Comparative Assessment of Oral Hygiene among Four Commercially Available Brands of Orthodontic Toothbrushes -An In-Vivo Study

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Abstract

Introduction: The most common problem with placement of orthodontic appliances (fixed) is the maintenance of proper oral hygiene. This may lead to periodontal problems. Orthodontic toothbrushes are to be used by patients with braces bonded on the teeth. Due to the varieties of manual orthodontic toothbrushes available commercially, there is often a dilemma amongst the patients as to which brand to use. The same confusion is also there amongst the orthodontists regarding the prescription of manual orthodontic toothbrushes. **Aim:** Comparative assessment of oral hygiene among four different commercially available brands of manual orthodontic toothbrushes. **Methodology:** A total of 60 subjects were selected for the study and were divided into four groups of 15 subjects each, randomly using simple random sampling. Four routinely prescribed brands of toothbrushes namely Colgate ortho Brush, Dr Dentaids Stim ortho MB orthodontic toothbrush, Oral B Orthodontic toothbrush and Thermoseal ortho brush were selected to be compared in terms of maintaining oral hygiene. One brand of orthodontic toothbrush was assigned for each of the four groups. Participants of all the four groups were given one common dentifrice and mouthwash. The subjects were asked to brush twice daily and use the mouthwash daily and were asked to report at the fixed time intervals for follow up. Oral hygiene of all the selected subjects was evaluated in terms of four indices; Orthodontic Plaque Index, Loe and Silness Gingival Index, Bleeding on Probing and Probing Pocket Depth. All these indices were recorded at three time intervals- T_0 (at the time of bonding), T_1 (3 months following T_0) and T_2 (6 months following T_0). **Results:** There were no significant differences in all the indices at time T_1 amongst all the toothbrushes. Comparison of the indices between T_0 and T_1 also showed no significant differences. Statistically significant difference was observed at time T_2 in the subjects (p value <0.001). Comparison of the indices between T_0 and T_2 showed statistically significant differences (p value <0.001). Tooth brush C showed least mean values of Orthodontic Plaque Index at T_1 and T_2. Even in terms of Gingival Index, Toothbrush C (Oral B Orthodontic toothbrush) showed the least mean values at both, T_1 and T_2. It was found that Toothbrush C was the best in terms of maintaining oral hygiene in terms of Orthodontic Plaque Index and Gingival index. In terms of Bleeding on Probing and Probing Pocket Depth, all the four selected brands of toothbrushes showed efficient results. **Conclusion:** With this study it was clear that amongst all four selected tooth brushes, Oral B Orthodontic toothbrush was more efficient in maintaining oral hygiene in orthodontic patients. All the four toothbrushes are equally efficient in maintaining adequate oral hygiene if used with proper care and changed periodically.

I. INTRODUCTION

Orthodontics is a specialty of dentistry that deals with the correction of malaligned teeth primarily, correction of the smile and establishing various facial proportions of the face in order to achieve an esthetically pleasing and socially acceptable facial profile. Orthodontic treatment aims at complete restoration of Orofacial health in terms of "physical, mental and social well-being" as defined by WHO[1]. Presence of malposed teeth and therefore an unattractive smile is the most important factor that is responsible for motivating individuals to undergo orthodontic treatment[2].

However there are many complications and problems that arise due to placement of orthodontic appliances whether fixed or removable. One of the major problems that individuals face following the placement of fixed orthodontic appliance is the maintenance of a proper oral hygiene[3]. The brackets bonded on the teeth tend to accumulate food debris persistently. This causes problems like, plaque accumulation, calculus formation, spontaneous gingival bleeding, gingival enlargement, halitosis and periodontal attachment loss[4]. Apart from these conditions, some other commonly encountered complications during fixed orthodontic therapy include white spot lesions, gingival recession, tooth mobility and caries[5].

When compared to removable appliances like myofunctional appliances, the fixed appliances tend to show more plaque accumulation, gingival recession and tooth mobility[6]. Microbiological studies have shown that fixed orthodontic appliances provide highly retentive surfaces onto which increased numbers of Gram +ve and Gram –ve bacteria like *S. mutans, P. gingivalis, Lactobacillus* spp. *T. forsythia,* etc. colonize. These are associated with development of caries and periodontal diseases in patients with fixed orthodontic appliances[7, 8].

