

## Change in Skills Observed with a Novel Brushing Technique Based on Sequence Learning; Evaluated Through Video Bio-Feedback System in Children

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### Abstract

**Background:** Amongst young children an easy but adequately effective fones or horizontal scrub methods have often been advocated and is employed. Our observation is that children practicing this technique concentrate more on front buccal surfaces of the teeth and neglect inner surfaces of teeth. To overcome this problem modification in technique is required.

**Aim:** The aim of the study is to describe the brushing technique based on sequence learning principle and to evaluate change in skills observed after teaching and practicing this technique for a period of 12 weeks by 6 year old children with video bio-feedback system.

**Method:** The process of brushing starting from dispensing of the paste on brush till completion of brushing was video recorded for each child in a standardized way by expertise before and 12 weeks after the training of new brushing method. Data brushing skills were collected and was statistically analyzed.

**Result:** Overall change observed in learning skills of children with new brushing method as compared to innate method in both maxillary and mandibular arch showed statistically significant improvement with new brushing method ( $p < 0.001$ ).

**Conclusion:** For children tooth brushing should be presented as a habit and an integral part of the daily hygiene routine. Brushing technique based on sequence learning principle technique can be recommended as a novel method of brushing for children.

**Keywords:** Oral hygiene; Sequence learning; Brushing technique; Learning skills

### Introduction

Dental plaque has been defined as a complex community of bacterial species that is constantly formed over dental surfaces [1]. The accumulation of plaque or bio-film at the gingival and approximal margins can lead to gingival and periodontal diseases [2]. On the other hand one of the basic etiological factors of dental caries undoubtedly is the microorganism, which also is a part of this biofilm [3]. Regular oral hygiene is mandatory for dental plaque control. Although this bio-film is exposed to saliva and other natural self-cleaning mechanisms, the removal of dental plaque is not naturally achieved [1]. Tooth brushing is the most widespread mechanical means of personal plaque control technique in the world due to its effectiveness, convenience and cost and is considered to be an important factor in the long term maintenance of periodontal health [4].

It is generally known that tooth brushing by children less than ten years of age is inefficient [5]. This can be explained by the poor manual dexterity, lack of motivation, irregular pattern of brushing, lack of knowledge regarding an atomic structure of tooth and mechanical brushing habit with least attention [6]. So, among young children an easy but adequately effective Fones method or horizontal scrub method have often been advocated and is employed. In spite low level of posterior lingual and anterior lower lingual brushing was reported in previous literature [7].

To practice a proper brushing technique child has to remember sixteen different anatomical positions [8] which are difficult. We felt sequencing 16 positions in a row will help children to remember better

as the order in which material is presented can strongly influence what is learned and how fast performance increases [9].

Based on the sequence learning principle a brushing method was designed children. To evaluate its efficacy and to determine the comprehensive difficulty of various brushing movements used in this technique a study was designed.

The aim of the study is to evaluate the change in skills observed after teaching and practicing brushing technique based on sequence learning principle technique for a period of 12 weeks by the 6 year old children along with video bio-feedback system.

### Materials and Method

#### Sample selection

The pediatric dental department of JSS Dental College is providing oral health care education and reinforcement facility for primary school

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children of few of the residential schools in and around the Mysore city from past 10 years. Our objective is to encourage daily oral hygiene among children of residential schools. We concentrate especially on 1<sup>st</sup> grade (primary school) children (6 years of age group) who freshly join the residential school every year. As this was a pilot work one of the residential school in which we provide oral health education was randomly selected. All available 40 children from grade one is included in the study. The children included in the study stayed in this setup away from their parents for more than 10 months a year. Approval for this research work was obtained by the institutional ethical board and study was conducted during the period of November 2012 to January 2013 after obtaining permission from residential school authorities and the parents of the children. Verbal consent from all the children participating in the study was obtained.

### Brushing technique developed based on sequence learning principle

This technique advocates use of age appropriate volume of toothpaste onto a soft, age-appropriate sized toothbrush. This is an open mouth technique in which child is asked to brush their teeth in a small clock wise circular motion. Brushing starts from maxillary front buccal surface moving on to left, inner surfaces and right outer surface to finish with the position from which it is started. Mandibular arch will also follow the same sequence after which all four occlusal surfaces are brushed with horizontal scrubbing method (Figure 1). In order to achieve these skills two purposive strokes similar or dissimilar (circular and scrubbing) were required at each of the different positions in the mouth.

