



Safety and effectiveness of powered and manual toothbrush: A systematic review.

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Abstract

Introduction: Powered toothbrush has been developed as an alternative to manual tooth brush. It is crucial to understand if powered toothbrushes are safer and more beneficial for oral health applications than manual toothbrushes.

Objectives: Based on information that has been published in the literature, assess the efficacy and safety of powered and manual toothbrushes.

Materials and methods: Trials from which pertinent data could not be collected were eliminated from the evaluation, which was conducted in accordance with “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria”.

An initial literature search of publications indexed in the English language was performed through core databases (MEDLINE and Google Scholar), using the keywords: dental plaque, manual toothbrush, powered toothbrush and toothbrushing. Manual search was done in library and department archives. Trials published in English language during the period 1990-2017 with random allocation of healthy individuals of age ≥ 18 years comparing manual and powered toothbrush were included. Based on the characteristics of trial participants, the kind of intervention, and the safety and efficacy as outcome measures, data were extracted using the Cochrane data extraction template.

Results: Nine randomized controlled trials were reviewed. Two studies found safety of powered toothbrush comparable to manual toothbrush. No adverse events of powered toothbrush were reported. Power toothbrushes performed better than manual toothbrushes in seven studies. in terms of preventing plaque build-up and maintaining gingival health. **Conclusion:** Powered toothbrush was found to have similar safety but more effectiveness than manual toothbrush.

Keywords: dental plaque, manual toothbrush, powered toothbrush, toothbrushing

INTRODUCTION:

Dental caries, gingivitis, and periodontitis are all mostly caused by dental plaque. Gingivitis can occur when plaque accumulates. Periodontal disease adversely affects an individual’s oral and general health. Plaque accumulation at early stage accounts for gingivitis and further maturation to periodontitis. Maintaining oral health requires removing dental plaque. ^{1,2}

Oral hygiene practice involves cleaning tooth using tooth brush and toothpaste.³ The most common tools for maintaining oral hygiene are tooth brushes. They help in plaque control.¹

The evolution of manual toothbrushes paved the way for electric version. It helps to remove plaque and debris. Powered toothbrushes were introduced in the 1940s.⁴

Powered toothbrush has been developed as an alternative to manual tooth brush. There are three generations of powered toothbrush. The first generation was similar to manual brushing. It's working time was limited. Example is Broxodent[®]. The second generation had rotating head and prolonged working time. It was superior to manual toothbrushes. Additional features like pressure sensor and timer were included in the later generations. Examples are Braun Oral-B Plaque Remover[®] and Interplak[®]^{5,6}

The third generation comprises “sonic-powered toothbrushes” and “ultrasonic-powered toothbrushes”. They removed plaque better than manual toothbrushes. Rowenta Dentasonic[®] and Sonicare[®] are examples of third generation of powered toothbrushes.⁵

The dominance of powered toothbrush over manual toothbrush in terms of safety and effectiveness is a topic of constant debate. It is crucial to understand if powered toothbrushes are safer and more beneficial for oral health applications than manual toothbrushes. Hence, the current systematic review was carried out with the following research question and hypothesis:

Research question: In terms of efficacy and safety, are powered toothbrushes better than manual toothbrushes?

Research hypothesis: Powered toothbrushes are more secure and efficient than manual toothbrushes.

Objective: To assess the safety and effectiveness of powered and manual toothbrush.

MATERIALS AND METHODS:

Search strategy: “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 guidelines” were followed in conducting the review. A literature search of

publications indexed in the English language was carried out through core databases (MEDLINE and Google Scholar), with the following “keywords”: "toothbrushing"[“MeSH Terms”] OR "toothbrushing"[“All Fields”]. "powered toothbrush"[“All Fields”] AND "manual toothbrush"[“All Fields”]. "dental plaque"[“MeSH Terms”] OR ("dental"[“All Fields”] AND "plaque"[“All Fields”]) OR "dental plaque"[“All Fields”]. Manual search was done through library and department archives.

Selection criteria:

- ❖ The following criteria were used to determine which trials should be included: published in English language during the period 1990-2017; Trials with good and fair quality considering risk of bias; individuals of age ≥ 18 years; random allocation of healthy adult participants; comparing manual and powered toothbrush; Trials in which relevant data could not be extracted or comparing different types of powered toothbrush were excluded.

Data extraction:

Using the Cochrane data extraction template, data were retrieved from each included trial based on the characteristics of trial participants, the kind of intervention, and the safety and efficacy of the outcome measures.

RESULTS:

389 papers in all were found during the literature search. After duplicate entries were eliminated, 188 research' titles and abstracts were checked for eligibility. 18 studies were disqualified from the 27 papers that passed the full-text eligibility screening. Finally, nine papers that matched the qualifying requirements and were of high methodological calibre were included in the systematic literature review.⁷⁻¹⁵ The papers that were included in the study include a wide age range (18-75 years). All of them involved RCTs that compared powered and manual toothbrushes on healthy persons.

