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Comparative Evaluation Of Colour Stability Of Alkasite Restorative Material After Brushing Stimulation With Herbal And Fluoridated Toothpaste - An In-Vitro Study.

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ABSTRACT

Introduction: Cention N is a resin based, self-adhesive, and self-curing restorative material. It is also a bulk fill tooth-coloured restorative material that belongs to a new category of filling material called “Alkasite”. The present study aims at analysing the colour stability of the alkasite restorative material cention N after brushing simulation with a herbal toothpaste and fluoridated toothpaste.

Materials and methods: Cention N commercially available alkasite restorative material was chosen for this current study. 8 samples each of 10mm in diameter were prepared using the mould. The color stability prior to brushing of the prepared Cention N circular discs were determined using a vita easy shades spectrophotometer. L, a and b values were obtained prior to brushing simulation. 8 samples were placed in a brushing stimulator with 30000 cycles simulation. The colour stability value after brushing was again determined using the vita easy shade spectrophotometer. The colour stability values prior and after brushing stimulation were obtained and the values were tabulated, with the tabulated values analysis such as “t test” was performed.

Results: Mean ΔE value of fluoridated toothpaste was higher when compared to herbal toothpaste. Thus, cention N samples brushed with fluoridated toothpaste were less color stable. p value - 0.17 > 0.05 indicating statistically insignificant

Conclusion: It was found that colour stability of Cention N material was better in samples where brushing simulation was done with herbal toothpaste.

Keywords: Cention N, Color Stability, Brushing Stimulator, Spectrophotometer, innovative technology

INTRODUCTION

A suitable material used for restoration should be adhesive, tooth colored, resistant to wear, nontoxic, biocompatible to the tissue [1,2]. Cention N is an "alkasite" restorative which is a new category of filling material and is originally a subgroup of the composite resin. Cention N is a UDMA-based, self curing powder/liquid restorative with exceptional additional light-curing. [3]. Cention N being an dual curing material contains filler technology being used to impart adequate strength to withstand the stress, strains of the oral cavity, apart from filler technology cention N also contains polymerization technology also which uses hydroperoxide instead of the commonly used benzoyl peroxide which impacts greater temperature-resistance[4]. Cention N additionally offers benefits such as low polymerization shrinkage, low shrinking force, visibility on x rays because of the ytterbium fluoride filter, reduction in the overall setting time [5]. Posterior amalgam restorations done with optimum condensation forces are long lasting. But the poor esthetic appeal and mercury content has led to a surge of tooth coloured restorative materials in recent years.

Colour stability is essential when it comes to tooth-coloured restorative material. Many patients prefer replacing a stained restoration, regardless of its location within the oral cavity [6]. Tooth discoloration can be classified as surface, extrinsic and intrinsic color changes. Ingle defined tooth discoloration as "Any changes in hue, color/translucency of the tooth due to any cause; restorative materials, drugs (both topical/systemic), pulp necrosis/hemorrhage may be responsible" [7]. Tooth discolouration can be overcome by veneers, laminates/ tooth coloured inlay/onlay using various materials such as ceramic and composite.

The surface texture of dental materials plays a role on the accumulation of plaque, which may lead to gingival and periodontal inflammation also the discoloration of restorations and thus impair their esthetical appearance [8]. Increased surface roughness is associated with increased deposition of plaque and groughness is a determining factor for staining. [9] [10]. In vivo studies on the threshold surface roughness for bacterial plaque retention demonstrated that a mean roughness of above 0.2 µm was related to a substantial increase in bacterial retention [11].

Discoloration is of major concern for esthetic failure in case of direct tooth-colored restorations. It results due to surface staining, marginal staining because of microleakage, changes in surface morphology by wear, and internal material deterioration. Though extrinsic surface and marginal staining

are minimized by regular tooth cleaning as well as by the use of a good adhesive resin system, intrinsic discoloration is material-dependent and difficult to control by the clinical dentist [12]. Our team has extensive knowledge and research experience that has translated into high quality publications [13–30]. The present study aims at analysing the colour stability of the alkasite restorative material cention N after brushing simulation with a herbal toothpaste and fluoridated toothpaste.

