	11 months			Reduces plaque score
7.	Gingival health status in individuals using different types of toothpaste	1 year		Average PI = 2.03	Prevent plaque
8.	Efficacy of Herbal and Non-Herbal Toothpaste in the Reduction of Plaque, Gingivitis and Salivary Neutrophil Count – A Randomized Clinical Study	30 days	Average plaque score = 2.867	Average plaque score = 2.56	Reduces plaque score
9.	Fluoride Levels in Saliva and Plaque following the Use of High Fluoride and Conventional Dentifrices- a Triple Blinded Randomized Parallel Group Trial	24 hours			Prevent plaque
10.	A randomized clinical trial to determine the effect of a toothpaste containing enzymes and proteins on gum health over 3 months	13 weeks	Plaque score = 0.162	Plaque score = 0.051	Reduces plaque score
11.	Comparative Evaluation of Efficacy of Commercially Available Anticalculus Toothpaste with Fluoridated Toothpaste among Autistic Individuals: A Clinical Study	24 weeks	Plaque score = 1.9500	Plaque score = 1.3650	Reduces plaque score

DISCUSSION

Based on the results of reviews from 11 journals, it has been obtained some of the effects of brushing teeth with fluoride toothpaste on plaque growth, including preventing the growth of dental plaque and reducing plaque scores, between the two results found it can be concluded that these results are interrelated and have equally positive results in reducing plaque growth.

Mason et al in his study entitled "Stain control with two modified stannous fluoride/sodium tripolyphosphate toothpastes: A randomized controlled proof of concept study" compared two modified stannous fluoride/sodium tripolyphosphate toothpastes in 220 participants to determine the changes that occurred in the stain after the study. The results obtained after the study were toothpaste with lower stannous fluoride/sodium content did not have a

Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

negative impact on the formation of stains or dental plaque because it could prevent and remove stains or plaque on teeth [8].

These results are also the same as the research conducted by Cheng et al with the title "Effectiveness of Enzyme Dentifrices on Oral Health in Orthodontic Patients: A Randomized Controlled Trial" which examined the effectiveness of toothpaste containing enzymes and conventional toothpaste on White spot lesion index (WSL), gingival bleeding index (GBI), and visible plaque index (VPI) in 42 orthodontic patients. The results of this study showed that fluoride toothpaste was effective in reducing plaque scores in the control test at 3, 6, 9, 12 weeks [9].

Nadar et al in his research entitled "Comparative Evaluation of Efficacy of 4% Tulsi Extract (Ocimum sanctum), Fluoridated and Placebo Dentifrices against Gingivitis and Plaque among 14–15 years School Children in Davangere City, India – A Triple Blinded Randomized Clinical Trial" compared the antiplaque and antigingivitis effects of 4% Tulsi leaf extract toothpaste, fluoride toothpaste, and placebo toothpaste on 84 school children aged 14-15 years in Davangere city, India. The results of this study indicate that fluoride toothpaste has an effect on decreasing the average plaque score [5].

Geidel et al in his research entitled "Control of Plaque and Gingivitis by an Herbal Toothpaste – A Randomized Controlled Study" compared the efficacy of herbal toothpaste with two chemically active toothpastes on plaque and gingivitis controli on 76 respondents. The results of this study indicate that fluoridated toothpaste can reduce dental plaque scores after 24 weeks in a control test [6].

Al Habashneh et al in his research entitled "The Effect of a Triclosan/Copolymer/Fluoride Toothpaste on Plaque Formation, Gingivitis, and Dentin Hypersensitivity: A Single-Blinded Randomized Clinical Study" compared the effectiveness of non-Triclosan/Copolymer/Fluoride (herbal) toothpaste and toothpaste Triclosan/Copolymer/Fluoride (total) against plaque formation, gingivitis, and dentin hypersensitivity in 50 patients. The results of this study showed a decrease in plaque index scores in both toothpastes, namely fluoride toothpaste with herbal extract group and fluoride toothpaste which contains antiseptic group after the control test at a time span of 1, 3, and 6 months [7].

