IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 13, Issue 5 Ser.3 (Sept. – Oct. 2024), PP 17-26
www.iosrjournals.org

Effectiveness Of Advanced Oral Care Methods In Improving Oral Health Status Of Stroke Patients: A Systematized Literature Review

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Abstract
Background
Individuals who suffered from first-time stroke usually also suffer from physical impairments which affects their everyday living. Basic grooming such as oral care will be affected, this increases their susceptibility to oral infections/diseases. This necessitates a tailored and personalized approach to effective oral care routine for stroke patients.
Methods
A systematic search of 4 databases from both health and education arenas identified relevant literature; this was appraised using Joanna Briggs Institute Critical Appraisal tool and thematically analysed.
Findings
Findings across the studies revealed that advanced oral care methods were effective in improving oral health outcomes among stroke patients.
Conclusion
This review helps researchers to understand what has been done to improve the oral health of stroke patients (SP) and future studies to improve oral health.
Keywords: *Stroke, chlorhexidine mouthwash, powered brush, oral health*

Date of submission: 18-09-2024 Date of acceptance: 28-09-2024

I. Introduction

This systematized literature review explores selected databases to retrieve current research and articles highlighting the effectiveness of advanced oral care methods in improving oral health in stroke patients. Articles will be critically analyzed using the Joanna Briggs Institute (JBI) critical appraisal tools. Findings and results will be analyzed and summarized. Themes will be identified. Lastly, the discussion will include a summary of findings, strengths and limitations of studies, and research gaps.

Clinical Question

The literature review aims to study the effectiveness of advanced oral care methods for SPs in improving their oral health status. This clinical question was formulated to guide the author in finding best practice evidence surrounding the use of advanced oral care methods particularly for SPs.

II. Method

PIO Framework and Keywords/Synonyms

Table I

PIO Table

PIO elements	Keywords	Search terms	Synonyms
Patient/Population	Stroke patients	stroke	Stroke OR "Ischemic stroke" OR "Hemorrhagic stroke"
Intervention	Advanced Oral Care Methods	Chlorhexidine mouthwash, Powered brushes	(Chlorhexidine OR "Antiseptic mouthwash" OR Mouthwash OR "Oral rinse" OR "Powered toothbrush") AND ("Oral hygiene" OR "Oral care" OR Mouthcare)
Outcome	Improving oral health status	Oral health	"Oral health"

Table I shows the identified PIO elements, keywords, search terms and synonyms. The framework was adopted to generate the clinical question and is frequently implemented to perform extensive literature searches using selected keywords from the clinical question (Brown, 2020).

Databases and Search strings

Table II

Databases, Search Strings and Results

Database	Search Strings	Results
PubMed	(stroke[MeSH Terms]) AND ("chlorhexidine mouthwash" OR "powered toothbrush") AND ("oral hygiene")	8
CINAHL	(stroke OR "ischemic stroke" OR "hemorrhagic stroke") AND (mouthcare OR "oral hygiene" OR "oral care" OR "oral health" OR "mouthwash" OR mouthrinse OR "oral rinse") AND (chlorhexidine OR antiseptic OR "powered toothbrush")	9
ScienceDirect	(stroke OR "hemorrhagic stroke" OR "ischemic stroke") AND (chlorhexidine OR "powered toothbrush") AND ("oral hygiene" OR "oral health" OR "oral care" OR mouthcare)	2
Cochrane	stroke AND (chlorhexidine OR "powered toothbrush")	4

Table II shows the different databases, search strings, and booleans operators used during the search.

Databases were selected based on their extensive collection of nursing-related literature and their robust search capability to enhance the precision of search for relevant and current publications (Harnegie, 2013; Oermann et al., 2020; Puga & Atallah, 2020). Different databases (PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane, and Web of Science) were explored to ensure thorough and comprehensive search. The sole dependence on a single database may alter the objectivity of the conclusions and may affect the rigor and validity of the literature search (Paré, 2017).