MATERIALS AND METHODS

Cention N commercially available alkasite restorative material was chosen for this current study. 8 samples each of 10mm in diameter were prepared using the mould. The color stability prior to brushing of the prepared Cention N circular discs were determined using a vita easy shades spectrophotometer. L, a and b values were obtained prior to brushing simulation. 8 samples were placed in a brushing stimulator with 30000 cycles- 10000 cycles in linear X axis, 10000 cycles in linear y axis. Another 10000 cycles were divided into 5000 cycles clockwise and the remaining 5000 cycles anticlockwise. Total number of cycles of brushing is equal to three years of brushing with a duration of 8-9 hours. The colour stability value after brushing was again determined using the vita easy shade spectrophotometer. The colour stability values prior and after brushing stimulation were obtained and the values were tabulated, with the tabulated values descriptive analysis such as “t test” was performed and the result of the analysis test carried out was depicted in the form of a bar graph.

Calculation of colour stability

For determination of colour stability, a spectrophotometer of reflection time was used for measuring the colour changes (ΔE) based on the Commission Internationale de l’ Eclairage lab(CIELAB) system in 1976. The CIELAB colour space also referred to as L*a*b. L* for perceptual lightness, represents the lightness to darkness values that range from 0 to 100. a* and b* for the four unique colours that can be seen by the human vision,where, a* represents the greenness to redness with values of -127 to +128 and b* represents the blueness to yellowness with values of -127 to +128.The colour values of specimens before immersing were considered as baseline.The L, a, b values were obtained from the Vita EasyShade Spectrophotometer for the colour stability. The ΔE values were calculated in order to determine the degree of alteration in colour at different stages. The formula used is ΔE(L* a* b*) = [(ΔL*)2 + (Δa)2 + (Δb)

RESULTS

In the study, color stability of cention N was analysed after brushing simulation which is first of its kind. Table 1 shows pre LAB values of samples before placing them in a brushing simulator using herbal toothpaste. L, a and b values for sample 1 were 77.7, 1.8 and 15.2 respectively. For sample 2 the L, a and b values were 68.8, 1.8 and 11.7. For sample 3 the L, a and b values were 75.4, 1.3, and 14. For sample 4 the L, a and b values were 77.3, 1.8 and 15.8. Table 2 shows L, a and b values after removing samples from the brushing simulator using herbal toothpaste. For sample 1, the L, a and b values were 80, 1.2 and 13.6 respectively. For sample 2, the L, a and b values were 72.7, 1.5 and 9.4. For sample 3, the L, a and b values were 79.5, 1 and 12.5. For sample 4, the L, a and b values were 82.1, 1.1 and 13.4.

Table 3 shows ΔE values for colour stability for samples placed in a brushing simulator using herbal toothpaste. For sample 1, the ΔE was 2.86, for sample 2 was 4.53, for sample 3 and 4 was 4.37 and 5.41 respectively.

Table 4 shows L, a and b values for samples before placing them in a brushing simulator using fluoridated toothpaste. For sample 1, L, a and b values were 78, 1.5 and 14 respectively. For sample 2, the L, a and b values were 75, 1.6 and 16.1. For sample 3, the L, a and b values were 77.9, 1.9 and 14.5. For sample 4, the L, a and b values were 80.2, 1.2 and 14.3. Table 5 shows L, a and b values after removing samples from the brushing simulator using fluoridated toothpaste. For sample 1, L, a and b values were 81.2, 1.5 and 13.6 respectively. For sample 2 the L, a and b values were 84.2, 1.5 and 16.2. For sample 3 the L, a and b values were 82.6, 1.5 and 13.3. For sample 4, the L, a and b values were 83.5, 1.2 and 14. Table 6 shows ΔE values for colour stability for samples placed in a brushing simulator using fluoridated toothpaste. For sample 1 the ΔE was 3.22, for sample 2 was 9.2, for sample 3 and 4 was 4.86 and 3.31 respectively. Table 7 shows mean and standard deviation of herbal toothpaste as 4.29 and 1.05 respectively. The mean and standard deviation of fluoridated toothpaste was 5.14 and 2.8 respectively. Mean ΔE value was higher for samples using fluoridated toothpaste when compared to samples using herbal toothpaste (Figure 1). Thus, cention N samples brushed with fluoridated toothpaste were less color stable. The p value obtained was 0.17 which is more than 0.05, thus indicating statistically insignificant.

