EFFECT OF VARIOUS DENTIFRICES AND TOOTHBRUSHING ON THE PHYSICAL PROPERTY OF AN ESTHETIC RESTORATIVE MATERIAL

(IN- VITRO STUDY)

Thesis submitted in partial fulfilment of the requirement for degree of

MASTER OF DENTAL SURGERY

In the subject of

CONSERVATIVE DENTISTRY AND ENDODONTICS

DEPARTMENT OF CONSERVATIVE DENTISTRY & ENDODONTICS

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"Effect of Various Dentifrices and Tooth brushing On The Physical Property Of An Esthetic Restorative Material (In- Vitro Study)** is a bonafied and genuine research work carried out by me under the guidance of **Dr. Akanksha Bhatt**, Reader Department of Conservative Dentistry and Endodontics, Babu Banarasi Das College of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

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CERTIFICATE

This is to certify that the dissertation entitled **"Effect of Various Dentifrices and Tooth brushing On The Physical Property Of An Esthetic Restorative Material (In- Vitro Study)** is an original bonafied research work done by ***Dr. SURABHI GUPTA,*** in partial fulfilment of the requirement for the degree of **MASTER OF DENTAL SURGERY (M.D.S)** in the speciality of **CONSERVATIVE DENTISTRY AND ENDODONTICS** under our supervision.

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Introduction

INTRODUCTION

The introduction of composite resin by Bowen in 1960s was a landmark discovery in the field of dentistry, paving way for the development of cosmetics dentistry. Resin- based restoratives are increasingly being used in dentistry, mainly becase of their esthetic quality and good physical properties.[1] Dental composites are made of three chemically different materials the organic matrix (organic phase), the inorganic matrix (filler or disperse phase) and organosilane(coupling agent) to bond the filler to the organic resin.[2] Composite resin materials have evolved from traditional micro-hybrid and micro-filled materials. Nano-filled and nanohybrid composites were more recently introduced in an endeavor to provide a material displaying high initial polishing combined with superior polish and gloss retention.[1]

The ultimate goal of using a dental restorative material is to restore the biological, functional, and aesthetic properties of a healthy tooth structure. Due to the increasing restorative and esthetic demand of the patient and newer improvement of composite, its clinical use has expanded considerably over the years, regardless of the cavity type and location. Application of nanotechnology in composites with nano-particles and nano-clusters has been introduced which reduces the interstitial spaces among the inorganic particles, providing better physical properties and polish maintenance, which can be seen in the surface texture.[3] It reduces the material degradation over the years. This technology enables us to use nanocomposite in both anterior and posterior teeth[45, 46]. The aesthetic and clinical properties of composite resin depend not only on their structure, but also on the finishing and polishing protocol followed to achieve surface smoothness, which is of greater importance for longevity of the restoration[47- 49].

INTRODUCTION

The introduction of composite resin by Bowen in 1960s was a landmark discovery in the field of dentistry, paving way for the development of cosmetics dentistry. Resin- based restoratives are increasingly being used in dentistry, mainly becase of their esthetic quality and good physical properties.[1] Dental composites are made of three chemically different materials the organic matrix (organic phase), the inorganic matrix (filler or disperse phase) and organosilane(coupling agent) to bond the filler to the organic resin.[2] Composite resin materials have evolved from traditional micro-hybrid and micro-filled materials. Nano-filled and nanohybrid composites were more recently introduced in an endeavor to provide a material displaying high initial polishing combined with superior polish and gloss retention.[1]

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Surface roughness leads to adherence of bacterial plaque, which later evolve into periodontal disease[47- 49]. It is widely accepted that the surface roughness of intraoral hard surfaces has a major impact on the initial adhesion and retention of oral microorganisms i.e. rougher surfaces retain more plaque than smoother surfaces.[7, 50- 52] Plaque can accumulate on the composite surface with a roughness of more than 0.7μm.[6, 53- 56] Whereas, several experimental findings state that the dental material's surface roughness lower than 0.2μm, significantly reduces the possibility of bacterial adhesion.[8,57] Roughness has also major impact on the aesthetic appearance and discoloration of restorations, secondary caries and gingival irritation and wear of opposing and adjacent teeth.[7, 60]

Surface quality of restoration is one of the important factors that determine their clinical success. A smooth surface can improve longevity and esthetics of restorations.[5, 61, 62] So smooth surface enables clinical durability, good esthetic appearance, better optical compatibility with natural enamel tissue and surface gloss, as well as, preventing the discoloration and staining of the restoration.[8, 58.59]

Increase in demand by patients for better esthetic and simplified and safe procedures have propelled the use of composite resins in restorative treatments. However, it should be considered that the success and longevity of these restorations are related to the material, the dentist, and the patient[63]. The patients are responsible for their dietary habits, preventive measures, availability of fluoride, and oral hygiene. Since carious lesions have been the most common cause of direct composite resin restorations replacements.[4, 64]

A range of factors, including prophylaxis procedures and tooth brushing with the toothpaste, may alter the quality of the surface of both the enamel and the polished restorative materials in the oral cavity (Ehmford, 1983; Gracia- Godoy et al., 2009).[9,74, 75] Wear from tooth brushing can

influence the mechanical and optical properties of composite resin and surface roughness can increase due to the abrasion of the polymer matrix, followed by filler exposure which can eventually lead to loosening of filler particles.[10, 76] The effect of brushing on the surface roughness of resin composites is a significant factor in determining the performance of materials. As a result of this abrasive treatment, the greater the relative abrasiveness of the dentifrice, the greater will be the surface roughness of resin material, [77-79] consequently affecting the esthetics of restorations.[11, 80-82]

Dentifrices have been a source of concern and subject of study for many professionals, since it is one of the main resources used in daily oral care by the population. Dentifrices have different components such as detergents, fluoride, therapeutic ingredients, flavors, and abrasives. Among the abrasives, the most common are calcium carbonate and silica.[83] These abrasives have an important role in cleaning teeth, removing bacteria and stains from the tooth surface. However, the dentifrice should promote optimal tooth surface cleaning with minimal abrasion[84], since dentifrices with high amounts of abrasives can damage hard tissue, soft tissue and restorations, causing gingival recession, cervical abrasion, and dentin hypersensitivity.[4, 85, 86]

