

## Combined Effect of Electric Toothbrush and Oral Irrigator- “Aqua Brush”

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### Abstract

### Original Research Article

The efficacy and effectiveness of electric toothbrushes in comparison to manual toothbrushes lead to superior full-mouth and interproximal plaque removal and reduction of gingivitis, periodontitis and dental caries. Additionally, the use of an irrigator has been shown to improve the overall oral health. The aim of this study was to design and develop a utility model for the combined effect of the oral irrigator and tooth brush for maintaining oral health. The design of the modified toothbrushing unit comprises of an electric toothbrush and an oral irrigator. This was achieved by removing the electric toothbrush head to place a drill in the centre of the brush head for the insertion of irrigator head. The irrigator which was attached to a 50 ml water container with a detachable irrigator head powered by a 12 V external battery source was used to pump the water. The outcome was that a multifunctional working model combining the electric tooth brush and oral irrigator is designed successfully. Aqua Brush can be incorporated into the regular oral hygiene regimen making it convenient for the patient as it can be used as a single brushing unit and/or with the added irrigation enhancing the maintenance of oral hygiene.

**Keywords:** Aqua brush, electric tooth brush, oral hygiene, oral irrigator, plaque control.

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## 1.0 INTRODUCTION

Dental plaque is a primary etiological factor for gingivitis and further periodontal destruction. The use of tooth brush alone does not reach the interproximal tooth surface, which is more prone for plaque accumulation and in turn causes gingivitis, periodontitis and dental caries. Hence efficient plaque removal is known to be essential for the prevention of gingivitis and periodontal disease which can be achieved by mechanical and powered plaque control devices.

Weijden *et al.*, 2015 stated that electrical tooth brush provides a superior efficacy of reduction in dental plaque than manual tooth brush [1]. On the other hand, oral irrigator is a device used to remove plaque and biofilm adherent to the interdental or subgingival area of the tooth. Studies have suggested that incorporating a water pressure irrigator with tooth brushing, causes interdental stimulation and reduces the plaque accumulation. Brackett *et al.*, 2006 asserted that oral

irrigators also improve solution penetration into the periodontal pocket and it leads to reducing the advent of periodontitis [2].

The use of conventional tooth brushing is effective albeit serving the purpose, fails to provide the adequate depth of penetration into the gingival sulcus or pocket which can be vanquished by the combined use of the tooth brush and oral irrigator in one device. While most of the population still uses traditional manual toothbrushes, electric toothbrushes have become more popular and widely used today. The efficacy and effectiveness of electric toothbrushes in comparison to manual toothbrushes lead to superior full-mouth and interproximal plaque removal and reduction of gingivitis, periodontitis and dental caries. Additionally, the use of an irrigator has been shown to improve the overall oral health. Electric tooth brush and the irrigators are available as separate units in the market which makes brushing and irrigation process time consuming and tedious. Moreover, the bulky

nature of the irrigator may impede patient acceptance as an added oral hygiene aid in the routine dental hygiene regime. Hence our aim was to design and develop a utility model for the combined effect of an oral irrigator and tooth brush for maintaining oral health.

## 2.0 METHODOLOGY

This prototype was designed mainly to aid in enhancing the regular oral hygiene regimen. The study was set in the Faculty of Dental Sciences, Ramaiah

University of Applied Sciences, Bangalore from July to September 2021.

Aqua brush was designed using an oscillating rotating powered toothbrush (ORACURA) and an oral irrigator (ORACURA Smart Flosser). The design was made such that the tooth brush could be used as a single entity with no modifications in the function and the irrigator was modified.

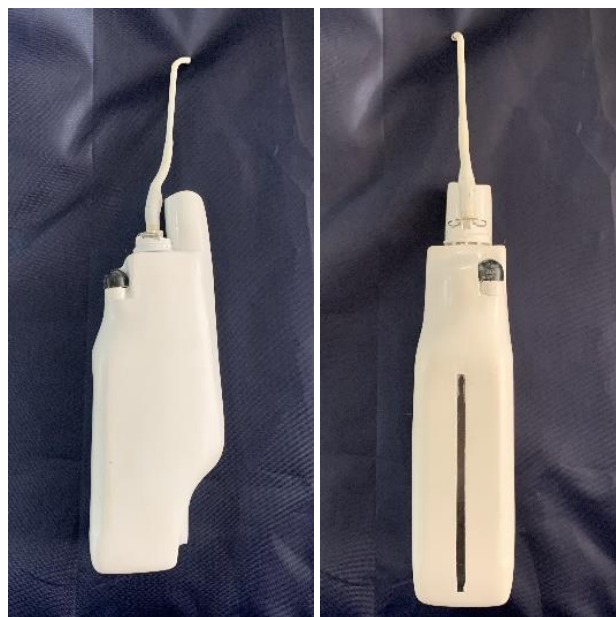
The electric brush was drilled on its centre of the brush head to engage the irrigator tip.



