MATHEWS Open Access Journals

ISSN 2474-6843

Commentary Article | Mathews Journal of Dentistry

Up-To-Date Methods Used in Dental Materials Designs

Loai Aljerf[1]*, Bayan AlHamwi[2]

[1]Department of Basic Sciences, Faculty of Dental Medicine, Damascus University, Damascus, Syria.

[2]Department of Chemistry, Faculty of Medicine, Syrian Private University, Damascus, Syria.

Corresponding Author: Loai Aljerf, Department of Basic Sciences, Faculty of Dental Medicine, Damascus University, Damascus, Syria, **Tel:** +96394448203; **Email:** envirochrom@hotmail.com

Received Date: 03 Oct 2018

Accepted Date: 08 Oct 2018

Published Date: 11 Oct 2018

Citation: Aljerf L and AlHamwi B. (2018). Up-To-Date Methods Used in Dental Materials Designs. M J Dent. 3(1): 020.

ABSTRACT

The construction of restorative and prosthetic dental appliances comprises a wide range of metals. The purpose of study is to review impression materials used for fabricating fixed restorations in dentistry and evaluate the development of dental materials as the strength and water sorption of conventional and high impact strength denture base resins with the reinforced glass fibers. In addition, we surveyed the hygroscopic expansion on the cusp deflection of tooth composite restoration. The corrosion of dental appliances releases metal ions into the body, and the linings of the mouth and the digestive system can absorb these ions. Amalgam remains the standard of care in many countries. A reaction to the mercury contained in a dental amalgam filling may have contributed to the deterioration of the subject's symptoms. However, one of the biggest disadvantages of dental amalgam is that gaining its ultimate strength associated with a slow process. The use of a rapid-setting amalgam with high early compressive strength could be a better option in preventing early fractures in dentistry. That is interesting, that we found that residual ions as mercury may be related to capsule design features, making their disposal a predicament, however, leaching of silver is not a problem.

KEYWORDS

Dental Materials; Appliances; Hygroscopic Expansion; Composite Restoration; Amalgam.

PERIODONTAL DISEASE AND CANCER

Amalgam remains a fertile subject for investigation. Research conducted during the past year has shed additional light on the setting reactions and on the variables influencing clinical behavior [1,2]. Uncombined mercury rapidly disappears as the alloy hardens; either by diffusion, combination or recombination in or with other phases present [3]. The initial shrinkage, subsequent expansion and final shrinkage can be explained by these actions. However, if polishing techniques are employed that produce temperatures above 65°C., mercury will be released, resulting in a mercury-rich amalgam at the critical marginal areas. A study of the exact relationship between residual mercury and compressive strength again established the weakening effect of excess mercury in the restoration [4]. The residual mercury content varied with the original mercury-alloy ratio and the condensation pressure. Serious loss in strength occurred when the mercury exceeded 55%. The particular study [5] made use of an improved laboratory method for measuring residual mercury has been worked out by Stone and his team.

Other investigations have been carried out to evaluate the efficiency of various matrix band techniques in restoring the normal tooth contour [6-8]. Silhouettes of the restorations which were made by seven techniques disclosed that both contouring and wedging of the matrix were essential to accurate reproduction of the contours. Gross cervical overhang occurred if the matrix band was not securely wedged.

RESINS

Research in the field of dental resins, both basic and applied, continues at an accelerated rate. The sorption of water as related to temperature and degree of polymerization and molecular weight has been reported [9]. The mechanical proper-

ties of the direct filling resins (such as modulus of elasticity, yield point and hardness) make resin inferior to dental gold alloys and amalgam for restorations that are subject to stress [10,11]. Many claims made concerning the adhesion of resin cements and filling materials to the hard tooth tissues under oral conditions have not been substantiated [11]. The data indicate that although certain resins are superior on a dry tooth surface absorption of moisture breaks the bond. The clinical significance of these observations remains to be established. Two studies [11, 12], based on a more than 24 month evaluation of a resin cement, indicated it to be equal to zinc phosphate cement except under a very few specified conditions. Color stability has been improved but remains a problem with all the self-cured resins. A spectrophotometric method for measuring the color changes in popular brands showed that none were entirely color stable [13].

There is added evidence that use of tin-foil substitutes causes lower strength and increases warpage of the denture base resin compared to resin processed in a mold lined with tin foil [14]. The influence of packing pressure on the vertical dimension of dentures showed that minimum increase in the vertical dimension occurred when the dentures were invested in artificial stone and packed at high pressures [15]. Artificial teeth were forced into plaster by the average packing pressure. Irritation of the mucosa under acrylic resin dentures has often been attributed to the residual monomer present after processing. The small amount of residual monomer is leached out during the finishing of the denture and the first 17 hours in the mouth [16]. This observation confirms previous studies [17] that true allergy to acrylic resins is seldom seen in the dental office. Another preliminary report [18] had indicated certain serious limitations to nylon as a denture base. Its mechanical properties are superior to current denture base resins but its dimensional change on curing and during water sorption makes nylon unsatisfactory, at least with the materials and techniques available.