Studies have been conducted to evaluate the surface roughness of composite resins caused by the abrasiveness of some dentifrices. Amaral *et al.*[65] evaluated the action of abrasive dentifrices on esthetic restorative materials after simulated tooth brushing cycles. The researchers found a notable difference between the abrasiveness of dentifrices, but not among the composite resins. The dentifrices that used silica and carbonate were less abrasive compared to the ones containing bicarbonate.[4, 65]

A large supply of new dentifrices is available in the market nowadays, which makes the consumer choice much more difficult and still some areas do not have access to modern dentifrices and still uses conventional powdered form of dentifrice which has larger abrasive content. Different forms like powder, gel and paste have added more to the confusion of the patients, and adding more to the confusion is the addition of herbal whitening toothpastes on the shelves. Toothpastes that promote whitening by removing or controlling extrinsic stains on the tooth surface through abrasion has become common.[67, 68] Typically, hydrated silica, calcium carbonate, dehydrated di-calcium phosphate, calcium pyrophosphate etc are the abrasives agents used.[12, 67, 68. 71-73] However, there is no study done and published till date that compared the effect of these four forms of dentifrices together.

Concerned about the integrity of nanocomposite resin restorations from the abrasivity of dentifrices available, this study aims to answer the following questions: -

(a) Does tooth brushing with dentifrice change the surface roughness of nanocomposite resins?

(b) Does the surface roughness remains the same, regardless of the type of dentifrice or nanocomposite resin evaluated?

Therefore, this in vitro study aims to compare and evaluate the effect of different dentifrices of various forms 1. Powder form- Dabur Lal Dant Manjan, Dabur (Dabur International Limited Dubai, U.A.E). 2. Paste form- Colgate Total Advance Health, (Colgate- Pamolive Company, India). 3. Gel form- Close Up Active Gel (Hindustan Unilever Limited, India). 4. Whitening toothpaste- Himalaya Herbals Sparkling White, Himalaya (The Himalayan Drug Company, India) and stimulated tooth brushing on the nanocomposite.

Result

RESULT

STATISTICAL ANALYSIS

Data were summarized as Mean ± SD (standard deviation). Groups were compared by paired t test. Groups were also compared by one way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey's HSD (honestly significant difference) post hoc test. A two-tailed (α=2) $p<0.05$ was considered statistically significant.

\RESULTS & OBSERVATIONS

The present study evaluates the surface roughness of composite resins after stimulated tooth brushing with different dentifrices. Total 100 disc shaped specimens were made and equally divided (n=20) into five groups. Group A was control group (no brushing protocol), Group B was brushed with Dabur Lal Dant Manjan, Group C was brushed with Colgate Total Advance Health and Group D was brushed with Close Up Active Gel and Group E was brushed with Himalaya Herbals Sparkling White, Himalaya. (Table 1 and Fig. 12). The surface roughness was assessed before and after treatment (tooth brushing with dentifrices for one minute i.e. 40,000 pulsation and 8,800 oscillations) and measured in micrometer (µm).

TABLE 1: ALLOCATION OF GROUP NAME AND DISTRIBUTION OF SAMPLES

TREATMENT	GROUP NAME	NO OF SAMPLES (N=100) (%)
No brushing or control	GROUP A	20 (20.0)
Dabur lal dant manjan	GROUP B	20 (20.0)
Colgate total advance	GROUP C	20 (20.0)
Close up gel	GROUP D	20 (20.0)
Himalaya Herbals Sparkling White, Himalaya	GROUP E	20 (20.0)

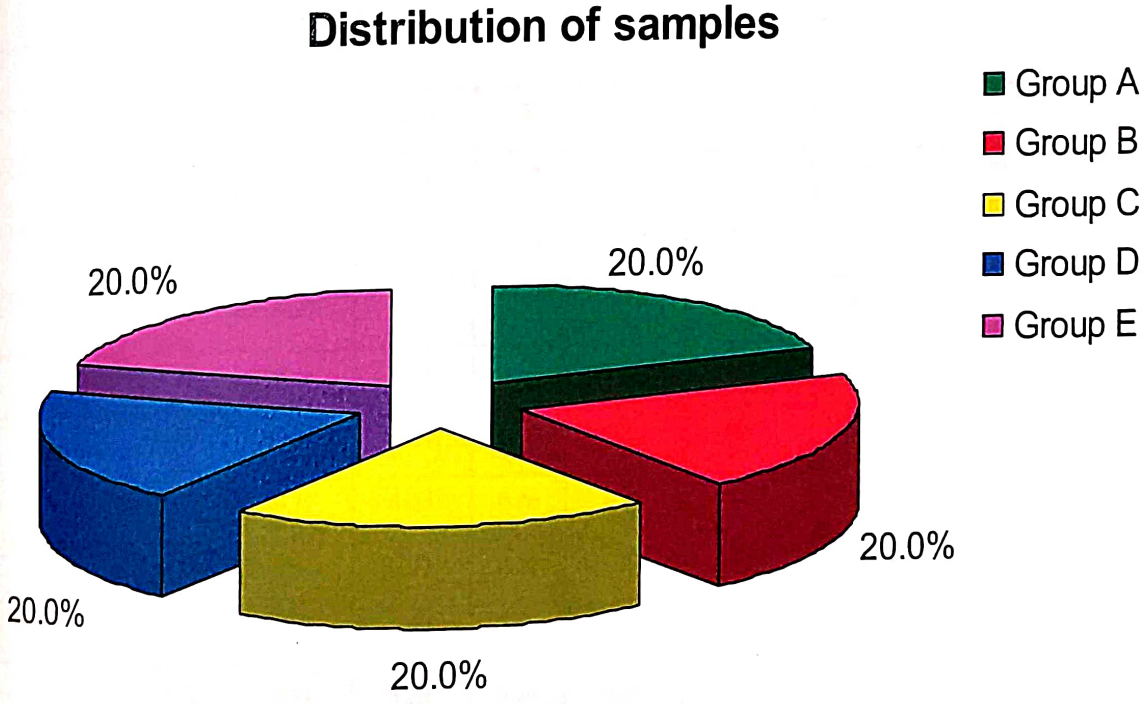


Fig. 12. DISTRIBUTION OF SUBJECTS IN FIVE GROUPS.

