Original Article

Effectiveness of Plaque Control with Novel Pediatric Oral Hygiene Need Station (Modified Oral Irrigation Device) as Compared with Manual Brushing and Flossing: Randomized Controlled Pilot Trial

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Abstract

Background: Establishing good hygiene habits are valuable for present and future oral health. Below 6 years, tooth brushing should be performed by parents, as increasing dexterity and cognition may permit supervised brushing until the child is capable of independent brushing. **Aim and Objectives:** The aim of the present study was to evaluate the effectiveness of modified oral irrigation device in children in terms of plaque control and to compare the effectiveness of plaque control with manual brushing with the modified oral irrigation device in children. **Materials and Methods:** A randomized clinical trial was performed on 12 subjects who were allocated to the two study groups. After obtaining the consent, the control group was instructed tooth brushing with regular pediatric commercially available toothbrush and the intervention group with modified oral irrigation device. Plaque scores in both groups were assessed pre- and post-brushing using modified navy plaque index. **Results:** The data were subjected to Descriptive statistics and Paired *t*-test using SPSS version 22. Intragroup comparison of mean difference of plaque score in control group and intervention group pre- and post-brushing was statistically significant. Intergroup comparison of manual brushing group with modified oral irrigation group shows $P < 0.05$ was statistically significant. **Conclusion:** Within the limitation of the present study, it has been found novel pediatric oral hygiene need Station is more effective than manual brushing since it combined the effect of brushing, flossing (water floss), and rinsing in children simultaneously and at the same time did not demand any special motor skill.

Keywords: *Manual brushing, modified navy plaque index, modified oral irrigation device, pre- and post-brushing*

Introduction

Childhood is mirror in which propensities of adulthood are reflected. Oral flora contains billions of microorganisms. Personal oral hygiene is the maintenance of oral cleanliness for the preservation of oral health, whereby microbial plaque is removed and prevented from accumulating on teeth and gingival. Plaque is the primary etiological factor in gingivitis and periodontal diseases,[1,2] so these diseases are largely preventable by plaque control. Mechanical disruption and removal of plaque is simple and effective. For the children below 6 years, tooth brushing should be performed by parents, when increasing dexterity and cognition may permit supervised brushing until the child is capable of independent brushing. In young children, gingival health is common despite plaque accumulation due to immature host responses and poor oral hygiene. However, establishing good hygiene habits is valuable for present and future oral health.[3] Today, most commonly used oral hygiene measures are tooth brushing and flossing.[4] Although brush stroke movements vary and should concentrate on the gingival and proximal surface where plaque is most detrimental, the individual's dexterity and thoroughness are more critical than technique or design in determining the efficacy of plaque removal.[5] Flossing in toddlers is valuable for caries prevention and should be commenced as soon as primary teeth establish proximal contacts. At this time, the incidence of proximal caries and gingivitis increases significantly. Manual dexterity and training are needed for effective flossing and since this is not expected of children under 8, parents should floss for young children. Floss incorporating sodium or amine fluoride can promote fluoride uptake *in vitro* by molar proximal surfaces and de-mineralized primary enamel, but caries reductions have

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yet to be shown.[6] Recent studies report the new electric toothbrushes to be superior in plaque removal to manual toothbrushes but significant improvements in gingival health are yet to be shown. Interproximal and subgingival cleaning is more efficient due to the small rotating brush head and increased vibration frequency, and there is less gingival abrasion.[7,8] The biophysical action of the bristles in the surrounding fluid may have clinical benefit by aeration, but this requires further study.

Oral hygiene measures include mechanical aids such as toothbrushes, floss, interdental brushes, and chemotherapeutic agents are mouth rinses, dentifrices, and chewing gums. The benefit derived from oral hygiene depends on the manual dexterity, lifestyle, motivation, and oral hygiene state of the individual.[3] Hence, there is a need for the new device which can aid in the brushing, flossing, and rinsing. The aim of the present study was to evaluate the effectiveness of modified oral irrigation device in children in terms of plaque control and to compare the effectiveness of plaque control with manual brushing with the modified oral irrigation device in children.

Materials and Methods

The study was a randomized hypothesis formulating clinical trial in design with approval from the Institutional Ethical Committee. It was conducted in the JSS High School, Lakshmipuram, and Mysore after taking permissions from the school authorities. Thirty children aged between 5.5 and 6.5 years were initially screened. Selected participants and their parents were given information about the nature of the study and written informed consent was obtained. Subjects with the closed primary dentition who were healthy and willing to participate in the study were included. Randomization was done using the lottery method. A total of 12 subjects were selected and allocated to the two groups. The control group was instructed tooth brushing with regular pediatric commercially available toothbrush (Colgate super junior) and commercially available fluoridated toothpaste (Colgate strong teeth with cavity protection; 1000 ppm F). Brushing with novel pediatric oral hygiene need (NPN) station-novel pediatric need station which is a modified oral irrigation device [Figure 1] was allocated to the intervention group with commercially available fluoridated toothpaste (Colgate strong teeth with cavity protection; 1000 ppm F). This device has a base unit which is a motorized water jet, and a detachable unit consisting of multiple brush head units. The base unit is equipped with a water reservoir and is fitted with motor which can release water jet with controllable pressure. The time duration for the jet was fixed at 2 min. The water jet from the base unit was prorogated to the brush head through integrated pipeline system with 1 mm diameter lumen running through the handle and neck of the brush and ending at the head between the bristles. From the base unit, water jet comes out of the brush head like a shower which helps in interdental cleaning and also cleaning within the gingival crevice. Prebrushing plaque scores were recorded using modified navy plaque Index in the both groups. Modified Fone's brushing technique was used to perform the brushing under the supervision of the trained examiner for the duration of 2–3 min.[9] Outcome measures were determined by assessing postbrushing plaque scores using the modified navy plaque Index. Collected data were statistically analyzed using descriptive statistics and paired and independent *t*-test.