In order to maintain proper oral hygiene, patients with fixed orthodontic braces treatment are often advised to use toothbrushes, dentifrices and mouthwashes amongst a vast variety available commercially. It is a proven fact that the use of orthodontic toothbrush is a better option over the regular toothbrushes for maintenance of oral hygiene[9]. Plaque control is better when using orthodontic toothbrushes as compared to conventional toothbrushes[10]. This is related to the difference in the design of orthodontic toothbrush and the conventional toothbrush. It was found that brushes with crisscross bristles were the most efficient in removing plaque when compared against toothbrushes with flat bristles and zigzag bristles[11].

Though the electric powered and sonic toothbrushes are most effective[12], they are costly and technique sensitive and also there are chances of debonding of orthodontic brackets. Hence using the manual orthodontic toothbrushes seems to be the better option.

Due to the varieties of manual orthodontic toothbrushes available commercially, there is often a dilemma amongst the patients as to which brand to use. The same confusion is also there amongst the orthodontists regarding the prescription of manual orthodontic toothbrushes based on proper scientific evidences. So, to demystify the dilemma regarding the prescription and usage of the best manual orthodontic toothbrush is indeed essential.

II. MATERIALS AND METHODS

The subjects for the present study were selected from the patients undergoing fixed orthodontic treatment in the institute. After screening for the inclusion and exclusion criteria, patients were made familiar with the study design using participant information sheet. Every participant was asked to sign on the informed consent form before participating in the study.

The patients hence selected for the study were divided into four groups randomly using simple random sampling. One brand of orthodontic toothbrush was assigned to every group. Participants of all the four groups were given one common dentifrice (Colgate Total) and mouthwash (Colgate Plax). All the subjects were instructed to brush using Modified Bass Technique[13].

The following indices and measurements were taken for the evaluation of patients' oral hygiene:

- ❖ Orthodontic Plaque Index[14]: The entire dentition was divided into sextants, (six groups of teeth). Teeth 17 to 14 (S1); Teeth 13 to 23 (S2); Teeth 24 to 27 (S3); Teeth 37 to 34 (S4); Teeth 33 to 43 (S5) and Teeth 44 to 47 (S6). Subjects were asked to rinse their mouth with the plaque disclosing agent. Then plaque was checked for on the labial surface of the teeth on each aspect of the bracket base (mesial, distal, occlusal/incisal and cervical). Scores were given for each tooth from 0 to 4. For each sextant, the tooth having the highest score was considered.
  - ➢ 0 = No plaque deposits around the tooth surfaces surrounding the brackets.
  - ➢ 1 = Isolated plaque islands on one tooth surface at the bracket base.
  - ➢ 2 = Plaque on two tooth surfaces at the bracket base.
  - ➢ 3 = Plaque on three tooth surfaces at the bracket base.
  - ➢ 4 = Plaque on all tooth surfaces at the bracket base and/or gingival inflammation.
- ❖ Loe and Silness Gingival Index[15]: The marginal gingiva around every tooth was examined clinically for the gingival index. Four areas will be examined around each tooth- Mesial, Buccal/Labial, Distal and Lingual/Palatal. Each of the four areas of marginal gingiva was given a score from 0 to 3, which was added up and divided by 4 to get the gingival index score of the tooth.
  - ➢ 0 = Normal Gingiva.
  - ➢ 1 = Mild inflammation- slight change in color, slight edema. No bleeding on probing.
  - ➢ 2 = Moderate inflammation- redness, edema and glazing. Bleeding on probing present.
  - ➢ 3 = Severe inflammation- marked redness and edema. Ulceration. Tendency to spontaneous bleeding.
- ❖ Bleeding on Probing: Bleeding on probing was assessed using a periodontal probe.

The probe was inserted in the marginal gingiva around all the teeth and after a period of 20 seconds, the teeth were examined for bleeding points. Gingival bleeding was recorded as present or absent.

- ❖ Probing Pocket Depth: Probing pocket depth was measured using a graduated periodontal probe around all the teeth. Pockets if present were recorded and the depths of the same were noted for the respective teeth.