### Data collection

A self designed format was used to record the general information of the child such as name, age, gender and address. A single trained pediatric dentist evaluated all the subjects for plaque using Turesky-modified Quigley-Hein index. Whole set of dentition were assessed for plaque on buccal and lingual surfaces after staining with the disclosing agent. To obtain base line data for the level of innate skills existing, each child was instructed to brush with their own brush and paste. This process of brushing, starting from dispensing of the paste on to the brush till the completion of brushing for each child was video recorded for each child in a standardized way by expertise.

Subsequently each child was provided a new pediatric brush and pediatric tooth paste and taught brushing technique developed based on sequence learning principle by verbal instruction, physical demonstration on models and with audiovisual video clip showing correct brushing technique by a pediatric dentist who is well-versed with this technique. Each child was asked to practice this new method in their mouth. The same methods were also taught to caregivers of the residential school and were asked to monitor and guide the children every day for a period of three months. Once in a week the same pediatric dentist visited the children and reinforced the method of new brushing technique. After three months once again plaque index was recorded for each child and was instructed to brush on their-own and this process of brushing starting from dispensing of the paste on brush till completion of brushing was video recorded in a standardized way by same expertise.

Pre and post brushing video clippings of each child was evaluated by two blinded expert examiners. The 16 positions that were explained above were evaluated for presence or absence of brushing. Also other parameters, like the amount of paste dispensed, duration of brushing, technique of brushing and the grip of holding brush also were noted.

### Data analysis

In the present study mean, standard deviation and percentages were used for descriptive statistics. Chi-square test was used for the comparison of percentages before and after procedure. To compare means between before and after procedure Wilcoxon Signed Ranks Test was used. Comparison of bi nominal distribution before and after McNemar Test was used.  $p < 0.05$  was used for statistical significance. SPSS 17 version was used for Statistical analysis.

### Results

Of the 40 children participated in the study 23 were boys and 17 were girls. In maxillary arch all three palatal positions (left, front and right) which were most commonly missed by children during brushing with innate method, were improved with new brushing method. The improvement observed was found to be statistically significant ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.022$ ) (Table 1). All three buccal positions (right, front and left) and two occlusal positions (right and left) showed higher values for innate skills which again improved with new brushing method. However the improvement observed was found to be statistically significant only in right occlusal position ( $p < 0.016$ ) (Table 1).

In mandibular arch also three lingual positions (left, front and right) were the areas that were commonly missed by children and showed less values during brushing with innate method which improved after teaching new brushing method. The improvement observed was found to be statistically significant ( $p < 0.001$ ,  $p < 0.013$ ,  $p < 0.016$ ). All three buccal positions (right, front and left) and two occlusal positions (right and left) showed higher values for innate skills which again improved with new brushing method. The improvement observed in right and left occlusal position was found to be statistically significant ( $p < 0.004$ ,  $p < 0.001$ ) (Table 2).

Overall change observed in learning skills of children with new brushing method as compared to innate method in both maxillary and mandibular arch showed statistically significant improvement in brushing skills with new brushing method ( $p < 0.001$ ) (Table 3 and 4).

Plaque scores assessed using Turesky-modified Quigley-Hein

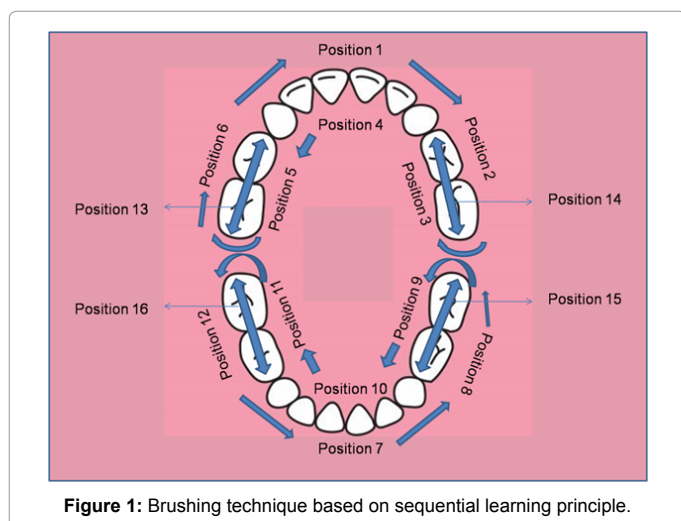


Figure 1: Brushing technique based on sequential learning principle.

plaque index showed statistically significant reduction in plaque through novel brushing technique in both buccal and lingual side (Table 5).