Several studies are devoted to a long neglected area in prosthetics, namely, deformation of the denture base under biting stress [19]. Strain gauges are an excellent laboratory tool to evaluate the type of denture base and anatomical design of the teeth.

CASTING AND INVESTMENT

Thompson et al. [20] have published a comprehensive review of the current status of inlay casting techniques. It is obvious that there are now several popular techniques available, all of comparable accuracy. Choice should probably be made of the procedure that works best in a particular person's hands.

There is continued research [21] to determine the exact mechanism of hygroscopic expansion. Until this phenomenon is completely understood, it will be difficult to establish a standardized technique. Another new hygroscopic method [22] whereby a specific amount of water is added to the top surface of the investment during setting has been presented. Alrahlah et al. [23] contend that the degree of expansion can be varied by the amount of water added.

Much still remains to be learned about small castings. Considerable variation exists in the fit of individual castings; differences as much as 1.0% in the size of castings made by a universally acceptable technique were reported [24]. Carvalho [25] has stressed the importance of accuracy of fit and the failures which inevitably result if reliance is placed on the cement alone.

IMPRESSION MATERIALS

The new rubber base impression materials are the subject of several preliminary reports [26-29]. Definite reliable techniques have yet to be established for these materials but several factors have been emphasized in these early publications. The material must be bonded well to the tray or band and should not be removed from the mouth until two minutes after the set. Special care must be taken to avoid any pinching of the band during removal.

INSTRUMENTATION

Experimentation on methods of cutting enamel continues to center on improvements in rotary methods, revaluation of the air abrasive technique and introduction and intense experimentation with ultrasonic devices. The developments of various rotary instruments are reviewed by Gu et al. [30]. In the abrading of enamel, the elimination or reduction of vibration is perhaps the most important single factor as vibration is the primary deterrent to dental service. The balance between this vibration factor and others such as reduced pain, rapidity of removal of enamel and simplicity of design, ease of repair, and life of the instrument will determine which of the auxiliary methods will be accepted within the next few years. The method that appears to be the most promising at the present time makes use of the water turbine hand piece [31-33].

According to Nakamura et al. [34], the air abrasive method first introduced in 1951 has been used by over 2,000 dentists. Between other methods used, air abrasive has been carefully given its advantages and disadvantages and all of these researches refer that the method has a place in dental practice. Time has shown, however, that it will not be widely accepted by dentists at the present level of development where many suggest ultrasonic method [35-38].

CONCLUSION

Clinical reports highlighted the fact that metals used in dental treatment, such as mercury, as well as cross-reactions [39,40] between nickel and palladium, may cause systemic hypersensitivity or toxicity. Sensitivity was shown based on the catalytic reaction of amalgam materials which had been proved to be an efficacious method for multiple signal amplification detection and rapid removal of ions such as Hg2+. Conventional and high impact strength denture base resin materials exhibited greater water sorption values than the same reinforced with glass fibers. In clinical situations, use of primer/adhesive is recommended for getting proper adhesion. At last, we recommend clinicians to have in mind that amalgam-resembling restorations are not always what they seem to be and additional attention may be required such as the well understanding of viscoelastic behaviors of each resilient denture liner and choose the material according to the clinical situation.