The choice of a search string for the different databases is dependent on the availability of database-specific indexing, database syntax and features, and search filters. PubMed and CINAHL offer medical subject headings (MeSH) terms which help the author to be consistent with the terminologies used, streamlining, and enhancing the search process to find the most relevant articles. Boolean operators were used for all the search strings to ensure that all the keywords and concepts were employed effectively through inclusion and exclusion operators such as 'AND', 'OR', and 'NOT'. This research question consists of several concepts (stroke, advanced

oral care methods, and oral health), therefore using boolean operators, the author may better establish relationships by narrowing the scopes between the concepts.

Limiters and Inclusion and Exclusion criteria

Table III

Inclusion and Exclusion Criteria Table

Inclusion	Exclusion
• Peer-reviewed articles • Articles within 10 years range (2013-2023) • English publications • Articles published in reputable databases	• Articles that are not peer-reviewed • Articles that are <2013 • Non-english publications • Systematic reviewed articles • Articles that includes chlorhexidine gel

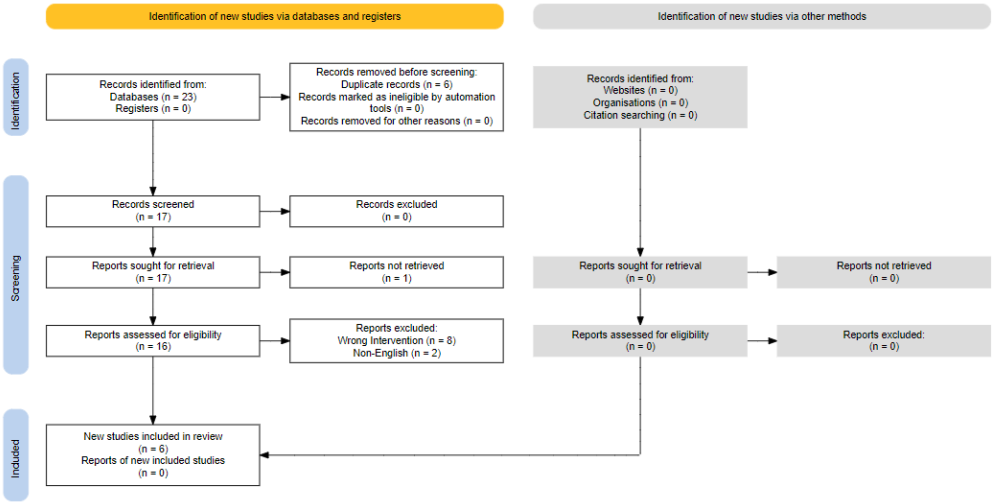
The literature review will focus on only peer-reviewed full-text, English publications within the last ten years. It will only highlight academic papers that have similar populations, interventions, and outcomes. To ensure that the articles are comprehensible by the author, only English publications will be identified. Eliminating non-English publications does not alter the findings, results, and conclusion of relevant studies (Nussbaumer-Streit et al., 2020). The reviewed articles are within the last ten years to ensure relevant up-to-date evidence and practices (Majid et al., 2011). For a more comprehensive and thorough understanding, only full text articles will be reviewed (De Vries et al., 2020).

PRISMA 2020

This section is with reference to Figure I. After the literature search on the different databases, a total of 23 articles were found. Of these, five duplicates were removed. A total of 17 articles were then retrieved for further evaluation. After eligibility screening, 10 studies were further omitted due to wrong intervention and non-English publication respectively. A total of 6 articles were assessed to be eligible and suitable to be included in the literature review.

Figure I

PRISMA Flow Chart. Adapted from (Page et al., 2021).



Studies Characteristics

A total of six articles were assessed for their methodological quality using the JBI critical appraisal tool for randomized controlled trials (RCT) (Barker et al., 2023). Standardizing the checklists reduces risks of biases, enhancing reliability and validity allowing the author to review articles in a consistent, reliable, and comprehensive manner (Pearson et al., 2005). All the articles were randomized control trials (Dai et al., 2017a; Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013a; Lam et al., 2013b; Kim et al., 2014).