Safety

Two studies assessed and compared the safety of powered toothbrush and found it was as safe as the manual counterpart.^{10,14} Powered toothbrushes did not cause any adverse effects like gingival recession and tooth abrasion.

Effectiveness

Nine studies assessed and compared the effectiveness of powered and manual toothbrush.⁷⁻¹⁵ Eight of them assessed the impact on the gingiva and plaque management.⁷⁻¹⁴ One study assessed the effect on stain removal.¹⁵ Seven of the eight studies found powered toothbrush superior in plaque control and gingival health when compared to manual toothbrush. On the contrary, one study found it was not superior to the manual one.¹⁴ A study found powered toothbrush performed better at stain removal when compared to manual toothbrush.¹⁵

DISCUSSION:

Plaque can lead to various dental diseases which includes gingivitis and dental caries. Plaque removal is necessary to stop dental disorders from developing and worsening. The most common method used is mechanical plaque control.¹⁶ Toothbrushing is the most widely used tool for plaque control.¹⁷ Unfortunately, manual brushes require dexterity and time. Hard toothbrushes, patients wearing appliances and improper brushing technique can lead to damage of the hard and soft tissues. Powered toothbrushes came into being with the intent of overcoming these barriers^{10,16}.

Powered toothbrushes provide a similar level of safety to manual toothbrushes. They use mechanical action as opposed to manual motion. They use one-third brushing force of a manual toothbrush and hence the incidence of gingival bleeding is less. Adverse effects have been reported with the usage of oscillating powered toothbrushes notably gingival abrasion and recession. Sonic toothbrushes do not cause trauma to the gingiva.¹ Powered toothbrush don't abrade the gingiva more than manual toothbrushes do.^{16,17}

Two studies found safety of powered toothbrush comparable to manual toothbrush.^{8,12} No adverse events of powered toothbrush were reported. Studies found little gingival recession, lower gingival abrasion and abrasion of the hard tissues and improved gingival health when powered toothbrush was used.

The efficiency of powered and manual toothbrushes was assessed in terms of avoiding plaque build-up and eliminating stains. Powered brushes are equally effective as those used by hand. They are faster than hand toothbrushes. Plaque from difficult-to-reach areas can be easily removed with brushing. Powered brushes imitate the physical movement of using a toothbrush by moving the brush head laterally and in a circle.¹⁵ Powered brushes with a rotating oscillation mode of operation surpass manual toothbrushes in terms of reducing plaque and gingivitis. No other powered brush reliably reduces plaque and gingivitis when compared to manual brushing.³

In seven studies, powered brushes were more effective than manual brushes at avoiding plaque accumulation and preserving gingival health.⁶⁻¹² It has been discovered that powered toothbrushes with rotation oscillation action (ROA) provide greater plaque control. A research, however, found no appreciable differences between powered and manual toothbrushes.¹³ According to a research, motorised toothbrushes are more successful at removing stains than manual toothbrushes.¹⁴

A few restrictions apply to the study. The search engines could only access English-language papers from Pubmed/Medline and Google Scholar, which may have reduced the amount of information accessible. Future systematic evaluations ought to use additional search engines, without regard to language, and over a longer time period. More RCTs examining the impact of powered tooth brushes on periodontal health using large research populations, extended follow-up should be conducted.

Power toothbrushes were equivalent to manual toothbrushes in terms of safety. Plaque management and stain eradication using powered toothbrushes were shown to be superior than manual toothbrushes and in case of socially disadvantaged population.

CONCLUSION:

In conclusion, powered toothbrushes are safer and more efficient at preserving oral health than manual toothbrushes. They are a practical and advantageous alternative for oral health, providing

equivalent safety and higher efficacy than manual toothbrushes. They showed greater plaque management, particularly in difficult-to-reach places, which helped to enhance gingival health. Overall, powered toothbrushes are a practical and advantageous choice for oral health that dental practitioners and those looking to enhance their oral hygiene should consider. It is advised to do more research with bigger study populations and longer follow-up to evaluate long-term effects on periodontal health.

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DATA AVAILABILITY: Datasets related to this article will be available upon request to the corresponding author