Baeshen et al in his research entitled "Comparison of Fluoridated Miswak and Toothbrushing with Fluoridated Toothpaste on Plaque Removal and Fluoride Release" compared (1) Miswak infused with 0.5% NaF, (2) nonfluoride miswak, (3) toothbrush with non-fluoride toothpaste, and (4) toothbrush with 1450 ppm fluoride toothpaste on the amount of plaque and fluoride concentration in saliva in 15 respondents. The result of this study was that there was no significant difference between siwak with 0.5% NaF and toothbrush with fluoride toothpaste, the use of miswak resulted in plaque removal which was equivalent to brushing teeth [10].

Pedersen et al in his research entitled "Gingival health status in individuals using different types of toothpaste" tested the relationship between medium-term use of fluoride toothpaste (> 1 year) containing natural enzymes and protein (Zendium™) on gingival index, plaque index and bleeding index compared with medium-term use of toothpaste without antimicrobial / anti-inflammatory ingredients in 305 participants. The results of this study are Medium-term use of fluoride toothpaste containing enzymes and protein (Zendium™) resulted in a lower average Plaque Index (PI) score compared to toothpaste without antimicrobial / anti-inflammatory active ingredients [11].

Singh et al in his research entitled "Efficacy of Herbal and Non-Herbal Toothpastei In The Reduction of Plaque, Gingivitis and Salivary Neutrophil Count - A Randomized Clinical Study" compared the efficacy of herbal toothpaste (Dantkanti) and non-herbal toothpaste (Colgate Total) in reducing plaque, gingivitis and salivary neutrophil counts. in 40 participants. The result of this study was that herbal toothpastes were as effective as non-herbal toothpastes containing fluoride in reducing plaque scores in a 30-day control trial [12].

Vincent & Thomas in his research entitled "Fluoride Levels in Saliva and Plaque following the Use of High Fluoride and Conventional Dentifrices- a Triple Blinded Randomised Parallel Group Trial" The purpose of this study was to assess the levels of salivary fluoride and plaque at different time intervals after the use of high fluoride toothpaste in 60 adolescent respondents. The results of this study were significant differences in fluoride levels were observed at different time intervals in saliva and plaque among the three groups, there was a positive correlation between fluoride levels in saliva and plaque. For the results of high fluoride levels in saliva, it can prevent plaque from forming on the teeth [13].

Daly et al in his research entitled "A randomized clinical trial to determine the effect of a toothpaste containing enzymes and proteins on gum health over 3 months" tested the effectiveness of toothpaste containing enzymes and proteins to improve gingival health and reduce supra-gingival plaque formation for 13 weeks compared with commercial toothpaste in 229 participants. The results of this study are Fluoride toothpaste containing natural enzymes and proteins tested in this study was able to reduce the gingival and plaque index after 13 days of use [14].

Aloha International Journal of Health Advancement (AIJHA)
ISSN 2621-8224
RESEARCH
Volume 4 Number 12, December 2021
DOI:
http://journal.aloha.academy/index.php/aijha
http://dx.doi.org/10.33846/aijha41201

Chaurasia et al in his research entitled "Comparative Evaluation of Efficacy of Commercially Available Anticalculus Toothpaste with Fluoridated Toothpaste among Autistic Individuals: A Clinical Study" compared a commercially available anticalculus toothpaste and a commercially available fluoride toothpaste against calculus levels in 40 autistic patients. The results of the research are Statistically significant reductions in plaque scores were seen over 8, 12, 24 weeks in both groups ($P < 0.05$) in both the commercial anticalculus toothpaste and the commercial fluoride toothpaste [15].

CONCLUSION

In some countries it has been found that commercial toothpaste containing fluoride has many benefits. The toothpaste also has several active ingredients that can help overcome dental and oral health problems that exist in the community. The composition and use of the right toothpaste can also help maximize the function of the toothpaste. Some other ingredients that are often found in fluoridated toothpaste are stannous fluoride, and sodium fluoride.

There is an effectiveness of brushing teeth with fluoride toothpaste on reducing plaque scores, because there are anti-microbial agents in fluoridated toothpaste so that it can prevent the growth of dental plaque. In addition, the benefits of this fluoride toothpaste, one of which is that it can prevent or reduce plaque growth so that it can reduce plaque scores if used regularly and as recommended.