Quality Appraisal (JBI)

All six articles were critically appraised and data extraction of the studies were presented in Table V.I,II & III. The following sections are a detailed summary of all studies after critical appraisal and synthesis of literatures.

Table V.I: Data extraction table

Author/ Title	Research design/ Level of evidence	Setting/ Context	Population Characteristics	Sample Size	Duration of exposure to intervention	Intervention groups
(Dai et al., 2017a) Oral health-related quality of life in patients with stroke: a randomized clinical trial of oral hygiene care during outpatient rehabilitation	RCT, 1.c	Mrs Ng Memorial Day Outpatients Center, Tung Wah Hospital (TWH) in Hong Kong SAR	• Outpatient stroke patients receiving stroke rehabilitation • Non-edentulous • Onset of stroke not more than 6 months ago	94	3 months, followed by another 3 months observational period	1. Conventional oral hygiene care programme (COHCP) comprising a manual toothbrush, and oral hygiene instruction 2. Advanced oral hygiene care programme (AOHCP) comprising a powered toothbrush, 0.2% chlorhexidine mouthrinse, and oral hygiene instruction.
(Dai et al., 2017b) A randomized clinical trial of oral hygiene care programmes during stroke rehabilitation	RCT, 1.c	Mrs Ng Memorial Day Outpatients Center, Tung Wah Hospital (TWH) in Hong Kong SAR	• Outpatient stroke patients receiving stroke rehabilitation • Non-edentulous • Onset of stroke not more than 6 months ago	94	3 months, followed by another 3 months observational period	1. COHCP comprising a manual toothbrush, toothpaste, and oral hygiene instruction 2. AOHCP comprising a powered toothbrush, 0.2% chlorhexidine mouthrinse, toothpaste, and oral hygiene instruction.

Table V.II: Data extraction table

Author/ Title	Research design/ Level of evidence	Setting/ Context	Population Characteristics	Sample Size	Duration of exposure to intervention	Intervention groups
(Dai et al., 2018) Effect of oral hygiene programmes on oral opportunistic pathogens during stroke rehabilitation	RCT, 1.c	Mrs Ng Memorial Day Outpatients Center, Tung Wah Hospital (TWH) in Hong Kong SAR	• Outpatient stroke patients receiving stroke rehabilitation • Onset of stroke not more than 6 months ago • Moderate to severe functional disability • Dentate • Normal cognitive ability or mild cognitive disability • No communication difficulties • No nasogastric feeding tube.	94	3 months, followed by another 3 months observational period	1. COHCP comprising a manual toothbrush, toothpaste, and oral hygiene instruction 2. AOHCP comprising a powered toothbrush, 0.2% chlorhexidine mouthrinse, toothpaste, and oral hygiene instruction.
(Lam et al., 2013a) Effect of oral hygiene interventions on opportunistic pathogens in patients after stroke	RCT, 1.c	Stroke rehabilitation ward at Tung Wah Hospital in Hong Kong	• Inpatient stroke patients receiving stroke rehabilitation • Age >50 • Moderate to severe functional disability • Dentate • Non- edentulous • No communication difficulties • No nasogastric feeding tube.	102	3 weeks with no follow up	1. oral hygiene instruction (OHI) only 2. OHI and 0.2% chlorhexidine mouth rinse twice daily 3. OHI, 0.2% chlorhexidine mouth rinse twice daily, and assisted brushing twice weekly