All the indices were taken in all the patients at the following time intervals:

- T0 - Immediately after orthodontic bracket bonding.
- T1 - 3 months following T0.
- T2 - 6 months following T0.

After comparative evaluation of above parameters between manual orthodontic tooth brush brands A, B, C and D; the best one in terms of maintaining a good oral hygiene, was determined using appropriate statistical methods.

III. RESULTS

Comparison of Orthodontic Plaque Index at time T_1 using one way ANOVA test shows that the mean value of Toothbrush B (1.8) is highest followed by Toothbrush D (1.73), Toothbrush A (1.53) least in Toothbrush C (1.33). This difference is not statistically significant with a test value of 1.667 and p value of 0.185. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of -0.267 and p value of 0.658. The difference between Toothbrush A and Toothbrush C is not statistically significant with a mean difference of 0.2 and p value of 0.822. The difference between Toothbrush A and Toothbrush D is not statistically significant with a mean difference of -0.2 and p value of 0.822. The difference between Toothbrush B and Toothbrush C is not statistically significant with a mean difference of 0.467 and p value of 0.193. The difference between Toothbrush B and Toothbrush D is not statistically significant with a mean difference of 0.067 and p value of 0.992. The difference between Toothbrush C and Toothbrush D is not

statistically significant with a mean difference of -0.4 and p value of 0.317.

Comparison of Orthodontic Plaque Index at time T_2 using one way ANOVA test shows that the mean value of Toothbrush A (2.33) is highest followed by Toothbrush D (2.27), Toothbrush B (2.2) least in Toothbrush C (1.47). This difference is statistically significant with a test value of 7.44 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of 0.133 and p value of 0.92. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 0.867 and p value of 0.001. The difference between Toothbrush A and Toothbrush D is not statistically significant with a mean difference of 0.067 and p value of 0.989. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.733 and p value of 0.005. The difference between Toothbrush B and Toothbrush D is not statistically significant with a mean difference of -0.067 and p value of 0.989. The difference between Toothbrush C and Toothbrush D is statistically significant with a mean difference of -0.800 and p value of 0.002.

Comparison of Orthodontic Plaque Index T_1-T_0 using one way ANOVA test shows that the mean value of Toothbrush B (1.8) is highest followed by Toothbrush D (1.73), Toothbrush A (1.53) least in Toothbrush C (1.33). This difference is not statistically significant with a test value of 1.667 and p value of 0.185. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of -0.267 and p value of 0.658. The difference between Toothbrush A and Toothbrush C is not statistically significant with a mean difference of 0.2 and p value of 0.822. The difference between Toothbrush A and Toothbrush D is not statistically significant with a mean difference of -0.2 and p value of 0.822. The difference between Toothbrush B and Toothbrush C is not statistically significant with a mean difference of 0.467 and p value of 0.193. The difference

between Toothbrush B and Toothbrush D is not statistically significant with a mean difference of 0.067 and p value of 0.992. The difference between Toothbrush C and Toothbrush D is not statistically significant with a mean difference of -0.4 and p value of 0.317.

Comparison of Orthodontic Plaque Index T_2-T_0 using one way ANOVA test shows that the mean value of Toothbrush A (2.33) is highest followed by Toothbrush D (2.27), Toothbrush B (2.2) least in Toothbrush C (1.47). This difference is statistically significant with a test value of 7.44 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of 0.133 and p value of 0.92. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 0.867 and p value of 0.001. The difference between Toothbrush A and Toothbrush D is not statistically significant with a mean difference of 0.067 and p value of 0.989. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.733 and p value of 0.005. The difference between Toothbrush B and Toothbrush D is not statistically significant with a mean difference of -0.067 and p value of 0.989. The difference between Toothbrush C and Toothbrush D is statistically significant with a mean difference of -0.800 and p value of 0.002.

Comparison of Gingival Index at time T_1 using one way ANOVA test shows that the mean value of Toothbrush A (2.13) is highest followed by Toothbrush B (1.47), Toothbrush D (0.87) least in Toothbrush C (0.6). This difference is statistically significant with a test value of 23.259 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is statistically significant with a mean difference of 0.667 and p value of 0.008. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 1.533 and p value of <0.001. The difference between Toothbrush A and Toothbrush D is statistically significant with a mean difference of 1.267 and

p value of <0.001. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.867 and p value of <0.001. The difference between Toothbrush B and Toothbrush D is statistically significant with a mean difference of 0.600 and p value of 0.02. The difference between Toothbrush C and Toothbrush D is not statistically significant with a mean difference of -0.267 and p value of 0.546.