Table 1: Table showing pre LAB values before placing sample in brushing simulator using herbal toothpaste

S. No.	L values	a values	b values
1	**77.7**	**1.8**	**15.2**
2	**68.8**	**1.8**	**11.7**
3	**75.4**	**1.3**	**14.0**
4	**77.3**	**1.8**	**15.8**

Table 2: Table showing post LAB values after removing samples from brushing simulator using herbal toothpaste

S. No.	L values	a values	b values
1	80.0	1.2	13.6
2	72.7	1.5	9.4
3	79.5	1.0	12.5
4	82.1	1.1	13.4

Table 3: Table showing ΔE values for colour stability for samples placed in brushing simulator using herbal toothpaste

S.NO.	Colour stability ΔE
1	2.86
2	4.53
3	4.37
4	5.41
Mean	4. 29

Table 4: Table showing pre LAB values before placing sample in brushing simulator using fluoridated toothpaste

S.No.	L values	a values	b values
1	78.0	1.5	14.0
2	75.0	1.6	16.1
3	77.9	1.9	14.5

4	**80.2**	**1.2**	**14.3**

Table 5: Table showing post LAB values after removing samples from brushing simulator using fluoridated toothpaste

S.No.	L values	a values	b values
1	**81.2**	**1.5**	**13.6**
2	**84.2**	**1.5**	**16.2**
3	**82.6**	**1.5**	**13.3**
4	**83.5**	**1.2**	**14.0**

Table 6: Table showing ΔE values for colour stability for samples placed in brushing simulator using fluoridated toothpaste

S.NO.	Colour stability ΔE
1	**3.22**
2	**9.2**
3	**4.86**
4	**3.31**
Mean	**5.14**

Table 7: Table showing mean of standard deviation of samples using herbal and fluoridated toothpaste. The significant difference was 0.17 > 0.05 (statistically insignificant).

Groups	Mean	Standard Deviation	Significance

Herbal Toothpaste	**4.29**	**1.05**	**0.17**
Fluoridated Toothpaste	**5.14**	**2.8**	