Figure 1: Novel pediatric oral hygiene need station (Modified oral irrigation device)

Results

The collected data were entered from the paper-based records into Excel data sheet. The data were subjected to appropriate Descriptive statistics and Paired *t*-test using SPSS version 22 (IBM corporation, Washington DC, United States). Intragroup comparison of mean plaque score in group 1 (manual brushing) pre- and post-brushing was 0.51600 ± 0.1039 and 0.28183 ± 0.0838, respectively. The difference in the plaque scores shows *P* value was statistically significant [Table 1]. Intragroup comparison of mean plaque score in modified oral irrigation device was 0.56833 ± 0.0652 and 0.14500 ± 0.04593. The difference was very highly statistically significant with $P \leq 0.00$ [Table 2]. Intergroup comparison of manual brushing group with modified oral irrigation group shows $P < 0.05$) was statistically significant with mean plaque scores being. 14500 in modified oral irrigation device group and. 28183 in manual brushing group [Table 3].

Discussion

Oral hygiene is the practice which enables to keep the oral cavity clean to prevent the onset and progression of dental caries. Dental caries remains as one of the most widespread disease of mankind. Dental caries is defined as a microbial disease of the calcified tissue of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth. It is a single most

Table 1: Intragroup comparison of manual brushing group

	Paired samples statistics				
	n	Mean±SD	df	*t*	Significant (two-tailed)
Pre	6	0.51600±0.103962	5	5.966	0.002
Post	6	0.28183±0.083882			

SD: Standard deviation

Table 2: Intragroup comparison of modified oral hygiene irrigation device

	Paired samples statistics				
	n	Mean±SD	df	*t*	Significant (two-tailed)
Pre	6	0.56833±0.065243	5	17.219	0.000
Post	6	0.14500±0.045935			

SD: Standard deviation

Table 3: Intergroup comparison of mean difference in plaque scores

Group	Group statistics					
	n	SD	SEM	df	*t*	Significant (two-tailed)
1	6	0.09614	0.03925	10	−4.085	0.02
2	6	0.06022	0.02459			

SD: Standard deviation; SEM: Standard error of mean

common chronic childhood disease. Although it may be argued that the disease is not life-threatening, the sequelae associated with it are far-reaching. The cost involved in the treating the disease in terms of workforce and hours spent is enormous. Furthermore, excruciating pain experienced by the patient can affect the patient as much as the esthetic problem it poses. Dentistry for children focuses to a very large extent on inculcating sound dental practices in every child for healthy dentition. With the thrust on prevention of dental caries, improvement of the quality of daily brushing is indispensable. To realize this goal the home oral hygiene and plaque control become the most important aspect of patient and parent education which a pedodontist can provide. Combing brushing with flossing is proven to provide better oral health.

A study by Mescher *et al*. showed that 6–8–year-old child had difficulty performing sulcular brushing and that hand function was age related. The ability of children to manipulate toothbrushes in the oral cavity varies according to their dexterity at different stages of their physical and neurological development. In the present pilot study, age group of the subjects was 5.5–6.5 years with the closed dentition. Children in this age have less manual dexterity for brushing and flossing. There are several oral hygiene aids used in children which has certain drawbacks.

Flossing in toddlers is valuable for caries prevention and should be commenced as soon as primary teeth establish proximal contacts. At this time, the incidence of proximal caries and gingivitis increases significantly manual dexterity and training are needed for effective flossing and since this is not expected of children under 8, parents should floss for young children. Several conventional methods for flossing such as pre-threaded flosses are available which is not children friendly. The present study used NPN Station which was a modified oral irrigation device. It includes brush, floss, and rinse in single station which helps the child for the better oral hygiene. This water flosser goes to the inaccessible areas whether it is open dentition or closed dentition and brings about the plaque removal. Use of fluoride mouthwash brings the chemical plaque control, so it is a three times more effective than a simple manual brushing. Special care children and neurodevelopmental disorders such as autism, cerebral palsy, and epilepsy were impairments of the growth and development, impaired motor function, learning. Maintain the oral hygiene is challenging. The advantages of NPN Station are children friendly, time-saving, parent supervision is not required.

The present study used Modified navy plaque index to record the plaque scores in the subjects before and after brushing. This index evaluates the amount of plaque in the tooth area bounded by the interproximal areas, the free gingival margin, and mesial or distal line angles. When the Modified navy plaque index was used, significant differences between pretooth brushing and posttooth brushing plaque scores could be demonstrated. Results of the present study showed that there was a significant difference observed in the plaque scores before and after the brushing in modified oral irrigation group.[10,11]

The limitation of the present study was sample size. As the present study was a pilot trial, only 6 subjects were included in this study. Further studies need to carry out in a larger sample size.

Conclusion

Children below 6–7 years are still developing the fine motor skills, effective flossing may seem challenging. Within the limitation of the present study, it has been found NPN Station – which is a modified oral irrigation device is more effective than manual brushing since it combined the effect of brushing, flossing (water floss), and rinsing in children simultaneously and at the same time did not demand any special motor skill.

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Conflicts of interest

There are no conflicts of interest.

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