

**Research Article****EVALUATION OF MECHANICAL PLAQUE REMOVAL EFFECTIVENESS OF TOOTHBRUSH AND ITS MODIFICATIONS IN INTELLECTUALLY DISABLED CHILDREN.**

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**ABSTRACT**

**Background:** Disability is an umbrella term that includes a problem in the body single-valued function or structure. Disabled children reveal a high prevalence of gingivitis and also show non-compliance towards brushing. Hence, the present study aimed to clinically evaluate and compare the mechanical plaque removal efficacy of Toothbrush Attached to Hand by Rubber Band, Toothbrush with a Bicycle Grip as a handle, Toothbrush with attached small bells and Normal toothbrush in the reduction of established plaque and gingivitis. **Materials and methods:** Out of 148 intellectually disabled children, 100 children meeting inclusion criteria were selected and randomly assigned to 4 equal groups and the toothbrushes were distributed for use according to the aforementioned brush modifications. Simplified Oral Hygiene Index and Patient Hygiene Performance Index were recorded at baseline, 30th day, 60th day, and 90th day. The efficacy of each toothbrush type was assessed by intergroup comparison. Statistical analysis was done using ANOVA test. **Results:** Both Toothbrush with a Bicycle Grip as a handle and Toothbrush with attached small bells demonstrated superior results with statistical significance. **Conclusion:** Modifications in toothbrush like Bicycle Grip and toothbrush with attached small bells can play an important role in creating interest among children to improve oral hygiene. These toothbrush modifications are not only economical but can also be easily advocated for children who are intellectually challenged.

**Keywords:** Bicycle grip, oral hygiene, plaque removal, small bells, special child.

**INTRODUCTION:**

Prevention has become the cornerstone of the modern dental practice. The effective plaque control is the basic password to the meaningful practice of preventive dentistry<sup>1</sup> ineffective plaque control results in poor oral hygiene. Common problems associated with poor oral hygiene are dental caries, periodontal disease, and tooth loss. Supra-gingival plaque removal has been found to be remarkably effective in reducing total plaque

specific subgingival species and showing sustained improvement in clinical parameters.<sup>2</sup> Various chemical and other mechanical methods have been advocated for this purpose, however, tooth brushing has been referred to as the most commonly used, effective and safest therapeutic method to get rid of plaque. Nevertheless, it is generally believed that toothbrushing is inefficient among children younger than 10 years, perhaps due to lack of motivation and poor manual dexterity, which are normal at this age.<sup>3</sup>

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The major dental health problem in intellectual and developmental disabled children is owing to their poor propensity towards the maintenance of oral hygiene leading to the development of periodontal disease. This may be attributed to the lack of motivation and manual dexterity for achieving the good standard of oral hygiene. Individuals with disabilities receive less oral care than the normal population in spite of the high level of dental diseases among them.<sup>4</sup> The physical, cognitive and behavioral limitations presented by severely disabled individuals require modification of usual toothbrush including changing the size and shape of the handle which allows for sufficient grasp.

It is also important to gain a child's interest in brushing by introducing new devices that a child can enjoy while brushing. Nowadays, "Brush Buddies" the musical talking toothbrush which is utilized broadly in the USA, is introduced in the Indian market. The music makes the child motivated to brush his/her teeth, leading to better participation in the brushing.<sup>1</sup> These types of toothbrushes may be more useful for the disabled children but are not economical. Children with special health needs are faced with a lifetime of functional limitations. Their caregivers have to cope with their special needs and the financial burden makes the parents more impoverished and indebted. Moreover, the social security systems targeting the caregivers of differently abled children are not well developed in India. So it is not only important that the toothbrush should effectively remove plaque but also, it should be economical.

Till date, no reported studies have been done to compare between modifications of toothbrushes with the normal toothbrush in disabled children. Keeping this in mind, we have formulated a study as described in the following.

### AIMS AND OBJECTIVES

The present clinical study was aimed to clinically evaluate and compare the mechanical plaque removal efficacy of Toothbrush Attached to Hand by Rubber Band, Toothbrush with a Bicycle Grip as a handle, Toothbrush to which small bells are attached and Normal toothbrush in intellectually disabled children.

### MATERIALS AND METHODS

The study was conducted by the Department of Pedodontics and Preventive Dentistry, St. Joseph Dental College, Eluru in association with two private intellectually disabled institutions located in Eluru, Andhra Pradesh. A total of 148 disabled children were screened after consent from caretakers. Finally, 100 children (8-16 years) who fulfilled the inclusion criteria were selected and informed consent was obtained from their parents/legal guardians.