OBSERVATION

THE TABLE BELOW SHOWS THE MEAN SURFACE ROUGHNESS VALUE(RA VALUE) FOR ALL THE GROUPS IN MICROMETER (μM)

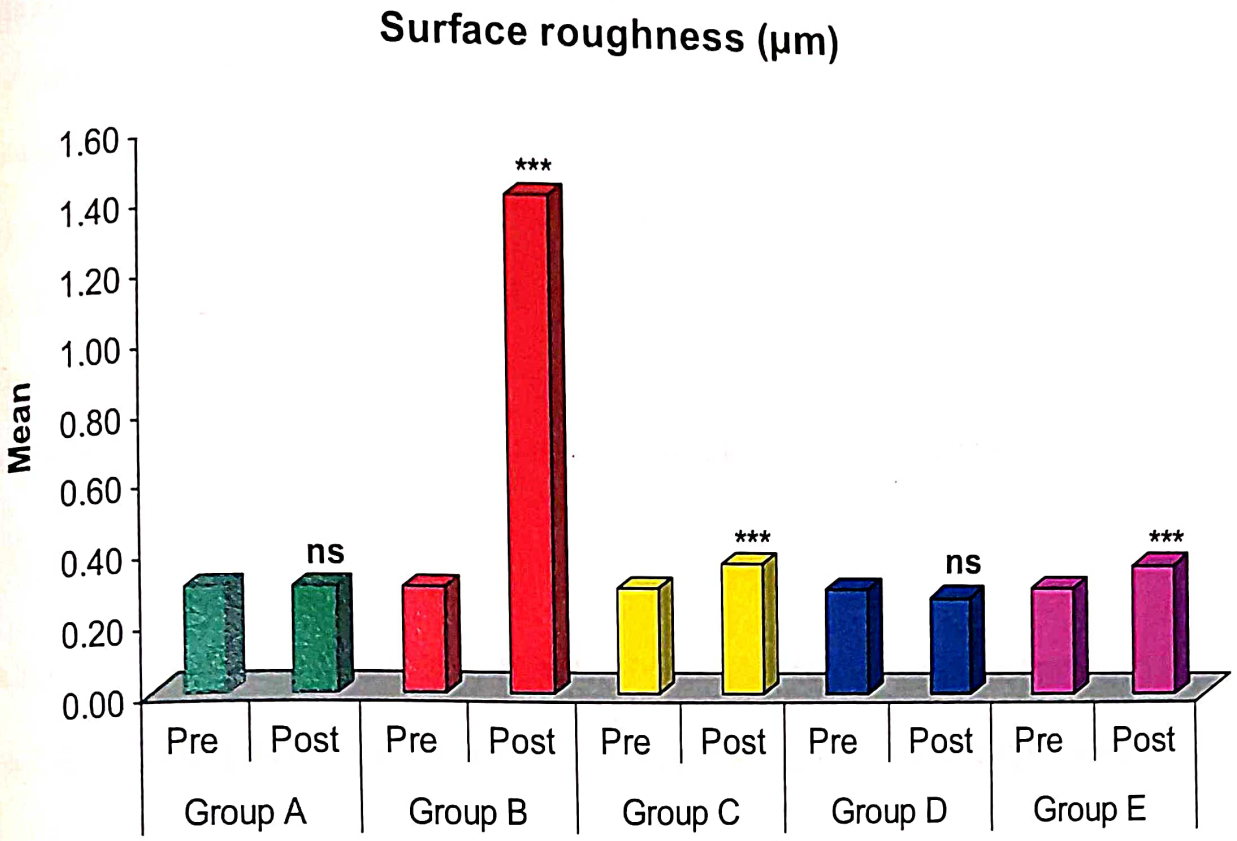
SNO	Group A (Control)		Group B (Dabur lal dant manjan)		Group C (Colgate total advance)		Group D (Close up gel)		Group E) Himalaya Herbals Sparkling White, Himalaya	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	0.30	0.34	0.31	1.48	0.35	0.42	0.34	0.27	0.33	0.38
2	0.36	0.28	0.33	1.58	0.28	0.38	0.28	0.30	0.29	0.39
3	0.26	0.29	0.30	1.41	0.25	0.36	0.29	0.24	0.29	0.35
4	0.36	0.26	0.27	1.31	0.26	0.35	0.26	0.29	0.30	0.32
5	0.37	0.19	0.37	1.27	0.19	0.34	0.19	0.28	0.26	0.37
6	0.19	0.37	0.26	2.17	0.37	0.39	0.37	0.26	0.31	0.36
7	0.26	0.36	0.26	1.32	0.36	0.36	0.36	0.27	0.32	0.38
8	0.26	0.26	0.26	1.00	0.30	0.33	0.26	0.27	0.26	0.36
9	0.28	0.36	0.25	1.46	0.36	0.39	0.36	0.28	0.35	0.38
10	0.34	0.30	0.31	1.21	0.31	0.38	0.30	0.28	0.32	0.39
11	0.34	0.27	0.31	1.31	0.27	0.39	0.27	0.26	0.26	0.40
12	0.28	0.36	0.28	1.60	0.33	0.35	0.36	0.33	0.36	0.39
13	0.30	0.26	0.30	1.58	0.26	0.32	0.26	0.24	0.27	0.36
14	0.26	0.36	0.29	1.34	0.36	0.37	0.36	0.29	0.35	0.33
15	0.19	0.37	0.26	1.38	0.37	0.36	0.37	0.30	0.33	0.39
16	0.37	0.19	0.34	1.07	0.24	0.38	0.19	0.24	0.23	0.38
17	0.36	0.26	0.32	1.55	0.26	0.36	0.26	0.28	0.29	0.39
18	0.26	0.30	0.30	1.57	0.30	0.38	0.30	0.26	0.32	0.36
19	0.36	0.34	0.33	1.41	0.31	0.39	0.34	0.27	0.35	0.38
20	0.27	0.26	0.31	1.25	0.26	0.40	0.26	0.28	0.27	0.36