Table V.III: Data extraction table

Author/ Title	Research design/ Level of evidence	Setting/ Context	Population Characteristics	Sample Size	Duration of exposure to intervention	Intervention groups
(Lam et al., 2013b) Randomized Clinical Trial of Oral Health Promotion Interventions Among Patients Following Stroke	RCT, 1.c	Stroke rehabilitation ward at Tung Wah Hospital in Hong Kong	• Previously admitted to rehabilitation ward, up to 7 days hospitalisation • Age <70 • Moderate to severe functional disability • Dentate • Normal cognitive ability or mild cognitive disability • No communication difficulties • No nasogastric feeding tube.	102	3 weeks with no follow up	1. Oral hygiene instruction (OHI) 2. OHI and a chlorhexidine (CHX) (Corsodyl) mouthrinse (0.2%, 10mL) twice daily for a 3-week period 3. OHI and a CHX mouthrinse and assistance with toothbrushing
(Kim et al., 2014) Effect of an Oral Hygienic Care Program for Stroke Patients in the Intensive Care Unit.	RCT, 1.c	Stroke patients in ICU of the neurosurgery department of a university hospital in South Korea	• Stroke patients in Intensive Care Unit • First time experiencing stroke • With >6 teeths • With no infections from any source	56	Ranging from 1 -5 weeks bit average 2.2. weeks.	Oral hygiene care programme (toothbrushing and gauze soaked chlorhexidine)

Randomization and Concealment

Some studies were not observed to have true randomization; instead, block randomization was used (Dai et al., 2017a; Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013a; Lam et al., 2013b). Block randomization is a method used in experimental research to allocate participants into intervention and control groups by grouping the participants with similar characteristics together (Schulz & Grimes, 2002). This helps to even out the distribution of variables, minimizing chances of selection biases and improving statistical efficiency (Schulz & Grimes, 2002). Although the use of block randomization may affect the external validity of studies by introducing the element of predictability (Efird, 2010), the authors tried to reduce selection bias and increase internal validity by having the allocation of participants sealed in opaque envelopes. As suggested by Monaghan et al. (2021), allocation concealment plays a pivotal role in minimizing selection bias by keeping the researchers unaware of the impending assignment of the participants. This may greatly reduce the chances of the block pattern being disclosed to those involved in the trial, thus reducing the chances of selection bias, and increasing the internal validity of the study.

The study by Kim et al. (2014) employed a random number generator to allocate participants into either group, therefore is truly randomized.

Baseline Differences Between Groups

Participants in RCTs are usually assigned randomly into the intervention groups. This may help to minimize selection bias and limit confounding variables from affecting the true effects and results of the intervention (Holmberg & Andersen, 2022). Additionally, a similar baseline helps studies to be relatable to a greater and wider population, allowing for a more dependable, meaningful, and informative comparison (Burgess et al., 2003). In the appraised RCTs, having similar oral health status at baseline remains crucial. This may allow the authors to test whether advanced oral care methods are more effective than common methods of oral hygiene through comparisons of baseline and current results. Therefore, the authors can determine that the outcome is independent of the potential of confounding variables and selection bias, which is solely based on the introduction of the intervention.

Blinding

Blinding is the process of not disclosing the nature of the intervention to participants, personnel administering the treatment, or outcome assessors until the end of the trial (Monaghan et al., 2021). During the study, participants may be speculative about their treatment assignment and seek external sources for additional information about the intervention. This may alter the results and outcome of the study due to participants' treatment-seeking behavior outside of the trial or through discussing with other participants involved in the study (Bhatia et al., 2021).

In the appraised RCTs, it was unclear whether the participants or those delivering the treatment were blinded to the study (Dai et al., 2017a; Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013b). Although the oral hygiene instructions were given by an independent dentist, the manufacturer who was delivering the instructions to operate the powered toothbrush knew the treatment assignment. Therefore, this shows that blinding may not always be achieved due to the nature of the research.

