Color Stability in Complete Dentures Constructed with Two Different Methods

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Abstract

Introduction: Although the artificial teeth seem to be more important, the change of color in the denture base has the same value regarding several components, one of them is color stability. Color stability is an important parameter for the complete denture wearing patients. The purpose of this study was to evaluate the color stability between two types of dentures: 1. Dentures constructed with injection molding technique and 2. Dentures constructed with compression molding method.

Materials and Methods: The dentures were stored in three different solutions: artificial saliva+tea, artificial saliva+coffee and artificial saliva.

Results: The color change was determined using a spectrophotometer. The group of dentures made of acrylic resin with the injection molding method showed less coloration compared to the dentures with the compression molding method. The solution that caused more coloration was tea.

Conclusions: Based on this study it can be concluded that the dentures which are constructed with the injection molding technique show a higher grade of color stability compared to the dentures constructed with compression molding technique.

Keywords: Color stability, complete dentures, solutions.

1. INTRODUCTION

The material of choice for the construction of complete dentures was polymethyl-methacrylate (PMMA) since 1940 [1-3]. PMMA has many advantages, but it has also several disadvantages such as dimensional shrinkage and color stability, which is still a contradictable parameter [4-8]. The stability of color is a quality that should all the restorative materials have [9-11]. The stability of the color in the artificial teeth in complete denture wearing has been recorded as an important component. Although artificial teeth are more evident, the change of color of the denture base causes severe psychologic problems in denture wearing patients and as a consequence the necessity of changing them [12-14]. The staining of the material shows also an old and damaged material. Several parameters might cause the staining process such as water absorption, the

change of colorant pigments etc. The stability of the color of the denture base and of the artificial teeth by different drinks and food colorants has been studied [15]. Cleaning agents are useful to assure a good appearance and to avoid the material staining. The accumulation of the material in the artificial teeth follows the same path as in the natural teeth [9]. The small accumulations can be eliminated by using brushes and rinses, while more difficult stains such as those from tea, coffee etc. are more difficult to eliminate [16].

2. MATERIALS AND METHODS

72 Dentures were constructed using two different polymerizing techniques: conventional molding and injection molding technique. They were divided in two groups: Group 1: 36 conventional dentures, the traditional group of dentures made by conventional molding

technique; Group 2: 36 experimental group, the group of dentures made by impression molding technique, with the SR IVOCAP system. The Master stone casts were constructed by the same silicone mold. So 72 identical master stone casts with each other were created. Over the master stone casts, two layers of wax were applied, artificial teeth were arranged. The negative of the first wax denture was created by a silicone sample. Over the silicone sample all the other master stone casts were positioned on place, where melted wax was poured. So the wax dentures created had the same height and thickness of the wax. The same artificial teeth were used for the construction of the wax dentures. For the first group, conventional molding technique was followed, while for the second group the injection molding technique with the SR-IVOCAP system (Tab. 1). Traditional curing process was followed. Three type of solutions were prepared : artificial saliva and tea, artificial saliva and coffee and artificial saliva. The color change was calculated. Each group was divided into three small groups of 12 dentures, based on the solution where they were stored: 12 dentures were stored in artificial saliva and tea, 12 dentures were stored in artificial saliva and coffee, 12 denture only in artificial saliva (the control group). The color was measured immediately after polymerization, after 24 hours and after 1 week. After 1 week of immersion the dentures were soaked in artificial saliva for 15 seconds to remove superficial stains, and then it was analyzed if it had any dark stains. Spectrophotometer was used to determine the color change. The statistical evaluation of the data was performed by analyzing the differences among materials and staining colors.

Table1. Types of acrylic resin

Denture base resin	Material	Manufacturer
Compression molded	SR-Ivocap Triplex Hot	Ivoclar Vivadent
Injection molded	SR-Ivocap High Impact	Ivoclar Vivadent

3. RESULTS

All dentures stored in coffee and tea showed an increase in color change compared to the change of color when stored in artificial saliva, despite their material. The value of the color change was determined by C.I.E. L* a* b* colour scale. (Tab. Nr.2) The amount of the color difference

was calculated with ΔE (Chart Nr.1). The color change between the two groups of dentures was statistically significant. Dentures stored in tea showed a higher coloration grade. After 7 days dentures constructed with the injection molding technique were less colored by coffee and tea compared to the dentures constructed with the compression molding technique (Tab. 2).

Table2. Color differences for the tested groups

Denture base resin	Solutions		
	Artificial saliva	Coffee	Tea
Compression	1.1 +/- 0.2	1.7 +/-0.3	2.3 +/-0.2
Injection	0.7 +/- 0.1	1.3 +/-0.2	1.9 +/-0.4

Chart Nr.1 : Color change related to different solutions

Color change ΔE

Polymerization technique

4. DISCUSSIONS

Significant color change in all samples were observed when they were stored in the solutions. The amount of color change depends on the type of the denture base material and on the type of the solution as well. Anyway the dentures constructed from the injection molding technique showed less staining compared to the dentures constructed with the conventional molding technique. The tendency of the staining of acrylic resin might be explained with its property to water absorption [17]. This property is closely related to the absorption of colored liquid by acrylic resin. These liquids enter in the resin material by expanding the polymer, by causing so the insertion of colorant agents [18, 19]. Visual detection of the denture constructed with injection molding technique showed they were less affected to discoloration. Dentures constructed with compression molding, received shrinkage after polymerization, which causes a gap through which the colorant pigments can have access. [20] Tea solution: Both dentures received pigmentation. This is thought to

happen because of the inorganic tea components [21]. Anyway, the dentures constructed with the injection molding technique showed less staining compared to the dentures constructed with compression molding technique. Coffee solution: In both groups, the dentures showed less stainings level compared to the tea solution.