SURFACE ROUGHNESS

The pre and post surface roughness of five groups are summarized in Table 2 and also depicted in Fig. 13. Comparing the pre and post surface roughness of each group, paired t test showed significant increase in surface roughness at post as compared to pre in Group B- Dabur Lal Dant Manjan (79.0%) (0.30 ± 0.03 vs. 1.41 ± 0.24, t=19.78, p<0.001), Group C- Colgate Total Advance (19.4%) (0.30 ± 0.05 vs. 0.37 ± 0.02, t=6.42, p<0.001) and Group E- Himalaya Herbals Sparkling White, Himalaya (18.4%) (0.30 ± 0.04 vs. 0.37 ± 0.02, t=7.22, p<0.001). However, it did not changed (increase/decrease) significantly at post as compared to pre in both Group A- Control group (0.30 ± 0.06 vs. 0.30 ± 0.06, t=0.02, p=0.983) and Group D- Close Up Gel (0.30 ± 0.06 vs. 0.28 ± 0.02, t=2.08, p=0.052) i.e. found to be statistically the same.

TABLE 2: PRE AND POST SURFACE ROUGHNESS (MEAN ± SD) OF FIVE GROUPS

GROUP	PRE (N=20)	POST (N=20)	MEAN CHANGE (POST-PRE)	% MEAN CHANGE	T VALUE	P VALUE
GROUP A	0.30 ± 0.06	0.30 ± 0.06	0.00 ± 0.10	0.0	0.02	0.983
GROUP B	0.30 ± 0.03	1.41 ± 0.24	1.12 ± 0.25	79.0	19.78	<0.001
GROUP C	0.30 ± 0.05	0.37 ± 0.02	0.07 ± 0.05	19.4	6.42	<0.001
GROUP D	0.30 ± 0.06	0.28 ± 0.02	-0.02 ± 0.05	8.1	2.08	0.052
GROUP E	0.30 ± 0.04	0.37 ± 0.02	0.07 ± 0.04	18.4	7.22	<0.001



$^{ns}p>0.05$ or $^{***}p<0.001$- as compared to Pre

Fig. 13. FOR EACH GROUP, COMPARISON OF MEAN SURFACE ROUGHNESS BETWEEN PRE AND POST PERIODS.

The net mean change in surface roughness (i.e. mean change from pre to post) of five groups is further summarized in Table 3 and also shown in Fig. 14. The mean (± SD) change in surface roughness of Group B (1.12 ± 0.25 µm) was the highest followed by Group C (0.07 ± 0.05 µm) and Group E (0.07 ± 0.04 µm), Group A (0.00 ± 0.10 µm) and Group D (-0.02 ± 0.05 µm) the least. **GROUP B > GROUP C= GROUP E > GROUP A > GROUP D**

Comparing the mean change in surface roughness of five groups, ANOVA showed significantly different change in surface roughness among the groups (F=294.90, p<0.001).

TABLE 3: COMPARISON OF MEAN CHANGE (POST-PRE) IN SURFACE ROUGHNESS (MEAN ± SD) OF FIVE GROUPS BY ANOVA

GROUP	MEAN CHANGE (POST-PRE)	F VALUE	P VALUE
GROUP A	0.00 ± 0.10	294.90	<0.001
GROUP B	1.12 ± 0.25		
GROUP C	0.07 ± 0.05		
GROUP D	-0.02 ± 0.05		
GROUP E	0.07 ± 0.04		