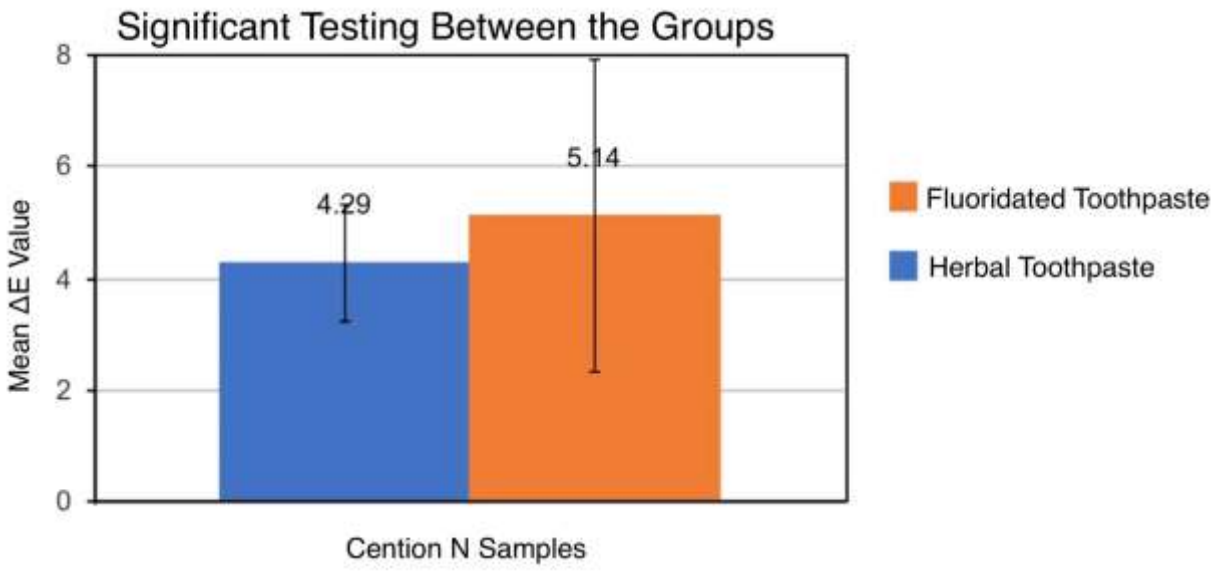

Figure 1: Bar graph showing mean ΔE values for samples placed before and after in brushing simulator using herbal and fluoridated toothpaste. Blue represents mean ΔE value of samples using herbal toothpaste and orange represents mean ΔE values of samples using fluoridated toothpaste. The X axis represents Cention N samples brushed using herbal and fluoridated toothpaste and the Y axis represents mean ΔE values. Independent sample t test was carried out. Mean ΔE value of fluoridated toothpaste was higher when compared to herbal toothpaste. Thus, cention N samples brushed with fluoridated toothpaste were less color stable. p value - 0.17 > 0.05 indicating statistically insignificant.

DISCUSSION

A prime property of dental restorative materials is color stability. For assessing chromatic differences the American Dental Association suggests using CIELAB colour coding system [31]. In the present study, colour evaluations was made by using the spectrophotometer using this CIELAB coding system as it was found useful in providing information about the location of an object colour in 3D space in terms of 3 coordinate values L*, a* and b* where L* represents the value of brightness and a* and b* represents the numeric correlates. The magnitude of colour difference ΔE obtained from these values. It was found that greater the ΔE value, higher is the difference between the 2 samples that are being compared [32].

Fluoridated toothpaste helps decrease the incidence of caries [33], The use of prophylactic home procedures frequently may have side effects, such as roughening of the surface of restorative materials and dental hard tissues, leading to increase in bacterial growth. As far as direct restorations are concerned, this is especially important for those restorations which cover the labial or buccal aspects of the restored tooth, such as Class IV or Class V fillings, while the proximal parts of Class II fillings are less affected by tooth brushing procedures [34]. The discoloration of dental materials is related to water sorption, cracks, porosities and surface finish, conversion rates and thermal postcuring or photochemical aging [35]. It may occur due to the intensity and duration of polymerization, as well as extrinsic factors, including exposure to environmental factors, ambient and ultraviolet (UV) irradiation, heat, water, and food colorants, and intrinsic factors such as the composition of the resin matrix and filler, the loading and particle size distribution, type of photoinitiator, and percentage of remaining carbon–carbon double bonds [36].

In a study conducted by Amalavathy et al, the staining effect of various beverages on and surface nanohardness of a resin coated and non-coated fluoride releasing tooth-coloured restorative material was analysed and showed that cention N had more potential to undergo surface discolouration than Equia Forte Fil glass hybrid system [37]. Another study showed that reinforced microfill restorative material tested was found significantly more color stable than the auto polymerized bis-acryl, light-polymerized composite provisional restorative materials, and microhybrid composites tested [38]. Colour stability of Cention N, Fuji IX GP, Fuji IX GP Extra restorative materials after thermocycling was evaluated in a study and it was found that ΔE values after 500 cycles of thermocycling to be 2.15 ± 0.71, 3.60 ± 084, 2.55 ± 0.62 respectively, indicating that Cention N had better colour stability when compared to other two materials [39]. The polishing of the composite surface was effective in reducing the discoloration in most of the materials tested. The gloss of those samples polymerized against a perfectly smooth surface such as a mylar strip or glass plate proved to be superior to any polishing method [40,41]. The limitations of the present study is less sample size, in future similar study can be done comparing glass ionomer cement and composite materials.

CONCLUSION

On analysing the results ΔE mean value was greater for fluoridated toothpaste when compared to herbal toothpaste. Thus, cention N samples brushed with fluoridated toothpaste were less color stable when compared to samples brushed with the herbal toothpaste.

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REFERENCES

1. Matis BA, Cochran MJ, Carlson TJ, Guba C, Eckert GJ. A three-year clinical evaluation of two dentin bonding agents. J Am Dent Assoc. 2004 Apr;135(4):451–7.