### INCLUSION CRITERIA

Children who are mentally challenged (mild to moderate)

Subjects with moderate gingivitis and fair plaque index.

Subjects who brush their teeth by their own

### EXCLUSION CRITERIA

Subjects with poor manual dexterity.

Subjects with muco-gingival problems.

Subjects with 3 or more carious teeth that require immediate treatment.

Subjects using any other supplemental plaque control devices such as interdental cleansing aids or mouthwashes.

### STUDY DESIGN

A total number of 100 intellectually disabled children were selected and subdivided into 4 groups comprising of 25 children in each group.

Group A: Normal toothbrush. (Fig. 1)

Group B: Toothbrush with attached Small Bells. (Fig. 1)

Group C: Toothbrush with a Bicycle Grip as handle. (Fig. 1)

Group D: Toothbrush attached to hand by the Rubber Band. (Fig. 1)



Figure 1: Normal Toothbrush and its modifications.

After having recorded the clinical parameters at baseline (0 days) using Greene and Vermilion’s Simplified Oral Hygiene Index (1964)<sup>5</sup> and Podshadley & Haley’s Patient Hygiene Performance Index (1968)<sup>6</sup> each subject was then instructed to brush twice daily with the allocated toothbrush. The oral hygiene Instructions regarding the method of brushing technique (FONES TECHNIQUE) were given. All the clinical

parameters were again recorded on the 30th day, 60th day, and 90th day.

**RESULTS**

The study was conducted in a single-blind manner with the chief investigator being unaware of the toothbrush used by the subjects. There were no dropout cases and all the subjects maintained their recall appointments. ANOVA test was used to check intergroup variables. Pre and Post results of Simplified Oral Hygiene Index from Table 1 showed that for groups A and D the mean score at baseline was not reduced at 90 days with greater than 0.05 p-value which was not statistically significant, whereas for groups B and C, the value of p was less than 0.05 which was significant statistically. Observations from Table 2 with Pre and Post results of Patient Hygiene Performance Index showed that for Group A the mean score at baseline was not reduced at 90 days with the value of p greater than 0.05 which was not statistically significant, whereas, for Groups B, C and D the value of p was less than 0.05 which was significant statistically.

Table 1: Pre and Post results of Simplified Oral Hygiene Index in Group A, Group B, Group C and Group D

	Mean±SD	ANOVA	
		F value for 3 months	P value for 3 months
Group A Baseline Mean	2.7±0.61	Group A - 1.2 Group B - 5.058 Group C - 8.166 Group D - 2.4	Group A - 0.305 Group B - 0.003 Group C - 0.000 Group D - 0.067
Group B Baseline Mean	3.9±0.63		
Group C Baseline Mean	2.9±0.7		
Group D Baseline Mean	2.5±1.1		
Group A Mean - 1 <sup>st</sup> month	2.6±0.53		
Group B Mean - 1 <sup>st</sup> month	1.7±0.47		
Group C Mean - 1 <sup>st</sup> month	2.1±0.62		
Group D Mean - 1 <sup>st</sup> month	1.9±0.68		
Group A Mean - 2 <sup>nd</sup> month	2.7±0.48		
Group B Mean - 2 <sup>nd</sup> month	1.7±0.50		
Group C Mean - 2 <sup>nd</sup> month	2.2±0.56		
Group D Mean - 2 <sup>nd</sup> month	2.1±0.64		
Group A Mean - 3 <sup>rd</sup> month	2.9±0.56		
Group B Mean - 3 <sup>rd</sup> month	2.3±0.55		
Group C Mean - 3 <sup>rd</sup> month	2.5±0.66		
Group D Mean - 3 <sup>rd</sup> month	2.4±0.97		

Table 2: Pre and Post results of Patient Hygiene Performance Index in Group A, Group B, Group C and Group D

	Mean±SD	ANOVA	
		F value for 3 months	P value for 3 months
Group A Baseline Mean	3.49±.83	Group A - 0.922 Group B - 37.18 Group C -7.96 Group D - 2.97	Group A - 0.433 Group B - 0.000 Group C - 0.000 Group D - 0.003
Group B Baseline Mean	3.9±.68		
Group C Baseline Mean	3.5±.84		
Group D Baseline Mean	2.9±1		
Group A Mean - 1 <sup>st</sup> month	3.2±.67		
Group B Mean - 1 <sup>st</sup> month	2.3±.57		
Group C Mean - 1 <sup>st</sup> month	2.6±.71		
Group D Mean - 1 <sup>st</sup> month	2.3±.61		
Group A Mean - 2 <sup>nd</sup> month	3.3±.62		
Group B Mean - 2 <sup>nd</sup> month	2.4±.50		
Group C Mean - 2 <sup>nd</sup> month	2.6±.59		
Group D Mean - 2 <sup>nd</sup> month	2.4±.63		
Group A Mean - 3 <sup>rd</sup> month	3.5±.80		
Group B Mean - 3 <sup>rd</sup> month	2.8±.58		
Group C Mean - 3 <sup>rd</sup> month	2.9±.70		
Group D Mean - 3 <sup>rd</sup> month	2.6±.71		