Comparison of Gingival Index at time T_2 using one way ANOVA test shows that the mean value of Toothbrush A (2.33) is highest followed by Toothbrush B (2.13), Toothbrush D (1.4) least in Toothbrush C (1.33). This difference is statistically significant with a test value of 30.718 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of 0.2 and p value of 0.64. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 1.000 and p value of <0.001. The difference between Toothbrush A and Toothbrush D is statistically significant with a mean difference of 0.933 and p value of <0.001. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.800 and p value of <0.001. The difference between Toothbrush B and Toothbrush D is statistically significant with a mean difference of 0.733 and p value of <0.001. The difference between Toothbrush C and Toothbrush D is not statistically significant with a mean difference of -0.067 and p value of 0.979.

Comparison of Gingival Index T_1-T_0 using one way ANOVA test shows that the mean value of Toothbrush A (2.13) is highest followed by Toothbrush B (1.47), Toothbrush D (0.87) least in Toothbrush C (0.6). This difference is statistically significant with a test value of 23.259 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is statistically significant with a mean difference of 0.667 and

p value of 0.008. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 1.533 and p value of <0.001. The difference between Toothbrush A and Toothbrush D is statistically significant with a mean difference of 1.267 and p value of <0.001. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.867 and p value of <0.001. The difference between Toothbrush B and Toothbrush D is statistically significant with a mean difference of 0.600 and p value of 0.02. The difference between Toothbrush C and Toothbrush D is not statistically significant with a mean difference of -0.267 and p value of 0.546.

Comparison of Gingival Index T_2-T_0 using one way ANOVA test shows that the mean value of Toothbrush A (2.33) is highest followed by Toothbrush B (2.13), Toothbrush D (1.4) least in Toothbrush C (1.33). This difference is statistically significant with a test value of 30.718 and p value of <0.001. Post hoc Tukey test shows that the difference between Toothbrush A and Toothbrush B is not statistically significant with a mean difference of 0.2 and p value of 0.64. The difference between Toothbrush A and Toothbrush C is statistically significant with a mean difference of 1.000 and p value of <0.001. The difference between Toothbrush A and Toothbrush D is statistically significant with a mean difference of 0.933 and p value of <0.001. The difference between Toothbrush B and Toothbrush C is statistically significant with a mean difference of 0.800 and p value of <0.001. The difference between Toothbrush B and Toothbrush D is statistically significant with a mean difference of 0.733 and p value of <0.001. The difference between Toothbrush C and Toothbrush D is not statistically significant with a mean difference of -0.067 and p value of 0.979.

Table 1: *One way ANOVA and Post Hoc Tukey test to compare the variables as continuous variables.*