2. Bernabé PFE, Holland R, Morandi R, de Souza V, Nery MJ, Otoboni Filho JA, et al. Comparative study of MTA and other materials in retrofilling of pulpless dogs' teeth. Braz Dent J. 2005;16(2):149–55.

3. Thuy DNT, Le Thi Hoai P. COMPARISON OF MICROLEAKAGE IN CLASS V CAVITIES RESTORED BY GLASS IONOMER CEMENT AND COMPOSITE WITH OR WITHOUT PROTECTIVE COATING MATERIAL [Internet]. Journal of Medicine and Pharmacy. 2021. p. 44–51. Available from: http://dx.doi.org/10.34071/jmp.2021.1.6

4. Nagesh J, Setty A, Marigowda J, Shivanna A, Paluvary S, Ashwathappa G. Comparative evaluation of surface roughness of novel resin composite Cention N with Filtek Z350 XT: In vitro study [Internet]. Vol. 7, International Journal of Oral Care and Research. 2019. p. 15. Available from: http://dx.doi.org/10.4103/injo.injo_9_19

5. Paul S, Raina A, Kour S, Mishra S, Bansal M, Sengupta A. Comparative evaluation of fluoride release and re-release and recharge potential of Zirconomer Improved and Cention [Internet]. Vol. 23, Journal of Conservative Dentistry. 2020. p. 402. Available from: http://dx.doi.org/10.4103/jcd.jcd_222_20

6. Braga SRM, Vasconcelos BT, Macedo MR de P, Martins VRG, Sobral MAP. Reasons for placement

and replacement of direct restorative materials in Brazil. Quintessence Int. 2007 Apr;38(4):e189–94.

7. Abdul-Rahman MS, University of Sulaimani. Evaluation of microleakage in the gingival margin of class II resin composite restoration when using three placement techniques (An in vitro study) [Internet]. Vol. 1, Sulaimani dental journal. 2014. p. 21–8. Available from: http://dx.doi.org/10.17656/sdj.10014

8. Jones CS, Billington RW, Pearson GJ. The in vivo perception of roughness of restorations [Internet]. Vol. 196, British Dental Journal. 2004. p. 42–5. Available from: http://dx.doi.org/10.1038/sj.bdj.4810881

9. Bollenl CML, Lambrechts P, Quirynen M. Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: A review of the literature [Internet]. Vol. 13, Dental Materials. 1997. p. 258–69. Available from: http://dx.doi.org/10.1016/s0109-5641(97)80038-3

10. Reis A. Effects of various finishing systems on the surface roughness and staining susceptibility of packable composite resins [Internet]. Vol. 19, Dental Materials. 2003. p. 12–8. Available from: http://dx.doi.org/10.1016/s0109-5641(02)00014-3

11. Bollen CML, Papaioanno W, Van Eldere J, Schepers E, Quirynen M, Van Steenberghe D. The influence of abutment surface roughness on plaque accumulation and peri-implant mucositis [Internet]. Vol. 7, Clinical Oral Implants Research. 1996. p. 201–11. Available from: http://dx.doi.org/10.1034/j.1600-0501.1996.070302.x

12. Inokoshi S, Burrow MF, Kataumi M, Yamada T, Takatsu T. Opacity and color changes of tooth-colored restorative materials. Oper Dent. 1996 Mar;21(2):73–80.

13. Muthukrishnan L. Imminent antimicrobial bioink deploying cellulose, alginate, EPS and synthetic polymers for 3D bioprinting of tissue constructs [Internet]. Vol. 260, Carbohydrate Polymers. 2021. p. 117774. Available from: http://dx.doi.org/10.1016/j.carbpol.2021.117774

14. PradeepKumar AR, Shemesh H, Nivedhitha MS, Mohamed Jubair Hashir M, Arockiam S, Maheswari TNU, et al. Diagnosis of Vertical Root Fractures by Cone-beam Computed Tomography in Root-filled Teeth with Confirmation by Direct Visualization: A Systematic Review and Meta-Analysis [Internet]. Vol. 47, Journal of Endodontics. 2021. p. 1198–214. Available from: http://dx.doi.org/10.1016/j.joen.2021.04.022

15. Chakraborty T, Jamal RF, Battineni G, Teja KV, Marto CM, Spagnuolo G. A Review of Prolonged Post-COVID-19 Symptoms and Their Implications on Dental Management. Int J Environ Res Public Health. 2021 May 12;18(10):5131.