## Discussion

Tooth brushing, as all habits of hygiene, is acquired during the socialization process of the child [10]. When this habit is properly taught in early childhood, it is naturally ingrained in the daily routine of the child, with only positive reinforcement needed later [11,12]. Tooth brushing can be compared with other health-related habits that will persist throughout life without great changes [13]. So teaching a

simple but correct method of brushing in early childhood is of at most important matter.

Many preschool children are probably introduced to oral hygiene procedures especially tooth brushing by their parents. With constant repetition, patterned of behavior learned at this age may become deeply ingrained and resistant to change. So, teaching a correct method of brushing by parents, care givers or dentists becomes a very essential part of this teaching and learning chain. Nevertheless, Instructions should be given according to the child's degree of readiness for tooth brushing and should include systematic training and reinforcement. Although manual dexterity and ability are necessary, intensive

Skill type	Position	Acquired innately	After training	Change observed after training	Significance
Maxillary front buccal	1	97.5%	100%	02.5%	1.00
Maxillary left buccal	2	85.0%	95.0%	10.0%	0.13
Maxillary left palata	3	02.5%	42.5%	40.0%	0.001*
Maxillary front palata	4	07.5%	65.0%	57.5%	0.001*
Maxillary right palata	5	05.0%	27.5%	22.5%	0.022*
Maxillary right buccal	6	77.5%	95.0%	17.5%	0.016*
Maxillary left occlusal	13	37.5%	40.0%	02.5%	1.00
Maxillary right occlusal	16	35.0%	55.0%	20.0%	0.15

a Binomial distribution used  
b McNemar Test

Table 1: Proportion of change observed in brushing position in children before and after the training for maxillary arch.

Skill type	Position	Acquired innately	After training	Change observed after training	Significance
Mandibular front buccal	7	100%	100%	0%	1.000
Mandibular left buccal	8	85.0%	90.0%	05.0%	0.688
Mandibular left lingual	9	07.5%	45.0%	37.5%	0.001*
Mandibular front lingual	10	12.5%	40.0%	27.5%	0.013*
Mandibular right lingual	11	02.5%	20.0%	17.5%	0.016*
Mandibular right buccal	12	75.0%	87.5%	12.5%	0.227
Mandibular left occlusal	14	55.0%	90.0%	35.0%	0.001*
Mandibular right occlusal	15	57.5%	87.5%	30.0%	0.004*

a Binomial distribution used  
b McNemar Test

Table 2: Proportion of change observed in brushing position in children before and after the training for mandibular arch.

	N	Mean	Std. Deviation	Minimum	Maximum	Z- value	p-value
Maxillary After	40	5.20	1.67	1.00	8.00	-4.675 (a)	0.001*
Maxillary before	40	3.48	1.09	1.00	6.00		

a Based on positive ranks.  
b Wilcoxon Signed Ranks Test

Table 3: Comparison of change observed in children in brushing skills before and after the training for maxillary arch and mandibular arch.

	N	Mean	Std. Deviation	Minimum	Maximum	Z- value	p-value
mandibular After	40	3.93	1.02	2.00	5.00	-4.933 (a)	.001*
mandibular before	40	5.60	1.10	4.00	8.00		

a Based on positive ranks.  
b Wilcoxon Signed Ranks Test

Table 4: Proportion of change observed in children in brushing skills before and after the training for mandibular arch.

	Mean	Std. Deviation	Mean difference	Z- value	P-value
Pre buccal	3.27	1.65	2.04	-22.78	0.001*
Post buccal	1.23	1.38			
Pre lingual	2.58	1.71	1.20	-17.80	0.001*
Post lingual	1.38	1.46			
Pre all	5.85	2.94	3.24	-23.42	0.001*
Post all	2.60	2.49			

Table 5: Proportion of change observed in plaque scores in children before and after the training.

individual training is essential [8,10]. Children should be educated in oral self-care according to their status of psychological development with simplest possible in orderly practicable but effective method [11].

Among young children, an easy but adequately effective horizontal scrubbing and Fones method has often been advocated and employed [14]. Horizontal scrubbing successfully removes the plaque from smooth outer and inner surfaces of the teeth; however, it is generally considered detrimental because vigorous scrubbing can encourage gingival recession and, with a dentifrice of sufficient abrasiveness and a hard textured toothbrush, can create areas of tooth abrasion [15].