**DISCUSSION**

Oral health is absolutely critical for overall health. For children with or without developmental disabilities, a smile is the simplest method of interacting with the world. Poor oral wellbeing may likewise contribute to systemic ailment (aspiration pneumonia, systemic infection, and systemic inflammation). Dental caries, Gingivitis, and periodontal disease are caused by bacteria due to lack of routine oral hygiene procedures.<sup>7</sup> Although various mechanical devices and chemical agents are proved to be effective for plaque control, mechanical plaque removal using a toothbrush still remains the most popular and effective method.

Biesbrock AR (2008)<sup>8</sup> evaluated the plaque removal efficacy of an advanced rotation-oscillation power toothbrush to a newly-introduced sonic toothbrush and found that Rotation-oscillation power to be more effective in plaque removal than Sonic toothbrush with the scores of statistical significance (P< 0.0001). Silverman (2004)<sup>9</sup> compared the small head Oralgiene powered toothbrush with the Braun Oral-B Mickey Mouse powered toothbrush

and a manual toothbrush (Oral-B Rugsrats 20) for the efficacy in plaque removal and reduction of gingival inflammation in young children. However, among them, no clinically meaningful differences were found with respect to plaque removal or gingival scores.

Disabled children cannot comprehend the significance of brushing teeth. So the tooth brushing ought to be presented in a manner that children can enjoy it rather than run away from it. Many toothbrush modifications are available in the market such as, powered toothbrush, superbrush, pulsar toothbrush, ultrasonic toothbrush, musical toothbrush, with Velcro strap, with varied grips and handles, double-headed toothbrushes which help in motivation.

Laskar(2010) conducted a study on the economic status of disabled children in New Delhi and stated that there is an urgent need for support activities for such families on a national level in order to curb the huge economic and social burden of caregiving.<sup>10</sup> The Lack of services to these growing segments of the population is the genuine matter to worry and is a major drawback. The present clinical study clinically evaluated and compared

the efficacy of normal Toothbrush and its modifications which are economical.

From the present study, it is evident that regardless of the type of brushing technique and dentifrices utilized, regular oral hygiene maintenance can reduce the plaque deposition. Among the 4 groups, the control Group A which used the normal toothbrush demonstrated poor results in the reduction of debris, calculus and plaque. In Group D, the toothbrush which is attached to the hand by Rubber Band demonstrated superior results, but the p-value was not statically significant. It may be attributed to the child's cooperation as the toothbrush firmly attaches to the hand with the help of the band and if the child does not hold onto the toothbrush the attached band can be lost easily.

In the present study, Toothbrush with a Bicycle Grip handle (Group C) and Toothbrush with attached small bells (Group B) demonstrated better results during follow-up. Hence, both modified toothbrushes can be effective for plaque removal if they are used on a regular basis. The physical and cognitive limitations presented by severely disabled individuals require modification of conventional toothbrush with a change in the shape of the handle that allows sufficient grasp.

The new modification used in the present study was a toothbrush with attached small bells demonstrated significant difference because of the fact that the child is motivated by the sound made by the bells while brushing which may have led to better participation in the act. This modification may have motivated the child to brush more regularly and efficiently. Ganesh M (2012) evaluated the efficacy of musical toothbrush and Colgate Smile toothbrush in the reduction of established plaque. The musical toothbrush was found to be effective initially, but as the time period increased both toothbrushes gave almost similar results.<sup>1</sup>

Based on the present data, the toothbrush with Bicycle Handle as a grip and Small Bells attached toothbrush have a great potential to remove plaque effectively as compared to the normal toothbrush and toothbrush attached to the hand by the Rubber Band, but more randomized controlled trials are necessary to evaluate the effectiveness of these modifications. Hence, future

studies with increased number of sample sizes are recommended with an added psychological investigation parameter to assess the role of improved interest in oral hygiene obtained with toothbrush modifications among disabled children.

## CONCLUSION

Modified toothbrushes such as toothbrush with Bicycle Grip handle and toothbrush with attached small bells were designed for the children needing assistance and to overcome the barrier experienced by them. These modified economical toothbrushes may play an important role in creating interest among intellectually challenged children with dexterity issues for improving oral hygiene.

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