Studies were clear in stating that they were conducting single-blinded RCTs and that outcome assessors were blinded to the treatment assignment (Dai et al., 2017a; Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013a; Lam et al., 2013b). This single-blinded method helps to significantly reduce detection biases and enhances the assessor's objectivity. Since outcome assessors were unaware of the treatment groups, they may not be influenced by their beliefs, perspectives, and preconceived knowledge when assessing and measuring the studies' outcomes (Mansournia et al., 2017). In a separate systematic review done by Hróbjartsson et al. (2014), unblinded assessors were responsible for biases toward favored intervention and overreporting of the hazard ratio by 0.25. Therefore, blinding the assessors helps to improve the internal and external validity, enhances reliability, and minimizes reporting bias of the studies.

Data Analysis Approach

The treatment groups were treated identically other than the intervention of interest as stated in appraised studies. The follow-ups of the participants were complete, adequately described, and analyzed. In the appraised studies, all authors except for studies by Lam et al. (2013a) and Lam et al. (2013b) followed up with the participants at the end of three and six months respectively with the inclusion of detailed accounts of the attrition rate.

According to Dumville et al. (2006), potential attrition biases may occur in both low and high-quality research. The use of Consolidated Standards of Reporting Trials (CONSORT) in RCTs helps authors to have a standardized approach to reporting clinical trials clearly and systematically (Butcher et al., 2022). The recommendation of reporting attrition in alignment with CONSORT includes, including a table or flowchart

showing the recruitment and baseline data of participants. This provides transparency regarding the number of participants lost to follow-up, and whether it has an impact on the overall outcome or findings (Dumville et al., 2006). Additionally, this helps to identify if the high attrition rate was subjected to any confounding variables or risk factors. Therefore, having accountability of the remaining participants helps to reduce potential biases and improves the quality and reliability of the respective studies.

In the RCTs, participants were analyzed in the group to which they were randomized. Identical, valid, and reliable tools were used across the different intervention groups. Outcomes in the appraised studies were also measured the same way for the treatment groups at their respective timeline ranging from three weeks to six months. Assessment tools such as the Löe and Silness plaque index (LSPI), Gingival Bleeding index and Mannitol Salt Agar laboratory test were used to test respective outcomes of the studies. These tools have been used repeatedly in oral health assessments for decades (Mir et al., 1998; Müller & Könönen, 2005; Tesic et al., 2020). The long history of each tool was able to account for the validity and reliability of the findings and outcome measurements of the patients. Appropriate statistical analysis was used in all appraised studies.

Consequently, the RCTs were given a percentage according to the requirements met during the critical appraisal. All articles scored at least 9 out of 13. All the RCTS had their respective strengths and weaknesses clearly stated. Additionally, elements of allocation concealment and blinding enhances studies' validity. Therefore, all 6 RCTs were assessed to be of good methodological rigor and thus included in the review. According to the JBI level of evidence for effectiveness, RCTs are ranked at level 1.c. Although each study method has its own drawbacks, RCTs were thought to be the gold standard for testing effectiveness of any interventions (Hariton & Locascio, 2018).

Data Extraction

Data from each study were extracted and formatted into tables. Each table synthesizes the findings of respective studies. The data extraction table can be found in Appendix C. The following section critically examines the findings.

Synthesis of Findings

From the data analysis, one main theme emerged. The emerging overarching theme is 'Effective Oral Care/Oral Hygiene". It is supported by three sub-themes, (1) Reduced Plaque, (2) Reduced Gingivitis, and (3) Tooth Brushing habits. The findings have been compiled in the thematic table below (Table V).

Table V

Thematic Analysis Table

Authors/Themes	Reduced plaque index	Reduced gingivitis index	Toothbrushing habits
(Dai et al., 2017a)	✓		✓
(Dai et al., 2017b)	✓	✓	✓
(Dai et al., 2018)	✓	✓	✓
(Lam et al., 2013a)	✓	✓	
(Lam et al., 2013b)	✓	✓	
(Kim et al., 2014)	✓	✓	

Effective Oral Care/Hygiene

Dental Plaque

Dental plaque naturally develops and accumulates on the tooth surfaces through the colonization of bacteria on tooth surfaces (Vyas et al., 2021). The accumulation of dental plaques may lead to a higher risk of periodontal disease such as gingivitis, causing the teeth to be loosened. The study by Sreenivasan et al. (2016) suggests that dental plaque is extremely common among every individual and has been established to be one of the largest contributors to poor oral health. Similarly, Vyas et al. (2021) established that prolonged poor oral status may be detrimental to overall health and well-being. Therefore, due to the nature of dental plaque and its effects on oral health, it is often looked at when determining oral health status.