		N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(ANOVA)	p value
Orthodontic Plaque Index T_1	Toothbrush A	15	1.53	0.834	0.667	1.667	0.185
	Toothbrush B	15	1.8	0.561			
	Toothbrush C	15	1.33	0.488			
	Toothbrush D	15	1.73	0.594			
	Total	60	1.6	0.643			
Orthodontic Plaque Index T_2	Toothbrush A	15	2.33	0.724	2.444	7.44	<0.001*
	Toothbrush B	15	2.2	0.561			
	Toothbrush C	15	1.47	0.516			
	Toothbrush D	15	2.27	0.458			
	Total	60	2.07	0.66			
Orthodontic Plaque Index T_1-T_0	Toothbrush A	15	1.53	0.834	0.667	1.667	0.185
	Toothbrush B	15	1.8	0.561			
	Toothbrush C	15	1.33	0.488			
	Toothbrush D	15	1.73	0.594			
	Total	60	1.6	0.643			
Orthodontic Plaque Index T_2-T_0	Toothbrush A	15	2.33	0.724	2.444	7.44	<0.001*
	Toothbrush B	15	2.2	0.561			
	Toothbrush C	15	1.47	0.516			
	Toothbrush D	15	2.27	0.458			
	Total	60	2.07	0.66			
Gingival Index T_1	Toothbrush A	15	2.13	0.64	6.978	23.259	<0.001*
	Toothbrush B	15	1.47	0.516			
	Toothbrush C	15	0.6	0.507			
	Toothbrush D	15	0.87	0.516			
	Total	60	1.27	0.8			
Gingival Index T_2	Toothbrush A	15	2.33	0.488	16.918	30.718	<0.001*
	Toothbrush B	15	2.13	0.352			
	Toothbrush C	15	1.33	0.488			
	Toothbrush D	15	1.4	0.507			
	Total	60	1.8	0.632			
Gingival Index T_1-T_0	Toothbrush A	15	2.13	0.64	6.978	23.259	<0.001*
	Toothbrush B	15	1.47	0.516			
	Toothbrush C	15	0.6	0.507			
	Toothbrush D	15	0.87	0.516			
	Total	60	1.27	0.8			
Gingival Index T_2-T_0	Toothbrush A	15	2.33	0.488	16.918	30.718	<0.001*
	Toothbrush B	15	2.13	0.352			
	Toothbrush C	15	1.33	0.488			
	Toothbrush D	15	1.4	0.507			
	Total	60	1.8	0.632			

Table 2: Post hoc Tukey subgroup comparison

Dependent Variable	Comparison Group	Compared With	Mean Difference	Std. Error	p Value
Orthodontic Plaque Index T_1	Toothbrush A	Toothbrush B	-0.267	0.231	0.658
		Toothbrush C	0.2	0.231	0.822
		Toothbrush D	-0.2	0.231	0.822
	Toothbrush B	Toothbrush C	0.467	0.231	0.193
		Toothbrush D	0.067	0.231	0.992
	Toothbrush C	Toothbrush D	-0.4	0.231	0.317
Orthodontic Plaque Index T_2	Toothbrush A	Toothbrush B	0.133	0.209	0.92
		Toothbrush C	0.867	0.209	0.001
		Toothbrush D	0.067	0.209	0.989
	Toothbrush B	Toothbrush C	0.733	0.209	0.005
		Toothbrush D	-0.067	0.209	0.989
	Toothbrush C	Toothbrush D	-0.800	0.209	0.002
Orthodontic Plaque Index T_1-T_0	Toothbrush A	Toothbrush B	-0.267	0.231	0.658
		Toothbrush C	0.2	0.231	0.822
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	Toothbrush B	Toothbrush C	0.467	0.231	0.193
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Orthodontic Plaque Index T_2-T_0	Toothbrush A	Toothbrush B	0.133	0.209	0.92
		Toothbrush C	0.867	0.209	0.001
		Toothbrush D	0.067	0.209	0.989
	Toothbrush B	Toothbrush C	0.733	0.209	0.005
		Toothbrush D	-0.067	0.209	0.989
	Toothbrush C	Toothbrush D	-0.800	0.209	0.002
Gingival Index T_1	Toothbrush A	Toothbrush B	0.667	0.2	0.008
		Toothbrush C	1.533	0.2	<0.001
		Toothbrush D	1.267	0.2	<0.001
	Toothbrush B	Toothbrush C	0.867	0.2	<0.001
		Toothbrush D	0.600	0.2	0.02
	Toothbrush C	Toothbrush D	-0.267	0.2	0.546
Gingival Index T_2	Toothbrush A	Toothbrush B	0.2	0.169	0.64
		Toothbrush C	1.000	0.169	<0.001
		Toothbrush D	0.933	0.169	<0.001
	Toothbrush B	Toothbrush C	0.800	0.169	<0.001
		Toothbrush D	0.733	0.169	<0.001
	Toothbrush C	Toothbrush D	-0.067	0.169	0.979

|		Toothbrush B	0.667	0.2	0.008
Gingival Index T_1-T_0	Toothbrush A	Toothbrush C	1.533	0.2	<0.001
		Toothbrush D	1.267	0.2	<0.001
	Toothbrush B	Toothbrush C	0.867	0.2	<0.001
		Toothbrush D	0.600	0.2	0.02
	Toothbrush C	Toothbrush D	-0.267	0.2	0.546
Gingival Index T_2-T_0	Toothbrush A	Toothbrush B	0.2	0.169	0.64
		Toothbrush C	1.000	0.169	<0.001
		Toothbrush D	.933	0.169	<0.001
	Toothbrush B	Toothbrush C	.800	0.169	<0.001
		Toothbrush D	.733	0.169	<0.001
	Toothbrush C	Toothbrush D	-0.067	0.169	0.979