REFERENCES

1. Ireland R. Kamus Kedokteran Gigi. Vol. 634. Jakarta: Jakarta: EGC; 2014. 225 p.
2. Kementrian Kesehatan RI. Faktor Risiko Kesehatan Gigi dan Mulut. Pus Data dan Inf Kementeri Kesehat RI. 2019;1–10.
3. Hidayat R, Tandiari A. Kesehatan Gigi dan Mulut-Apa yang Sebaiknya Anda Tahu? 2016.
4. Adiko MT, Hadi S. The Correlation Between Teeth Brushing Time and the Number of DMF-T On Iv And V Grade Elementary Students In Surabaya. 2017;2(2):39–43.
5. Nadar G, Usha G, Lakshminarayan N. Comparative Evaluation of Efficacy of 4% Tulsi Extract (Ocimum sanctum), Fluoridated and Placebo Dentifrices against Gingivitis and Plaque among 14–15 years School Children in Davangere City, India – A Triple Blinded Randomized Clinical Trial. Contemp Clin Dent. 2020;8(September):11–9.
6. Geidel A, Krüger M, Schrödl W, Jentsch H. Control of Plaque and Gingivitis by an Herbal Toothpaste - A Randomised Controlled Study. Oral Health Prev Dent [Internet]. 2017;15(5):407–13. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28993821
7. Al Habashneh R, Farasin R, Khader Y. The effect of a triclosan/copolymer/fluoride toothpaste on plaque formation, gingivitis, and dentin hypersensitivity: A single-blinded randomized clinical study. Quintessence Int (Berl). 2017;48(2):123–30.
8. Mason S, Young S, Qaqish J, Frappin G, Goyal C. Stain control with two modified stannous fluoride/sodium tripolyphosphate toothpastes: A randomised controlled proof of concept study. J Dent X. 2019;2(June).
9. Cheng HC, Hu HT, Chang YC. Effectiveness of enzyme dentifrices on oral health in orthodontic patients: A randomized controlled trial. Int J Environ Res Public Health. 2019;16(12).
10. Baeshen H, Salahuddin S, Dam R, Zawawi KH, Birkhed D. Comparison of Fluoridated Miswak and Toothbrushing with Fluoridated Toothpaste on Plaque Removal and Fluoride Release. J Contemp Dent Pract. 2017 Apr;18(4):300–6.
11. Pedersen AML, Darwish M, Nicholson J, Edwards MI, Gupta AK, Belstrøm D. Gingival health status in individuals using different types of toothpaste. J Dent [Internet]. 2019;80(August 2018):S13–8. Available from: https://doi.org/10.1016/j.jdent.2018.08.008
12. Singh PK, Prasad KVV, Kotian A. " EFFICACY OF HERBAL AND NON -HERBAL TOOTHPASTE IN THE REDUCTION OF PLAQUE , GINGIVITIS AND SALIVARY NEUTROPHIL COUNT " - A RANDOMIZED. 2018;5(6):588–94.
13. Vincent S, Thomas AM. Fluoride Levels in Saliva and Plaque following the Use of High Fluoride and Conventional Dentifrices- a Triple Blinded Randomised Parallel Group Trial. Medina-Solis CE, editor. Sci World J [Internet]. 2019;2019:7. Available from: https://search.proquest.com/docview/2223751033?accountid=159110
14. Daly S, Seong J, Newcombe R, Davies M, Nicholson J, Edwards M, et al. A randomised clinical trial to determine the effect of a toothpaste containing enzymes and proteins on gum health over 3 months. J Dent. 2019 Jan 1;80:S26–32.
15. Chaurasia P, Vajawat M, Rao D. Comparative evaluation of efficacy of commercially available anticalculus toothpaste with fluoridated toothpaste among autistic individuals: A clinical study. J Int Clin Dent Res Organ [Internet]. 2018;10(2):71. Available from: https://search.proquest.com/docview/2162960287?accountid=159110