Most studies explored the effects of improved oral hygiene techniques through studying the presence of dental plaque. The LSPI was utilized in some selected studies (Dai et al., 2017b; Lam et al., 2013b; Kim et al., 2014), while the rest of the articles used alternative methods and described the results briefly. LSPI was developed in the early 1960s and is used epidemiologically to evaluate the effectiveness of oral hygiene interventions (Fischman, 1986; Marks et al., 1993). LSPI is used to evaluate the effectiveness of the different oral hygiene interventions, namely the effects between conventional and advanced oral hygiene care programs (Dai et al., 2017a; Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013a; Lam et al., 2013b; Kim et al., 2014). This scoring system of this tool grades the degree of accumulation of plaque on the scale from 0 to 3. The grade is dependent on the amount of accumulation of dental plaques on the gingival margins (Fischman, 1988; Marks et al., 1993). According to Fischman (1988) and Löe (1967), this method of assessing the severity of plaque is effective and efficient in ensuring a comprehensive report of measuring anti-plaque agents. A comprehensive scoring system with its criterion can be found in Appendix D. A study by Mark et al. (1993) evaluated the reliability and reproducibility of different clinical indices such as LSPI. The result revealed that the LSPI is a valid, reliable, and effective tool that is useful for researchers who are doing research surrounding the topic of oral health.

Selected studies found that PI was significantly reduced across all control and intervention groups ($p<0.001$), but especially in the intervention group of interest (Dai et al., 2017b; Kim et al., 2014; Lam et al., 2013b). The most common variable in the intervention groups across all studies is the employment of chlorhexidine mouthwash and the provision of professional oral hygiene instructions, followed by the employment of powered toothbrushes or assisted brushing. The study by Dai et al. (2017b) found that the intervention groups have greater statistical significance in reducing the accumulation of plaque. The study compared the percentage of moderate to abundant plaque at baseline and three months post-intervention. It revealed that there is over 40% decrease in the percentage of plaque found on tooth surfaces and that the measurements are now lower and narrower, indicating that there is a positive shift (Dai et al. (2017b), highlighting the effectiveness of the intervention over the three months intervention period. Furthermore, there was no statistical significance of both groups ($p>0.05$) at baseline, however, three months after the intervention, there was a significant statistical difference ($p<0.05$) (Dai et al., 2017b). The yielded result is similar in the subsequent three articles which employed the use of LSPI where the reduction of dental plaque is statistically significant ($p<0.01$) in the intervention groups with advanced oral hygiene practices.

Interestingly, the study by Dai et al. (2017b) suggested that the reduction of PI in intervention groups may be associated with the antibacterial nature of chlorhexidine mouthwash and the consistent oscillation of the powered toothbrush. Similarly, the study done by Dai et al. (2018) suggests that chlorhexidine solution is the 'gold standard' for its antibacterial properties in preventing the build-up of dental plaque on tooth surfaces. Additionally, Dai et al. (2017a) suggest that studies have proven that powered toothbrushes are more effective in reducing dental plaque accumulation due to their 'rotational oscillation' function. The 'rapid vibration' and 'rotational oscillation' in which powered toothbrushes are programmed to behave induce hydrodynamic forces which are effective in disrupting dental plaque from forming on tooth surfaces (Adam et al., 2020; Jain, 2013). Therefore, as supported by the evidence from other studies, the use of chlorhexidine solution and powered toothbrushes in respective studies can be contributing factors to the reduction in dental plaque across all selected and related studies.