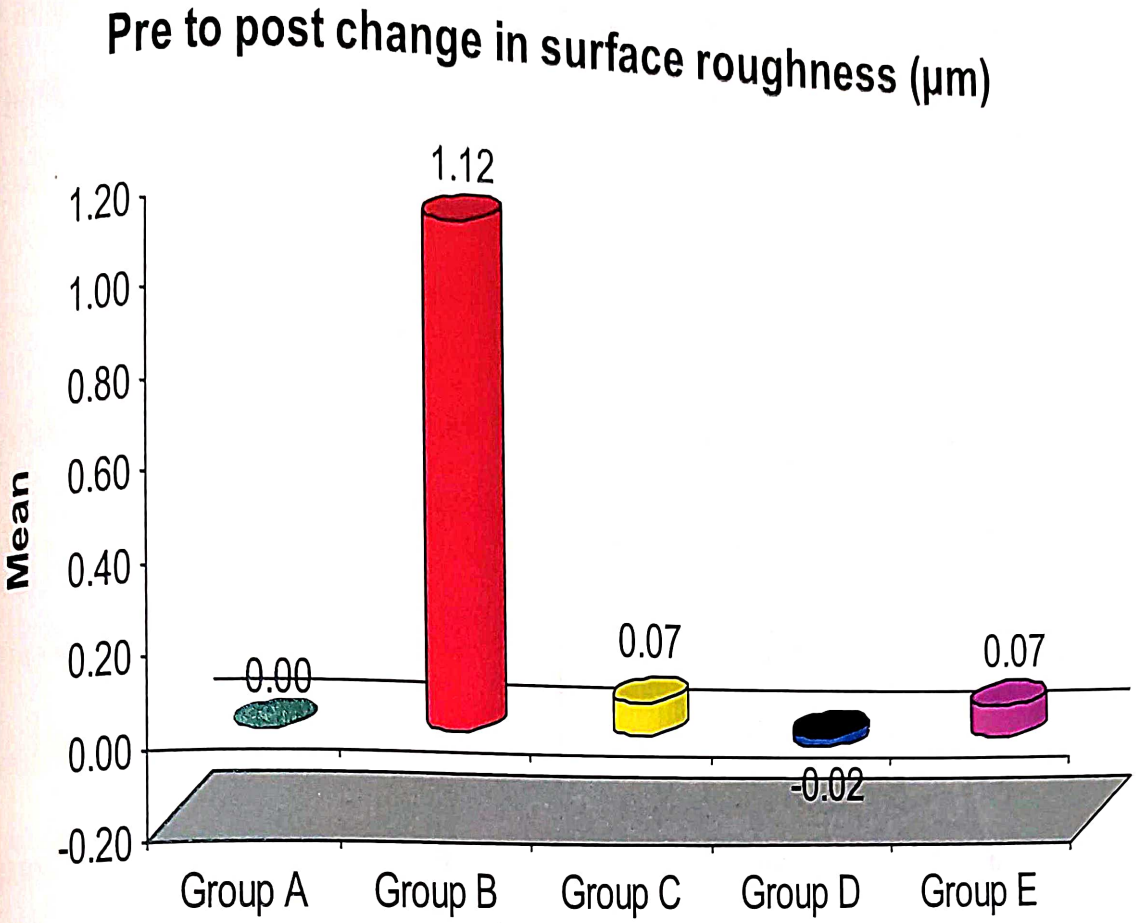
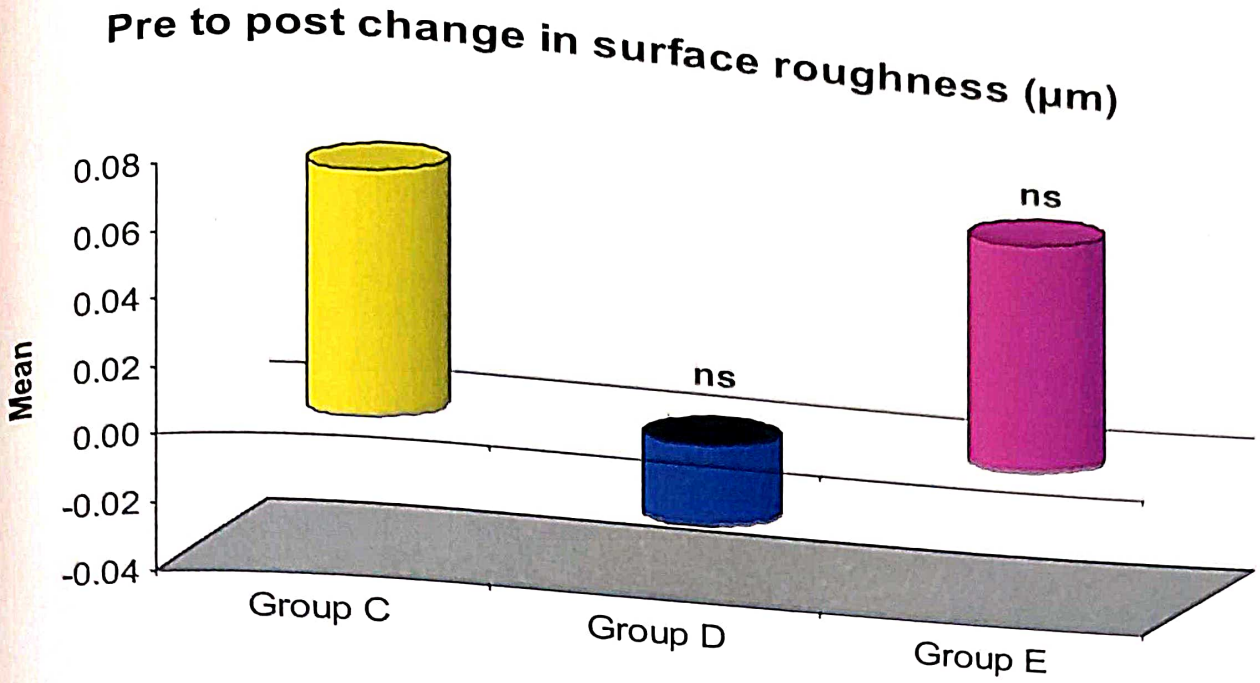


Fig. 14. PRE TO POST NET MEAN CHANGE IN SURFACE ROUGHNESS OF FIVE GROUPS.

Further, comparing the mean change in surface roughness between groups, Tukey test showed significantly ($p<0.001$) different and higher mean change in surface roughness of Group B as compared to other groups (Group A, Group C, Group D and Group E). However, mean change in surface roughness did not differed ($p>0.05$) between Group A, Group C, Group D and Group E i.e. found to be statistically the same (Table 4 and Fig. 15 and 16).

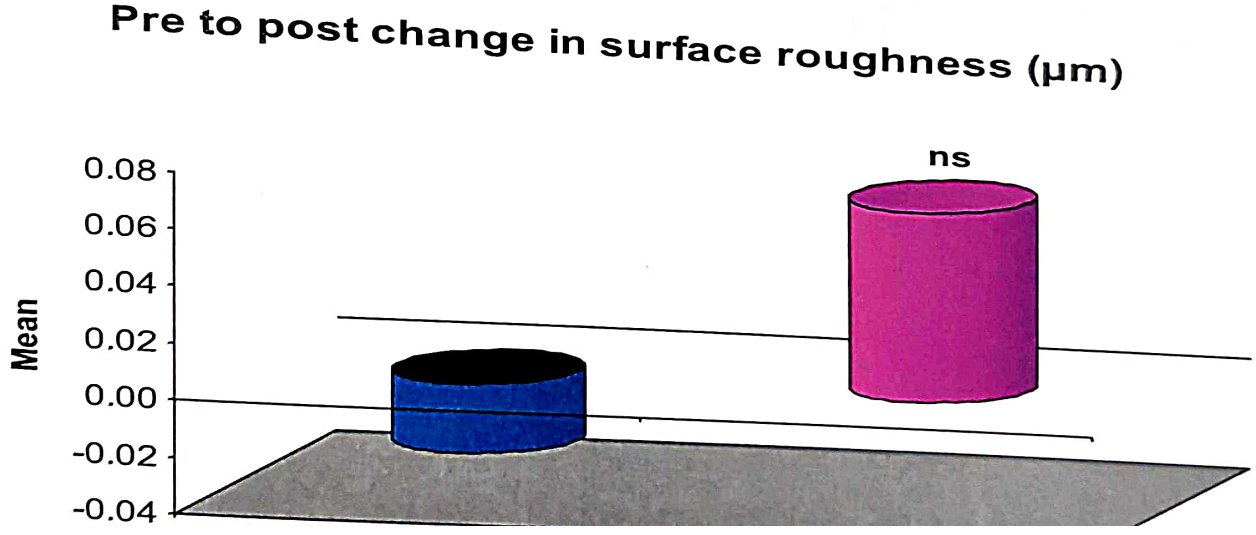
TABLE 4: COMPARISON OF MEAN CHANGE (POST-PRE) IN SURFACE ROUGHNESS BETWEEN GROUPS BY TUKEY TEST