There was not a single subject in whom; pocket formation was seen in all the four brands of orthodontic toothbrushes. Graph 1 shows the comparison of Orthodontic plaque index at time intervals T_0, T_1 and T_2. At the time of bonding of the fixed appliance i.e. T_0, the score was zero. At time interval T_1, the Orthodontic plaque index score for Toothbrush C was the least, which shows the efficiency of Toothbrush C in maintaining oral hygiene.

Graph 2 shows the comparison of changes in the Orthodontic plaque index scores at the stipulated time intervals amongst all the four brands of Orthodontic toothbrushes. From this chart it was clear that the changes are minimal with Toothbrush C when compared to the other three toothbrushes.

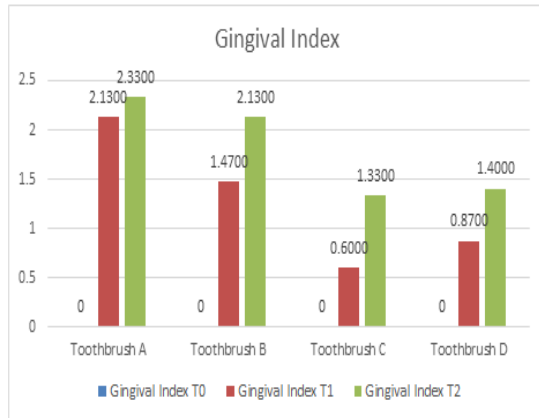Chart 1: Orthodontic Plaque Index scores at different time intervals
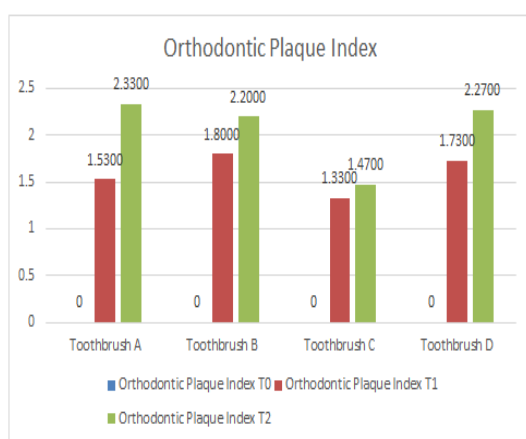
Chart 2: Changes in Orthodontic Plaque Index scores at different time intervals
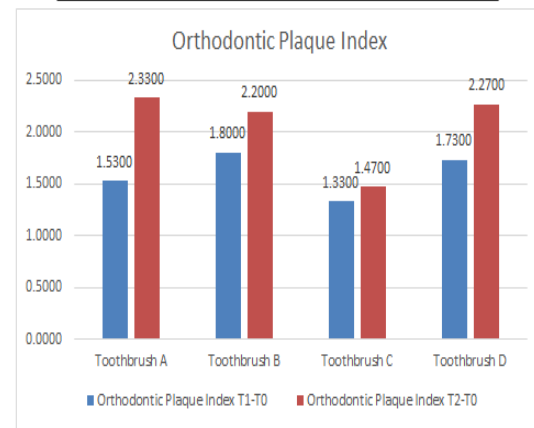
Similarly, Graphs 3 and 4 show the Gingival Index scores at the stipulated time intervals and changes in the Gingival Index scores between the different time intervals respectively. From graph 3 it was clear that Toothbrush C showed the least grades of gingival index at time intervals T_1 and T_2. The changes from baseline at time intervals T_1 and T_2 also showed the least values in terms of gingival index for Toothbrush C.

So Toothbrush C was considered the best among the four selected brands of orthodontic toothbrushes in maintaining oral hygiene.