Gingivitis

Gingivitis is an inflammation of the dental gums, causing bad breath, bleeding gums and sensitive teeth (Wu et al., 2021). If left untreated, it may lead to periodontitis, a condition in which teeth become loose and eventual loss of tooth (Wu et al., 2021). This condition is highly associated with the presence of dental plaque. The formation of dental plaque due to poor oral hygiene results in the colonization of bacteria on tooth surfaces (Rathee, 2023). This causes the gum tissue to be irritated and therefore inflamed, leading to gingivitis (Rathee, 2023). Additionally, plaque-induced gingivitis is the most common cause of gingivitis. Therefore, dental plaque and gingivitis are closely related.

Study by Chapple et al. (2015) presented that the negative effects of severe periodontitis affect eleven percent of all adults, affecting not just their oral health but also overall quality of life. Gingivitis is common and can be prevented if at risk individuals adopt effective oral hygiene methods routinely (Singh & Singh, 2013). All but one of the studies by Dai et al. (2017a) explored the effects of improved oral hygiene techniques through studying the presence of gingivitis. The Gingival Bleeding Index (GBI) was utilized in some selected studies (Dai et al., 2017b; Lam et al., 2013b; Kim et al., 2014), while the rest of the articles used alternative methods and described the results briefly.

Selected studies found that GBI was significantly reduced across all control and intervention groups ($p<0.001$), but especially in the intervention group of interest (Dai et al., 2017b; Kim et al., 2014; Lam et al., 2013b). The most common variable in the intervention groups across all studies is the employment of chlorhexidine mouthwash and the provision of professional oral hygiene instructions, followed by the

employment of powered toothbrushes. The study by Dai et al. (2017b) found that the intervention groups have greater statistical significance in reducing the GBI. Similarly, the studies attributed the greater statistical significance to the provision of oral hygiene instructions, powered toothbrushes or assisted brushing and chlorhexidine mouthwash. However, the use of chlorhexidine mouthwash emerged as all the studies included it in the different intervention groups.

Additionally, the study by Dai et al. (2017b) suggests that there is a relationship between dental plaque and gingival bleeding. The findings suggest that the reduction in gingival bleeding is closely related to the reduction of dental plaque. This is elaborated by Murakami et al. (2018) that the accumulation of dental plaque increases risks of irritated gums and therefore causes dental plaque-induced inflammatory gingival conditions such as bleeding and inflamed gums. Therefore, it is evident that both dental plaque and gingivitis play key roles in ensuring optimal oral health.

Tooth Brushing Habit

Proper and regular toothbrushing is the cornerstone towards better oral health (Hayasaki et al., 2014). Effective brushing techniques such as brushing duration and consistency can aid in reducing risks of dental plaques and gingivitis, preventing the growth of bacteria and microorganisms in the oral cavity. In the selected studies, oral hygiene instructions were delivered to either participating participants or dentists who are responsible delivering oral hygiene to their patients (Dai et al., 2017b; Dai et al., 2018; Lam et al., 2013a; Lam et al., 2013b; Kim et al., 2014). This ensures that participants are aware of the standards of oral hygiene that they should adhere to and that they have similar knowledge of managing their oral health at baseline.

Dai et al. (2017b) discovered in their study that participants who reported irregular brushing practices were around 17% and 5% more likely to have dental plaque and gingivitis, respectively, than participants who reported regular brushing habits. The statistical difference ($p<0.001$) and ($p<0.05$) shows that there is a significant association between irregular brushing and dental plaque and gingivitis respectively.

Interestingly, the study by Lam et al. (2013b) suggests that oral clearance may potentially be another factor which may affect the accumulation of dental plaque. Stroke affects an individual's ability to swallow or clear orally. Lam et al. (2013b) hypothesized that the inability to oral clearance may be another factor to the accumulation of dental plaque in the oral cavity.