5. CONCLUSIONS

Within the limitations of this study, we can conclude that:

1. All dentures had significant color change when stored in coffee or tea solutions. Solutions made of tea produced higher coloration compared to coffee solution.
2. Injection molding dentures showed less stains compared to the conventional molding technique after processing, after 24 hours and after 1 week of denture polymerization.

REFERENCES

- [1] Khokhar, Z. A. et al. (1991). "Color stability of restorative resins." *Quintessence international* 22 9: 733-7.
- [2] Sepúlveda-Navarro WF, Arana-Correa BE, Borges CP, Jorge JH, Urban VM, Campanha NH. (2011). Color stability of resins and nylon as denture base material in beverages. *J Prosthodont.* 20:632-8. 10.1111/j.1532-849X.2011.00791.
- [3] Goiato MC, Nóbrega AS, dos Santos DM, Andreotti AM, Moreno A. (2014). Effect of different solutions on color stability of acrylic resin-based dentures. *Braz Oral Res.*28:1-7.
- [4] Scotti, R. et al. (1997). "The in vitro color stability of acrylic resins for provisional restorations." *The International journal of prosthodontics* 10 2:164-8 .
- [5] Wang, R. et al.(1989). "A comparison of resins for fabricating provisional fixed restorations." *The International journal of prosthodontics* 2 2:173-84 .
- [6] Berger JC, Driscoll CF, Romberg E, Luo Q, Thompson G.(2006). Surface roughness of denture base acrylic resins after processing and after polishing. *J Prosthodont.* May-Jun;15(3):180-6. 10.1111/j.1532-849X.2006.00098.
- [7] Gungor H, Gundogdu M, Yesil Duymus Z. (2014). Investigation of the effect of different polishing techniques on the surface roughness of denture base and repair materials. *J Prosthet Dent.*112:1271-7. 10.1016/j.prosdent.03.023.
- [8] Singh S, Palaskar JN, Mittal S. (2013). Comparative evaluation of surface porosities in conventional heat polymerized acrylic resins cured by water bath and microwave energy with microwavable acrylic resin cured by microwave energy. *Contemp Clin Dent.*4:147-51. 10.4103/0976-237X.114844.
- [9] Oğuz S, Mutluay MM, Doğan OM, Bek B.(2007). Color change evaluation of denture soft lining materials in coffee and tea. *Dent Mater J.* 26:209-16. 10.4012/dmj.26.209.
- [10] Waliszewski M. (2005). Restoring dentate appearance: a literature review for modern complete denture esthetics. *J Prosthet Dent.* 93:386-94. 10.1016/j.prosdent.2005.01.004.
- [11] Goiato MC, Santos DM, Haddad MF, Pesqueira AA. (2010). Effect of accelerated aging on the microhardness and color stability of flexible resins for dentures. *Braz Oral Res.*24:114-9. 10.1590/S1806-83242010000100019.
- [12] Heydecke G, Locker D, Awad MA, Lund JP, Feine JS. (2003). Oral and general health-related quality of life with conventional and implant dentures. *Community Dent Oral Epidemiol.* Jun;31(3):161-8. 10.1034/j.1600-0528.2003.00029.
- [13] Sahin O, Koroglu A, Dede DÖ, Yilmaz B. (2016). Effect of surface sealant agents on the surface roughness and color stability of denture base materials. *J Prosthet Dent.* 116:610-6. 10.1016/j.prosdent.03.007.
- [14] Hong G, Murata H, Li Y, Sadamori S, Hamada T.(2009). Influence of denture cleansers on the color stability of three types of denture base acrylic resin. *J Prosthet Dent;* 101:205-13. 10.1016/S0022-3913(09)60032-9.
- [15] Koksall T, Dikbas I. (2008). Color stability of different denture teeth materials against various staining agents. *Dent Mater J.* Jan;27(1):139-44. doi: 10.4012/dmj.27.139. PMID: 18309623.
- [16] Jagger DC, Al-Akham L, Harrison A, Rees JS. (2002). The effectiveness of seven denture cleansers on tea stain removal from PMMA acrylic resin. *Int J Prosthodont.* Nov-Dec;15(6):549-52. PMID: 12475160.
- [17] Dae-Eun Jang, Ji-Young Lee, Hyun-Seon Jang, Jang-Jae Lee, Mee-Kyoung Son. (2015). Color stability, water sorption and cytotoxicity of thermoplastic acrylic resin for non metal clasp denture. *J Adv Prosthodont.* Aug; 7(4): 278-287.
- [18] Yannikakis S, Zissis A, Polyzois G, Andreopoulos A.(2002). Evaluation of porosity in microwave-processed acrylic resin using a photographic method. *J Prosthet Dent.* 87:613-619.
- [19] Compagnoni MA, Barbosa DB, de Souza RF, Pero AC.(2004). The effect of polymerization cycles on porosity of microwave processed denture base resin. *J Prosthet Dent.* 91: 281-285.

- [20] Bohra PK, Ganesh PR, Reddy MM, Ebenezar AV, Sivakumar G. (2015). Colour stability of heat and cold cure acrylic resins. J Clin Diagn Res. Jan;9(1):ZC12-5. doi: 10.7860/JCDR/2015/11620.5400. Epub 2015 Jan 1. PMID: 25738078; PMCID: PMC4347169.
- [21] Nordbo H, Attramadal A And Eriksen Hm.(1983). Iron Discoloration Of Acrylic Resin Exposed To Chlorhexidine Or Tannic Acid: A Model Study. J Prosthet Dent; 49(1), P: 126-129.

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