16. Muthukrishnan L. Nanotechnology for cleaner leather production: a review [Internet]. Vol. 19,

Environmental Chemistry Letters. 2021. p. 2527–49. Available from: http://dx.doi.org/10.1007/s10311-020-01172-w

17. Teja KV, Ramesh S. Is a filled lateral canal – A sign of superiority? [Internet]. Vol. 15, Journal of Dental Sciences. 2020. p. 562–3. Available from: http://dx.doi.org/10.1016/j.jds.2020.02.009

18. Narendran K, Jayalakshmi S, Ms N, Sarvanan A, Amirtha GS, Sukumar E. Synthesis, Characterization, Free Radical Scavenging and Cytotoxic Activities of Phenylvilangin, a Substituted Dimer of Embelin [Internet]. Vol. 82, Indian Journal of Pharmaceutical Sciences. 2020. Available from: http://dx.doi.org/10.36468/pharmaceutical-sciences.720

19. Sawant K, Pawar AM, Banga KS, Machado R, Karobari MI, Marya A, et al. Dentinal Microcracks after Root Canal Instrumentation Using Instruments Manufactured with Different NiTi Alloys and the SAF System: A Systematic Review [Internet]. Vol. 11, Applied Sciences. 2021. p. 4984. Available from: http://dx.doi.org/10.3390/app11114984

20. Bhavikatti SK, Karobari MI, Zainuddin SLA, Marya A, Nadaf SJ, Sawant VJ, et al. Investigating the Antioxidant and Cytocompatibility of Linn Extract over Human Gingival Fibroblast Cells. Int J Environ Res Public Health [Internet]. 2021 Jul 4;18(13). Available from: http://dx.doi.org/10.3390/ijerph18137162

21. Karobari MI, Basheer SN, Sayed FR, Shaikh S, Agwan MAS, Marya A, et al. An In Vitro Stereomicroscopic Evaluation of Bioactivity between Neo MTA Plus, Pro Root MTA, BIODENTINE & Glass Ionomer Cement Using Dye Penetration Method [Internet]. Vol. 14, Materials. 2021. p. 3159. Available from: http://dx.doi.org/10.3390/ma14123159

22. Singh TR, Rohit Singh T, Ezhilarasan D. Ethanolic Extract ofLagerstroemia Speciosa(L.) Pers., Induces Apoptosis and Cell Cycle Arrest in HepG2 Cells [Internet]. Vol. 72, Nutrition and Cancer. 2020. p. 146–56. Available from: http://dx.doi.org/10.1080/01635581.2019.1616780

23. Ezhilarasan D. MicroRNA interplay between hepatic stellate cell quiescence and activation [Internet]. Vol. 885, European Journal of Pharmacology. 2020. p. 173507. Available from: http://dx.doi.org/10.1016/j.ejphar.2020.173507

24. Romera A, Peredpaya S, Shparyk Y, Bondarenko I, Bariani GM, Abdalla KC, et al. Bevacizumab biosimilar BEVZ92 versus reference bevacizumab in combination with FOLFOX or FOLFIRI as first-line treatment for metastatic colorectal cancer: a multicentre, open-label, randomised controlled trial [Internet]. Vol. 3, The Lancet Gastroenterology & Hepatology. 2018. p. 845–55. Available from: http://dx.doi.org/10.1016/s2468-1253(18)30269-3

25. R KR, Kathiswar RR, Ezhilarasan D, Rajeshkumar S. β-Sitosterol-assisted silver nanoparticles activates Nrf2 and triggers mitochondrial apoptosis via oxidative stress in human hepatocellular cancer cell line [Internet]. Vol. 108, Journal of Biomedical Materials Research Part A. 2020. p. 1899–908. Available from: http://dx.doi.org/10.1002/jbm.a.36953

26. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441–8.