III. Discussion

Summary of findings

The summarized findings from the literature review offer several insights surrounding the use of advanced oral care methods.

Firstly, all the studied participants in the intervention groups are offered chlorhexidine mouthwash coupled with either powered toothbrush or assisted brushing or manual brushing. In intervention groups receiving advanced oral care methods, it was proven to be effective in improving oral health outcomes such as the reduction in dental plaque index and gingival bleeding index. As stated in chapter one, chlorhexidine mouthwash has antibacterial properties and aids in disruption of plaque formation. However, it should be used in adjunct to toothbrushing as plaque can only be effectively removed manually. It is still in question as to which type of brushing methods can complement chlorhexidine mouthwash more effectively. Further quantitative study may seek to find out which is the better toothbrush between manual and powered.

Secondly, the participant's lack of oral health education or knowledge across all selected studies remains apparent. In selected studies, despite professional instructions regarding oral hygiene, participants do not adhere to it. Irregular brushing and the lack of consistency are some of the many factors that may affect the results of the study. This reveals that participants may or may not be aware of the detrimental effects of their neglection towards their oral health. Additionally ,the oral hygiene instruction may not contain sufficient information that warrants the attention of the participants to act. Further qualitative studies can be warranted to seek to understand SP barriers, understanding and knowledge to achieving optimal oral health.

Lastly, dental plaque may build when SP is unable to perform oral clearance effectively. Because of stroke, SP may have trouble swallowing or clearing their oral cavity effectively after meals. Food may be lodged in the intricate corners or in between teeth. This may cause bacteria to build up, subsequently causing plaques to form. All studies, except for the study by Lam et al. (2013b), failed to account for this potential variable that may alter the findings of the study. A quantitative study examining the impact of oral aids such as water flossers and interdental brushing may be warranted.

Strengths and Limitations

Some strengths from this review were identified. Firstly, the studies have contributed to expanding knowledge of oral health among stroke patients. The research highlighted the significance of developing appropriate individualized oral hygiene care for SP. Secondly, this review may act as a foundation for future

research. This review helps researchers to understand what has been done to improve the oral health of SP. Lastly, this review may be suggestive of the future inclusion of a multidisciplinary approach to the provision of oral care to SP. For nurses to provide holistic care, they need to be trained in all aspects to ensure that they can assist their patients more effectively and holistically.

Some weaknesses from this review were identified. Firstly, the lack of variation in the studies as all the studies in the review were RCTs. Studies have shown that the combination of both qualitative and quantitative studies may help researchers to ensure a comprehensive coverage of the significance of the topic as the barrier to oral health may not only be physical factors but also emotional and psychological factors (Gentles et al., 2016). Secondly, the sample size of most studies was too small. Thus, may not be generalized. Lastly, there was a lack of previous research on the studies topic. As shown in Table 2 under search results, limited studies were available for literature review. Therefore, this may affect the credibility and scope of study of the literature review. This warrants new research to be done on this topic.

Gaps for research

Firstly, quantitative research on the effects of the types of toothbrushes accompanied by chlorhexidine mouthwash could be warranted. In the previous studies, chlorhexidine was not included in the control groups. This may help researchers to identify the optimal brushing method which may benefit SP.

Secondly, a qualitative study is recommended to understand the struggles, barriers, and possible motivation to oral care among SP. This may allow researchers to understand SP on a personal level and their unique experiences when performing oral hygiene.

Lastly, a study incorporating oral aids such as flosser and interdental brushing in oral care research may be warranted. This will help researchers to understand the possible impact of oral clearance on dental health.

IV. Conclusion

This review has reviewed existing and current evidence surrounding the effects of the type of brushes along with chlorhexidine mouthwash on oral health. Keywords were extracted from the clinical question to conduct a search on relevant and reliable databases. Selected articles were analyzed and appraised using the JBI checklist. Data was also extracted to synthesize findings. Three sub themes emerged. Gaps in research were identified through thorough examination of the subthemes.

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