COMPARISONS	MEAN DIFFERENCE	Q VALUE	P VALUE	95% CI OF DIFFERENCE
Group A vs. Group B	-1.12	39.28	<0.001	-1.23 to -1.00
Group A vs. Group C	-0.07	2.52	>0.05	-0.19 to 0.04
Group A vs. Group D	0.02	0.86	>0.05	-0.09 to 0.14
Group A vs. Group E	-0.07	2.41	>0.05	-0.18 to 0.04
Group B vs. Group C	1.05	36.76	<0.001	0.93 to 1.16
Group B vs. Group D	1.14	40.14	<0.001	1.03 to 1.25
Group B vs. Group E	1.05	36.87	<0.001	0.94 to 1.16
Group C vs. Group D	0.10	3.38	>0.05	-0.02 to 0.21
Group C vs. Group E	0.00	0.11	>0.05	-0.11 to 0.12
Group D vs. Group E	-0.09	3.27	>0.05	-0.21 to 0.02



$^{ns}p>0.05$- as compared to Group C

Fig. 15. COMPARISON OF CHANGE (POST-PRE) IN SURFACE ROUGHNESS BETWEEN THREE GROUPS.



Conclusion

CONCLUSION

Within the limitations of the methodology used in present in vitro study " Effect Of Various Dentifrices And Toothbrushing On The Physical Property Of An Esthetic Restorative Material" it was possible to conclude that:-

1. The composite resins Nano Hybrid (SwissTEC composite, Coltene/ Whaledent AG showed surface roughness after one minute of stimulated tooth brushing cycles.
2. The dentifrice GROUP B (Dabur Lal Dant Manjan) caused a higher surface roughness in composite resins as compared to other Groups
3. The dentifrice GROUP C (Colgate Total Advance) caused a higher surface roughness in composite resins as compared to GROUP E (Himalaya Herbals Sparkling White, Himalaya)
4. The dentifrice GROUP D (Close Up Active Gel) caused a lowest surface roughness in composite resins as compared to other Groups

Considering the results and observations pertaining to surface roughness of the composite resins, the dentifrice Close Up Active Gel caused lowest surface roughness of composite resins when compared to other dentifrices.

Bibliography

BIBLIOGRAPHY

1. R. R. Moraes, L. S. Gonçalves, A. C. Lancellotti, S. Consani, Correr-Sobrinho, And M. A. Sinhoreti (2009) Nanohybrid Resin Composites: Nanofiller Loaded Materials Or Traditional Microhybrid Resins?. Operative Dentistry: September 2009, Vol. 34, No. 5, Pp. 551-557.

2. Da Cas Nv, Ruat Gr, Bueno Rp, Pachaly R, Pozzobon Rt. Effect Of Whitening Toothpaste On Superficial Roughness Of Composite Resin. Gen Dent. 2013 July; 61(4): Es-11

3. Mohammed S Abzal, Mensudar Rathakrishnan, Venkatachalam Prakash, Paramasivam Vivekanandhan, Arunajatesan Subbiya, Vridhachalam Ganapathy Sukumaran J Conserv Dent. 2016 Mar-Apr; 19(2): 171–174. Doi: 10.4103/0972-0707.178703

4. Monteiro B, Spohr Am. Surface Roughness Of Composite Resins After Simulated Toothbrushing With Different Dentifrices. Journal Of International Oral Health: Joh. 2015;7(7):1-5

5. Lefever D, Perakis N, Roig M, Krejci I, Ardu S. The Effect Of Toothbrushing On Surface Gloss Of Resin Composites. Am J Dent. 2012 Feb;25(1):54-8.

6. Khokhar N H, Hassan M, Gonzalez M A. Evaluation Of Surface Roughness Of Four Composite Restorative Materials. Jpda Vol. 22 01 Jan- Mar 2013

7. Giacomelli L, Derchi G, Frustaci A, Et Al. Surface Roughness Of Commercial Composites After Different Polishing Protocols: An Analysis With Atomic Force Microscopy. The Open Dentistry Journal. 2010;4:191-194. Doi:10.2174/1874210601004010191.

8. Kumari C M, Bhat K M, Bansal R. Evaluation Of Surface Roughness Of Different Restorative Composites After Polishing Using Atomic Force Microscopy. J Conserv Dent 2016;19:56-62

Tirali Re[1], Çehreli Sb, Yazici R, Yalçinkaya Z. Effect Of Two Anti-Erosion Pastes On Surface Roughness Of Different Restorative Materials. Eur J Paediatr Dent. 2013 Jun;14(2):135-9

Keico Graciela Sano T; Ana Paula Terossi De. G; Vivian C; Silmara Aparecida Milori C; Alma Blasida Concepcion Elizaur Benitez C. The Influence Of Mouth Rinses And Simulated Tooth Brushing On The Surface Roughness Of A Nanofilled Composite Resin. Braz Oral Res May/June 2012 Vol 26, No.3 Sao Paulo

Roselino, Lourenço De Moraes Rego; Chinelatti, Michelle Alexandra; Alandia-Roman, Carla Cecilia And Pires-De-Souza, Fernanda De Carvalho Panzeri. Effect Of Brushing Time And Dentifrice Abrasiveness On Color Change And Surface Roughness Of Resin Composites. Braz. Dent. J. 2015, Vol.26, N.5 [Cited 2017-10-26], Pp.507-513.

Natalia Ventura Da Cas, Gabrielle Rodrigues Ruat, Renata Pla Rizzolo Bueno, Raquel Pachaly, Roselaine Terezinha Pozzobon. Effect Of Whitening Toothpaste On Superficial Roughness Of Composite Resin. Gen Dent. 2013 Jul; 61(4): E8–11.

Marsha A Black; Stephen C Bayne; Charlotte A Peterson; Lynn R Smith. Effect Of Power Tooth Brushing On Simulated Wear Of Dental Cement Margins. J Dent Hyg Fall 2007, Vol. 81 No

Nainan Mt, Balan Ak, Sharma R, Thomas Ss, Deveerappa Sb. The Comparison Of The Effects Of Different Whitening Toothpastes On The Micro Hardness Of A Nano Hybrid Composite Resin . J Conserv Dent 2014;17:550-4

Osman Tolga H, Çagatay Barutcigil D. Color Recovery Effect Of Commercial Mouth Rinses On A Discolored Composite. Jerd Special Issue: Color And Appearance In Dentistry July/August 2014 Vol. 26, Issue 4, Pages 256–263.