Chart 3: Gingival Index scores at different time intervals

Chart 4: Changes in Gingival Index scores at different time intervals
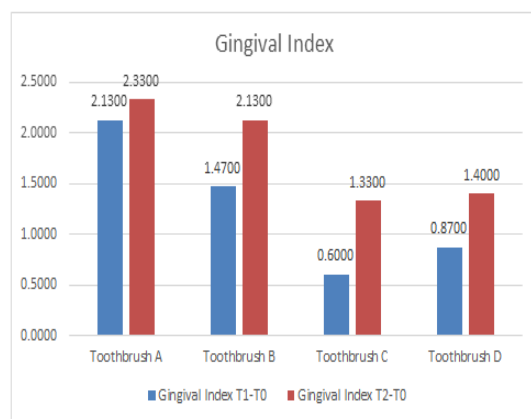
IV.   DISCUSSION

Fixed orthodontic appliances provide for potential sites for adherence of plaque. Thus maintaining proper oral hygiene in such times becomes difficult. Orthodontic treatment using fixed appliances demands meticulous cleaning using toothbrush. Orthodontic toothbrushes are designed a little bit different from the conventional toothbrushes. Powered toothbrushes are much more efficient in maintaining the oral hygiene when compared to the manual toothbrushes. But the powered toothbrushes are not easily affordable to everyone, because of which manual toothbrushes are preferred more than the powered toothbrushes. Amongst the multiple commercially available brands of orthodontic toothbrushes, confusion is always there in the patients as well as the orthodontists as to which brand to use or prescribe.

This study was a prospective type of study. In this study, subjects were selected randomly as and when they were fixed with an orthodontic appliance in their mouth. The subjects were randomly divided into four groups, in which the four selected brands of orthodontic toothbrushes were prescribed. The subjects were advised to brush twice daily using a common dentifrice that was prescribed to them. The subjects reported for regular follow-up visits. All the necessary indices were taken at the stipulated time intervals.

From this study it was clear that Toothbrush C was the best in terms of maintaining oral hygiene in patients with fixed orthodontic appliances. In the first three months after bonding of the orthodontic appliance, the changes in the Orthodontic Plaque Index and Gingival Index were found to be not significant. But when it comes to six months post bonding of the fixed appliances in the subjects, the changes in both the indices were more or less significant. With this observation one thing can be inferred, that the cleaning efficacy of the orthodontic toothbrushes starts reducing after three months of use. Changing of the toothbrushes periodically can help maintain adequate oral hygiene with the fixed orthodontic appliance bonded to the teeth.

The other three brands of orthodontic toothbrushes are pretty much efficient in maintaining the oral hygiene for the initial three months after bonding of the fixed appliance. Hence regular changing of the orthodontic toothbrushes can help maintain proper oral hygiene in orthodontic patients.

Franz Martin Sander et al[16] conducted a study to test the efficiency of different electric powered toothbrushes in maintaining oral hygiene in subjects with fixed orthodontic appliances bonded in their oral cavities. They concluded that neither of the selected electrically powered toothbrushes demonstrated satisfactory oral hygiene maintenance. It was the longer duration of brushing, appropriate brushing technique and special toothbrush head designs that are necessary for the maintenance of proper oral hygiene in patients with fixed orthodontic appliances bonded in the oral cavity.

Along with proper manual toothbrush, the other cleaning aids also play an important role in maintaining the oral hygiene in orthodontic patients. Kossac et al[17] conducted a study in which they compared the efficacies of various oral cleaning devices to improve the oral hygiene in subjects with fixed orthodontic appliances. They concluded in this study the importance of various interdental cleaning aids which helped in reducing the incidence of plaque induced gingivitis in orthodontic patients.

V. CONCLUSION

The bonding of fixed orthodontic appliances in the oral cavity demands meticulous oral hygiene practices. If not taken care of, it could lead to various periodontal diseases during the course of the orthodontic treatment ultimately hampering the tooth movement procedure. The use of an orthodontic toothbrush rather than a conventional manual toothbrush is considered better in maintaining oral hygiene. Periodic changing of the toothbrushes is also equally important. Along with the orthodontic toothbrush, other interdental cleaning aids and mouthwashes can lead to the maintenance of proper oral hygiene which is of paramount importance to a satisfactory finish to the orthodontic treatment.

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