**Figure 1: Powered tooth brush head with the hole drilled in the centre**

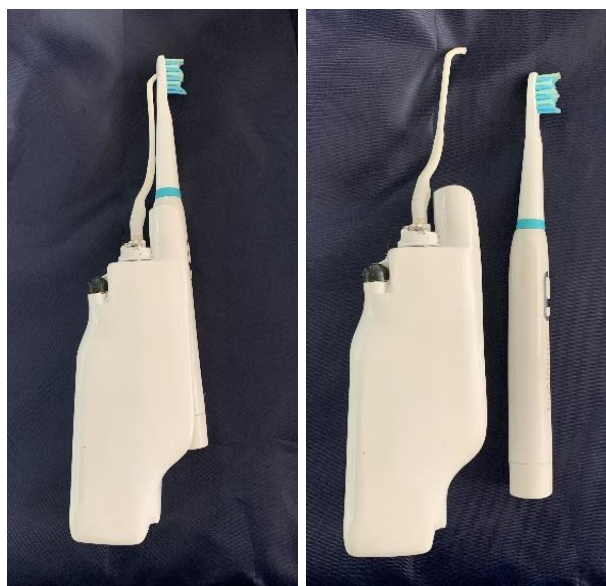
Irrigator motor has been collected from the commercially available irrigator. A 50 ml water container has been used along with the motor, which is

arranged in such a way that it can be filled manually through the cap provided externally.



**Figure 2: Irrigator with toothbrush slot**

A 12 V internal battery source was used for the battery source and a switch button was given to control the irrigator (Figure 2).



**Figure 3: Toothbrush fit into the irrigator**

A separate attachment is made on the design for the easy placement of the toothbrush, so that it slides and fits into the irrigator head.

### 3.0 DISCUSSION

In the present study we have developed a portable model of electric tooth brush attached to an oral irrigator. Previous studies have proved the effectiveness of electric tooth brush and oral irrigator as a separate oral hygiene regimen.

Erbe *et al.*, in 2019 did a study on patients with orthodontic brackets, where they compared the effectiveness of interactive power toothbrush over manual tooth brush. The interactive power toothbrush group had significantly lesser plaque accumulation compared to the manual tooth brushing over 6 weeks [3].

A randomized clinical trial was conducted by Klukowska *et al.*, 2014 to assess the efficacy of plaque removal by different bristle types. An oscillating-rotating power brush with angled bristle tuft and a manual tooth brush with flat bristles were compared. It was concluded that the oscillating-rotating power tooth brush achieved double the plaque reduction in full mouth, especially in the interdental area compared to the manual brush [4]. In another study by Buechel B *et al.*, 2014 compared the oscillating- rotating power brush with sonic tooth brush in 131 subjects. The study concluded that the oscillating rotating power brush was five times more efficient in plaque removal compared to the sonic power brush [5]. A 11-year longitudinal study was conducted on 2891 patients in the year by Pitchika *et al.*, 2019. The study concluded that powered tooth brush had statistically significant reduction in clinical attachment level loss, probing pocket depth and had increased number of remaining teeth [6]. Several studies have agreed to these studies confirming the

efficiency of oscillating rotating power brush over other brush head including a meta-analysis by Cochrane database [7, 8]. For the same reason we have used the oscillating-rotating power brush head with angled tufts to achieve maximum plaque removal due to its oscillatory, rotational and vibratory movement.

Numerous studies have been conducted to assess the effect of oral irrigation in adjunct with the mechanical debridement. Efficient oral cleaning not only in the smooth areas but also in the interdental areas is vital as insufficient interdental cleaning may cause root caries and subgingival inflammation. Hence along with the tooth brush, additional oral hygiene is required that is dental floss, interdental brush and oral irrigator [9, 10].

Bunk D *et al.*, 2020 evaluated the benefit of oral irrigation along with tooth brushing in periimplantitis patient. The author stated that the oral irrigation has reduced the presence and severity of the peri implantitis in 12 weeks [11]. Few studies have evaluated the enhanced oral hygiene regimen that is the combination of electrical tooth brush and oral irrigator yielded improved gingival health and plaque control compared to home care oral hygiene regimen and the daily use of oral irrigator combination with manual tooth brushing is much more effective in reducing the gingival bleeding than flossing [12].

Panahov *et al.*, 2022 stated that there is an increased prevalence of periodontal disease with the advent of fixed prosthesis due to inadequate interdental brushing. This can be reduced up to a level by using electrical tooth brush with oral irrigators [13].

Therefore, our main objective of developing this model, Aqua Brush, was to address and help reduce the above-mentioned oral health problems.

## 4.0 CONCLUSION

The multifunctional prototype of Aqua brush is a combination of an Electric tooth brush and an oral irrigator. The novel modification gives an enhanced oral hygiene compared to brushing with toothbrush alone. This prototype primarily aims for enhancement in maintenance of patient oral hygiene and can be easily used as two separate entities. The convenient design modification may help in better patient acceptance in routine oral hygiene practice.

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