16. Vishal J, Jeffret A. Platt, Ana M. Spoh, Gilberto A. Borges. Color Stability, Gloss, And Surface Roughness Of Indirect Composite Resins. J Of Oral Science, March 2013 Vol. 55, No. 1, Page 9-15.

17. Simone Xavier Silva C, Anne Buss Becker, Alessandra Nara De Souza R, Leonor De Castro Monteiro L, Marcelo Ferrarezi De A, And Vanderlei Salvador B. Effect Of Four Bleaching Regimens On Color Changes And Microhardness Of Dental Nanofilled Composite. Int. J Dent 2009 Vol (2009), Article Id 313845, 7 Pages.

18. Keico Graciela Sano T; Ana Paula Terossi De G; Vivian C; Silmara Aparecida Milori C; Alma Blasida Concepcion Elizaur Benitez C. The Influence Of Mouth Rinses And Simulated Tooth Brushing On The Surface Roughness Of A Nanofilled Composite Resin. Braz Oral Res, May/June 2012. Vol.26, No.3 Sao Paulo

19. Hafez, R & Ragab, Hala & Niazy, M & El-Mowafy, O. (2010). Influence Of Storage Media And Power-Toothbrushing On Contemporary Restoratives Surface-Roughness. .

20. Senawongse, P. And Pongprueksa, P. (2007), Surface Roughness Of Nanofill And Nanohybrid Resin Composites After Polishing And Brushing. Journal Of Esthetic And Restorative Dentistry, 19: 265–273. Doi:10.1111/J.1708-8240.2007.00116.

21. Teixeira, E. C.N., Thompson, J. L., Piascik, J. R. And Thompson, J. Y. (2005), In Vitro Toothbrush-Dentifrice Abrasion Of Two Restorative Composites. Journal Of Esthetic And Restorative Dentistry, 17: 172–181. Doi:10.1111/J.1708-8240.2005.Tb00109.

22. Cristiane Mariote A ; Jose Augusto R ; Maria Carolina Guilherme E; Marcelo Werneck Barata A; Giselle Maria M; Harald O. H; Med And Luiz Andre Freire P. Effect Of Whitening Dentifrices On The Superficial Roughness Of Esthetic Restorative Materials. Jerd March 2006 Vol. 18, Issue 2, Pages 102–108

23. Débora Alves Nunes Leite L; André Luís Faria E S; Flávio Henrique Baggio A; Priscila Christiane Suzy L, Egberto M; Gláucia Maria Bovi A; José Roberto L. In

Vitro Assessment Of The Effectiveness Of Whitening Dentifrices For The Removal Of Extrinsic Tooth Stains. Braz Oral Res April/June 2008 Vol. 22 No. 2 Sao Paulo.

24. Juliana Da C, Anne Adams- B, Kelly R, Jack L. Ferracane. The Effect Of Various Dentifrices On Surface Roughness And Gloss Of Resin Composites. J Of Dent, 2010 Vol 38, Supplement 2, Pages E 123- E 128.

25. Wang, L., Garcia, F. C. P., De Araújo, P. A., Franco, E. B. And Mondelli, R. F. L. (2004), Wear Resistance Of Packable Resin Composites After Simulated Toothbrushing Test. Journal Of Esthetic And Restorative Dentistry, 16: 303–314. Doi:10.1111/J.1708-8240.2004.Tb00058.

26. Faika Abdelmegid[1]*, Fouad Salama, Saeed Al-Bagami, Khalid Zailay, Mohammed Al-Mutlag. Effect Of Anti-Erosion Toothpastes On Surface Roughness Of Different Restorative Materials. Ijmsci Volume 4 Issue 1 [January 2017

27. Bezgin, T., Özer, L., Tulga Öz, F. And Özkan, P. (2015), Effect Of Toothbrushing On Color Changes Of Esthetic Restorative Materials. J Esthet Restor Dent, 27: S65–S73. Doi:10.1111/ Jerd.12136 J Conserv Dent. 2016 Mar – Apr ; 19(2) : 171-174. Doi: 10.4103/0972-0707.178703

28. Em Da Silva, Cuf De Sá Rodrigues, Da Dias, S Da Silva, Cm Amaral, And Jga Guimarães (2014) Effect Of Toothbrushing-Mouthrinse-Cycling On Surface Roughness And Topography Of Nanofilled, Microfilled, And Microhybrid Resin Composites. Operative Dentistry: September/October 2014, Vol. 39, No. 5, Pp. 521-529.

29. Cho, L.-R. , Yi, Y.-J. And Heo, S.-J. (2002), Effect Of Tooth Brushing And Thermal Cycling On A Surface Change Of Ceromers Finished With Different Methods. Journal Of Oral Rehabilitation, 29: 816–822. Doi:10.1046/J.1365-2842.2002.00877.