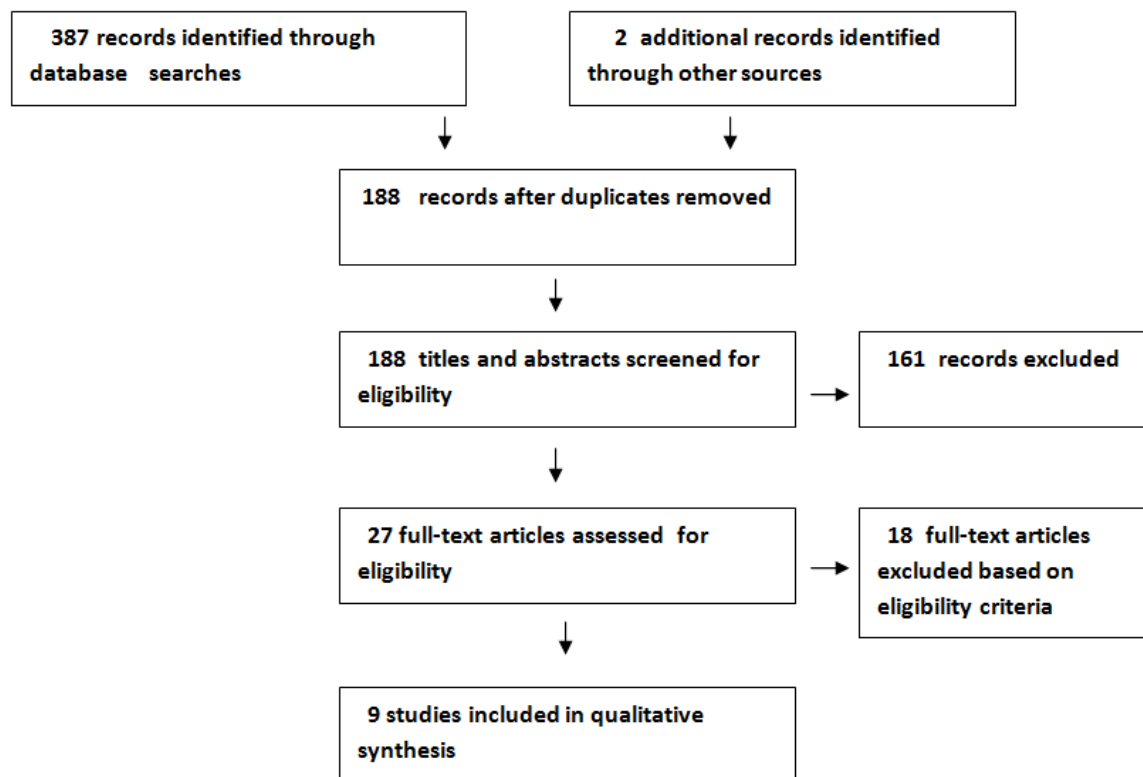
Figure 1: Flow diagram of publications included in the study

Table 1: Risk of bias in the included studies

Authors	Random sequence generation	Allocation concealment	Selective reporting	Other bias	Blinding of participants and personnel	Blinding of outcome	Incomplete outcome data
Van der Weiden GA et al ⁶	Low risk	Unclear risk	Unclear risk	Low risk	Low risk	Low risk	Low risk
Terézahy GT et al ⁷	Low risk	Unclear risk	Unclear risk	Low risk	Low risk	Low risk	Low risk
Baab DA et al ⁸	Unclear risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
Yashika JA ⁹	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
Killoy WJ et al ¹⁰	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
Rosema NA et al ¹¹	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
Lee J et al ¹²	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
McCracken GI et al ¹³	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk
Moran J et al ¹⁴	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table 2: Summary of the results

Authors	Population	Index used	Intervention and comparison	Outcome* ^{powered} versus manual
Van der Weiden GA et al ⁶	20 subjects (>18 years)	Silness & Loe Plaque index	Manual toothbrush (M), Blend-a-Dent (BL), the Braun Plak Control & Interplak	Better plaque removal and improves gingival health
Terézhalmy GT et al ⁷	72 subjects (18 - 70 years)	Silness & Loe Plaque index	Rechargeable power toothbrush and two manual toothbrushes	Better plaque removal and improves gingival health
		Silness & Loe Plaque index		
Baab DA et al ⁸	40 subjects (18-59 years)	Silness & Loe Plaque index	Powered :Interplak Manual: Butler 411 toothbrush	Better plaque removal and improves gingival health As safe as manual tooth brush
Yashika JA ⁹	60 subjects (18-28 years)	Silness & Loe Plaque index	Powered : Oral B vitality ROA powered toothbrush Manual: Oral B®	ROA more effective in plaque removal
Killoy WJ et al ¹⁰	24 subjects (>18 years)	O'Leary and Turesky plaque index	Powered : ROA Manual toothbrush	ROA more effective in plaque removal
Rosemana NA et al ¹¹	122 subjects (21-25 years)	Silness & Loe Plaque index Loe & Silness gingival index	Powered : ROA Manual toothbrush	ROA more effective in plaque removal
Lee J et al ¹²	40 subjects (27-75 years)	Silness & Loe Plaque index	Powered:Sonicare DiamondClean) Manual: Butler 311	Better plaque removal and improves gingival health As safe as manual tooth brush
McCracken GI et al ¹³	60 subjects (18-45 years)	-----	Powered: Philips SonicareElite powered toothbrush Manual: Oral-B 35	No difference in overall tooth wear
Moran J et al ¹⁴	24 subjects (18-65 years)		Powered: Powerclean Manual:Flex Sensitive	Powered tooth brush superior to manual tooth brush in terms of stain removal