Fones technique is indicated for young children and others who do not have the proper muscle development for the more complex techniques. Fones technique uses large, sweeping, scrubbing circles over occluded teeth, with the toothbrush held at right angles to the tooth surfaces. With the jaws parted, the palatal and lingual surfaces of the teeth are scrubbed in smaller circles. Occlusal surfaces of the teeth are scrubbed in an antero-posterior direction. It has equal or better potential than the Bass technique for plaque removal. It is easy to learn, takes shorter time and provides good gingival stimulation. But it has its own disadvantage like it can cause trauma of the gingival tissues. Interdental areas are not properly cleaned [16]. It is a closed mouth technique and does not follow a sequence because of which children tend to forget the palatal, occlusal and lingual surface more often. So we felt sequencing 16 anatomical positions will help children to remember all the positions better and will aid in improvement of skills. Sequence learning is inherent to human ability and is part of conscious and subconscious learning as well as activities. Sequences of information or sequences of actions are used in various everyday tasks: Sequence learning can be used to study skill acquisition and in studies of various groups ranging from neuropsychological patients to infants [17].

Development of grammatical understanding in very young children continues for several years. This could explain the difficulty found in the training and practice of oral hygiene techniques in preschool children using only verbal instructions [8]. To overcome this we used both verbal and audiovisual methods for teaching. For evaluation we used video feed back system. Video recording may have put some children under pressure but we felt that proper evaluation is possible with this method as video clippings can be repeatedly played and re-evaluated in case of doubt. Also videos can act as reference for long term evaluation, and by watching his/her own brushing video children can improve their technique, so it acts as a bio-feedback system.

## Conclusion

Within the limitations of the study overall change observed in learning skills of children with the new brushing method as compared to innate method in both maxillary and mandibular arch showed statistically significant improvement in brushing skills. Therefore the brushing technique based on sequential learning principle can be recommended as a novel method of brushing for children.

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## References

1. Socransky SS, Haffajee AD (2002) Dental biofilms: difficult therapeutic targets. *Periodontol* 2000 28: 12-55.
2. Westfelt E, Rylander H, Dahlén G, Lindhe J (1998) The effect of supragingival plaque control on the progression of advanced periodontal disease. *J Clin Periodontol* 25: 536-541.
3. Leal SC, Bezerra AC, de Toledo OA (2002) Effectiveness of teaching methods for toothbrushing in preschool children. *Braz Dent J* 13: 133-136.
4. Tan E, Daly C (2002) Comparison of new and 3-month-old toothbrushes in plaque removal. *J Clin Periodontol* 29: 645-650.
5. Unkel JH, Fenton SJ, Hobbs G Jr, Frere CL (1995) Toothbrushing ability is related to age in children. *ASDC J Dent Child* 62: 346-348.
6. Grossman E, Proskin H (1997) A comparison of the efficacy and safety of an electric and a manual children's toothbrush. *J Am Dent Assoc* 128: 469-474.
7. Zimmer S, Bizhang M, Seemann R, Barthel CR (2001) [Effective of preventive programs on oral hygiene of adults and school children]. *Gesundheitswesen* 63: 98-101.
8. Simmons S, Smith R, Gelbier S (1983) Effect of oral hygiene instruction on brushing skills in preschool children. *Community Dent Oral Epidemiol* 11: 193-198.
9. Frank E, Ritter, Josef Nerb, Erno Lehtinen, Tim O Shea (2007) In order to learn: how the sequence of topics influences learning. Oxford University Press, Oxford, New York, USA.
10. García-Godoy F (1986) [Oral health as part of the socialization process]. *Acta Odontol Pediatr* 7: 11-13.
11. Tsamtsouris A, White GE, Clark ER (1979) The effect of instruction and supervised toothbrushing on the reduction of dental plaque in kindergarten children. *ASDC J Dent Child* 46: 204-209.
12. Sutcliffe P, Wishart WA, Clemson N (1977) Supervised toothbrushing in a nursery school. *Br Dent J* 142: 192-194.
13. Paunio P, Rautava P, Sillanpää M, Kaleva O (1993) Dental health habits of 3-year-old Finnish children. *Community Dent Oral Epidemiol* 21: 4-7.
14. Sgan-Cohen HD, Adut R (2001) Promotion of gingival and periodontal health from childhood. In: Bimstein E, Needleman HL, Karimbux N, Van Dyke TE (Eds.), *Periodontal and Gingival Health and Disease Children, Adolescents and Young Adults*. Martin Dunitz, London, UK.
15. Piotrowski BT, Gillette WB, Hancock EB (2001) Examining the prevalence and characteristics of abfractionlike cervical lesions in a population of U.S. veterans. *J Am Dent Assoc* 132: 1694-1701.
16. Tooth Brushing Technique. Maulana Azad Institute of Dental Sciences, New Delhi, India.
17. Clegg BA, Digirolamo GJ, Keele SW (1998) Sequence learning. *Trends Cogn Sci* 2: 275-281.

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