Annexure

ANNEXURE – I

OBSERVATIONS

	Group A (Control)		Group B (Dabur lal dant manjan)		Group C (Colgate total advance)		Group D (Close up gel)		Group E (Himalaya sparking white)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
0	0.30	0.34	0.31	1.48	0.35	0.42	0.34	0.27	0.33	0.38
	0.36	0.28	0.33	1.58	0.28	0.38	0.28	0.30	0.29	0.39
	0.26	0.29	0.30	1.41	0.25	0.36	0.29	0.24	0.29	0.35
	0.36	0.26	0.27	1.31	0.26	0.35	0.26	0.29	0.30	0.32
	0.37	0.19	0.37	1.27	0.19	0.34	0.19	0.28	0.26	0.37
	0.19	0.37	0.26	2.17	0.37	0.39	0.37	0.26	0.31	0.36
	0.26	0.36	0.26	1.32	0.36	0.36	0.36	0.27	0.32	0.38
	0.26	0.26	0.26	1.00	0.30	0.33	0.26	0.27	0.26	0.36
	0.28	0.36	0.25	1.46	0.36	0.39	0.36	0.28	0.35	0.38
0	0.34	0.30	0.31	1.21	0.31	0.38	0.30	0.28	0.32	0.39
1	0.34	0.27	0.31	1.31	0.27	0.39	0.27	0.26	0.26	0.40
2	0.28	0.36	0.28	1.60	0.33	0.35	0.36	0.33	0.36	0.39
3	0.30	0.26	0.30	1.58	0.26	0.32	0.26	0.24	0.27	0.36
4	0.26	0.36	0.29	1.34	0.36	0.37	0.36	0.29	0.35	0.33
5	0.19	0.37	0.26	1.38	0.37	0.36	0.37	0.30	0.33	0.39
16	0.37	0.19	0.34	1.07	0.24	0.38	0.19	0.24	0.23	0.38
17	0.36	0.26	0.32	1.55	0.26	0.36	0.26	0.28	0.29	0.39
18	0.26	0.30	0.30	1.57	0.30	0.38	0.30	0.26	0.32	0.36
19	0.36	0.34	0.33	1.41	0.31	0.39	0.34	0.27	0.35	0.38
20	0.27	0.26	0.31	1.25	0.26	0.40	0.26	0.28	0.27	0.36

ANNEXURE – II

FORMULA USED FOR THE ANALYSIS

ARITHMETIC MEAN

The most widely used measure of central tendency is arithmetic mean, usually referred to simply as the mean, calculated as

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

STANDARD DEVIATION AND STANDARD ERROR

The standard deviation (SD) is the positive square root of the variance, and calculated as

$$SD = \sqrt{\frac{\sum X_i^2 - \frac{(\sum X_i)^2}{n}}{n-1}}$$

ANALYSIS OF VARIANCE

Analysis of variance (ANOVA) is used when we compare more than two groups simultaneously. The purpose of one-way ANOVA is to find out whether data from several groups have a common mean. That is, to determine whether the groups are actually different in the measured characteristic. One way ANOVA is a special case of the linear model. For more th
parametric ANOVA is use

and SE (standard error of the mean) is calculated as

$$SE = \frac{SD}{\sqrt{n}}$$

Where, n= no. of observations

PAIRED t-TEST

Paired t-test was used to calculate the differences between two paired samples i.e. when in each observation in Sample 1 is in some way correlated with an observation in Sample 2, so that the data may be said to occur in pairs and calculated as

$$t = d/S_d$$

where, d is the mean of difference within each pair of measurements and S_d the standard error of the difference. The degrees of freedom (DF) is calculated as

$$DF = n-1$$

ANALYSIS OF VARIANCE

Analysis of variance (ANOVA) is used when we compare more than two groups simultaneously. The purpose of one-way ANOVA is to find out whether data from several groups have a common mean. That is, to determine whether the groups are actually different in the measured characteristic. One way ANOVA is a simple special case of the linear model. For more than two independent groups, simple parametric ANOVA is used when variables under consideration follows Continuous

exercise group distribution and groups variances are homogeneous otherwise non parametric alternative Kruskal-Wallis (H) ANOVA by ranks is used. The one way ANOVA form of the model is

$$Y_{ij} = \alpha_{.j} + \varepsilon_{ij}$$

Where;

- Y_{ij} is a matrix of observations in which each column represents a different group.
- $\alpha_{.j}$ is a matrix whose columns are the group means (the "dot j" notation means that α applies to all rows of the j^{th} column i.e. the value α_{ij} is the same for all i).
- ε_{ij} is a matrix of random disturbances.

The model posits that the columns of Y are a constant plus a random disturbance. We want to know if the constants are all the same.

TUKEY MULTIPLE COMPARISON TEST

After performing ANOVA, Tukey HSD (honestly significant difference) post hoc test is generally used to calculate differences between group means as

$$q = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

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$$Y_{ij} = \alpha_{.j} + \varepsilon_{ij}$$

Where;

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The model posits that the columns of Y are a constant plus a random disturbance. We want to know if the constants are all the same.

TUKEY MULTIPLE COMPARISON TEST

After performing ANOVA, Tukey HSD (honestly significant difference) post hoc test is generally used to calculate differences between group means as

$$q = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

where,

$$SE = \sqrt{\frac{S^2}{2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

S^2 is the error mean square from the analysis of variance and n_1 and n_2 are number of data in Group I and 2 respectively.

Statistical level of significance: "p" the level of significance signifies as below:

$p > 0.05$	Not significant (ns)
$p < 0.05$	Just significant (*)
$p < 0.01$	Moderate significant (**)
$p < 0.001$	Highly significant (***)

ANNEXURE – III

Babu Banarasi Das University
Babu Banarasi Das College of Dental Sciences,
BBD City, Faizabad Road, Lucknow – 226028 (INDIA)

Dr. Lakshmi Bala
Professor and Head Biochemistry and
Member-Secretary, Institutional Ethics Committee

Communication of the Decision of the IIIrd Institutional Ethics Sub - Committee

IEC Code: 15 (Revised)

Title of the Project: Effect of various dentifrices & tooth brushing on the Physical properties of an esthetic restorative material: An In-vitro study. **BBDCODS/07/2017**

Principal Investigator: Dr. Surabhi Gupta **Department:** Conservative Dentistry & Endodontics

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: Revised, MDS Project Proposal

Dear Dr. Surabhi Gupta,

The Institutional Ethics Sub- Committee meeting comprising following four members was held on 04th May, 2017.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry, BBDCODS, Lucknow
2.	Dr. Narendra Kumar Gupta Member	Prof., Department of Prosthodontics, BBDCODS, Lucknow
3.	Dr. Smita Govila Member	Reader, Department of Conservative Dentistry, BBDCODS, Lucknow
4.	Dr. Subhash Singh	Reader, Department of Pedodontics, BBDCODS, Lucknow

The committee reviewed and discussed your submitted documents of the modified MDS Project Protocol in the meeting.
The modified proposal was reviewed.

Decisions: The committee approved the above protocol from ethics point of view.

Lakshmi Bala 10/07/17

(Dr. Lakshmi Bala)
Member-Secretary
IEC

Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

Forwarded by:

10/7/17

(Dr. B. Rajkumar)
Principal
BBDCODS

PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
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