27. Maheswari TNU, Nivedhitha MS, Ramani P. Expression profile of salivary micro RNA-21 and 31 in oral potentially malignant disorders [Internet]. Vol. 34, Brazilian Oral Research. 2020. Available from: http://dx.doi.org/10.1590/1807-3107bor-2020.vol34.0002

28. Gudipaneni RK, Alam MK, Patil SR, Karobari MI. Measurement of the Maximum Occlusal Bite Force and its Relation to the Caries Spectrum of First Permanent Molars in Early Permanent Dentition. J Clin Pediatr Dent. 2020 Dec 1;44(6):423–8.

29. Chaturvedula BB, Muthukrishnan A, Bhuvaraghan A, Sandler J, Thiruvenkatachari B. Dens invaginatus: a review and orthodontic implications [Internet]. Vol. 230, British Dental Journal. 2021. p. 345–50. Available from: http://dx.doi.org/10.1038/s41415-021-2721-9

30. Kanniah P, Radhamani J, Chelliah P, Muthusamy N, Balasingh EJJ, Thangapandi JR, et al. Green Synthesis of Multifaceted Silver Nanoparticles Using the Flower Extract of Aerva lanata and Evaluation of Its Biological and Environmental Applications [Internet]. Vol. 5, ChemistrySelect. 2020. p. 2322–31. Available from: http://dx.doi.org/10.1002/slct.201903228

31. Seghi RR, Hewlett ER, Kim J. Visual and instrumental colorimetric assessments of small color differences on translucent dental porcelain. J Dent Res. 1989 Dec;68(12):1760–4.

32. Ruyter IE, Nilner K, Moller B. Color stability of dental composite resin materials for crown and bridge veneers. Dent Mater. 1987 Oct;3(5):246–51.

33. Marinho VCC, Higgins JPT, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents [Internet]. Cochrane Database of Systematic Reviews. 2003. Available from: http://dx.doi.org/10.1002/14651858.cd002782

34. Heintze SD, Forjanic M. Surface roughness of different dental materials before and after simulated toothbrushing in vitro. Oper Dent. 2005 Sep;30(5):617–26.

35. Dietschi D, Campanile G, Holz J, Meyer J-M. Comparison of the color stability of ten new-generation composites: An in vitro study [Internet]. Vol. 10, Dental Materials. 1994. p. 353–62. Available from: http://dx.doi.org/10.1016/0109-5641(94)90059-0

36. Sarafianou A, Iosifidou S, Papadopoulos T, Eliades G. Color Stability and Degree of Cure of Direct Composite Restoratives After Accelerated Aging [Internet]. Vol. 32, Operative Dentistry. 2007. p. 406–11. Available from: http://dx.doi.org/10.2341/06-127

37. Amalavathy RK, Kurinji Amalavathy R, Sahoo HS, Shivanna S, Lingaraj J, Aravinthan S. Staining effect of various beverages on and surface nano-hardness of a resin coated and a non-coated fluoride

releasing tooth-coloured restorative material: An in-vitro study [Internet]. Vol. 6, Heliyon. 2020. p. e04345. Available from: http://dx.doi.org/10.1016/j.heliyon.2020.e04345

38. Guler AU, Yilmaz F, Kulunk T, Guler E, Kurt S. Effects of different drinks on stainability of resin composite provisional restorative materials. J Prosthet Dent. 2005 Aug;94(2):118–24.

39. Bhattacharya S, Purayil TP, Ginjupalli K, Kini S, Pai S. Effect of Thermocycling on the Colour Stability of Aesthetic Restorative Materials: An in-vitro Spectrophotometric Analysis [Internet]. Vol. 20, Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 2020. Available from: http://dx.doi.org/10.1590/pboci.2020.020

40. Shintani H, Satou J, Satou N, Hayashihara H, Inoue T. Effects of various finishing methods on staining and accumulation of Streptococcus mutans HS-6 on composite resins [Internet]. Vol. 1, Dental Materials. 1985. p. 225–7. Available from: http://dx.doi.org/10.1016/s0109-5641(85)80046-4

41. Stanford WB, Fan PL, Wozniak WT, Stanford JW. Effect of finishing on color and gloss of composites with different fillers [Internet]. Vol. 110, The Journal of the American Dental Association. 1985. p. 211–3. Available from: http://dx.doi.org/10.14219/jada.archive.1985.0265