REFERENCES

1. Fujii Y. (2017). Severe dermatitis might be caused by a cross-reaction between nickel and palladium and dental amalgam resolved following removal of dental restorations. Clinical Case Reports. 5(6): 795-800.
2. Aljerf L and AlMasri N. (2018). Educational study of the best Eco-Friendly applicatory dental restorative methods in using well-designed chemical composition of amalgam. Acta Scientific Dental Sciences. 2(8): 113-120.
3. Parsaee Z. (2018). Electrospun nanofibers decorated with bio-sonochemically synthesized gold nanoparticles as an ultrasensitive probe in amalgam-based mercury (II) detection system. Ultrasonics Sonochemistry. 44: 24-35.
4. Tabari M, Fekrazad R, Alaghemand H and Hamzeh M. (2017). Effect of diode laser irradiation on compressive strength of dental amalgam. Electronic Physician Journal. 9(4): 4084-4089.
5. Stone ME, Pederson ED, Cohen ME, Ragain JC, et al. (2002). Residual mercury content and leaching of mercury and silver from used amalgam capsules. Dental Material. 18(4): 289-294.
6. Aljerf L and Choukaife AE. (2017). Hydroxyapatite and Fluoroapatite behavior with pH Change. International Medical Journal. 24(5): 407-410.
7. Choukaife AE and Aljerf L. (2017). A descriptive study – in vitro: new validated method for checking Hap and Fap Behaviours. International Medical Journal. 24(5): 394-397.
8. Goldman A, Frencken JE, De Amorim RG and Leal SC. (2018). Replacing amalgam with a high-viscosity glass-ionomer in restoring primary teeth: A cost-effectiveness study in Brasilia, Brazil. Journal of Dentistry. 70: 80-86.
9. Kanaparthi DB, Rao AK and Chandra TS. (2017). Comparative study of transverse strength and water sorption between conventional and fiber reinforced denture base resins – An in vitro study. Journal of Medical Science and Clinical Research. 5(7): 25102-25107.
10. Heller A. (2017). Clinical procedures to avoid the 'dark halo' in restorations with direct composite resins. Dental Update. 38(5): 304-312.
11. Aljerf L. (2015). Effect of thermal-cured hydraulic cement admixtures on the mechanical properties of concrete. Interceram - International Ceramic Review. 64(8): 346-356.
12. Schumacher GE, Eichmiller FC and Antonucci JM. (1992). Effects of surface-active resins on dentin/composite bonds. Dental Material. 8(4): 278-282.
13. Podgórski M. (2012). Structure-property relationship in new photo-cured dimethacrylate-based dental resins. Dental Material. 28(4): 398-409.
14. Makaronidis I. (2014). Restorative dentistry: Tin foil filling. British Dental Journal. 217(5): 207-208.
15. Taguchi N, Murata H, Hamada T and Hong G. (2008). Effect of viscoelastic properties of resilient denture liners on pressures under dentures. Journal of Oral Rehabilitation. 28(11): 1003-1008.
16. Ali AA, Alharbi FA and Suresh CS. (2013). Effectiveness of coating acrylic resin dentures on preventing candida adhesion. Journal of Prosthodontics. 22(6): 445-450.
17. Du Buske LM, Babakhin AA, Volozhin AI, Vinogradova OD, et al. (2003). Relationship between methods of polymerization and histamine releasability and adjuvant activity of acrylic resins used in dental materials (DM). Journal of Allergy and Clinical Immunology. 111(2): S168.
18. Sepúlveda-Navarro WF, Arana-Correa BE, Borges CPF, Jorge JH, et al. (2011). Color stability of resins and nylon as denture base material in beverages. Journal of Prosthodontics. 20(8): 632-638.
19. Atwood DA. (1968). Final report of the workshop on clinical requirements of ideal denture base materials. Journal of Prosthetic Dentistry. 20(2): 101-105.
20. Thompson MC, Thompson KM and Swain M. (2010). The all-ceramic, inlay supported fixed partial denture. Part 1. Ceramic inlay preparation design: a literature review. Australian Dental Journal. 55(2): 120-127.
21. Arpa C, Ceballos L, Watts DC and Silikas N. (2016). 3-D hygroscopic expansion of resin-composites. Dental Material. 32(Supplement 1): e39-e40.
22. Mossa H, Elkhatat E and Labib L. (2018). Hygroscopic expansion influence on cuspal deflection of tooth composite restoration. Journal of Advances in Medical and Pharmaceutical Sciences. 15(4): 1-7.

23. Alrahlah A, Silikas N and Watts DC. (2014). Hygroscopic expansion kinetics of dental resin-composites. Dental Material. 30(2): 143-148.
24. Sabouhi M and Hedayatipanah M. (2015). The comparison of vertical margin discrepancy in casting fabricated with metal ring, ringless and metal ring with hygroscopic expansion investment systems. Avicenna Journal of Dental Research. 7(2): 6-6.
25. Carvalho RM. (2010). Commentary. Bond strength of two resin cements on dentin using different cementation strategies. Journal of Esthetic and Restorative Dentistry. 22(4): 269-269.
26. Hamalian TA, Nasr E and Chidiac JJ. (2011). Impression materials in fixed prosthodontics: Influence of choice on clinical procedure. Journal of Prosthodontics. 20(2): 153-160.
27. Singh K, Sahoo S, Prasad KD, Goel M, et al. (2012). Effect of different impression techniques on the dimensional accuracy of impressions using various elastomeric impression materials: An in vitro study. The Journal of Contemporary Dental Practice. 13(1): 98-106.
28. Choi MR and Park CJ. (2014). Dimensional stability of rubber impression materials immersed in iodophor disinfectant. Journal of Dental Rehabilitation and Applied Science. 33(1): e80.
29. Tzimas K, Gerasimou P and Tolidis K. (2017). Shark fin test analysis: Thixotropic behavior of elastomeric impression materials. Dental Material. 33(Supplement 1): e80.
30. Gu Y, Kum KY, Perinpanayagam H, Kim C, et al. (2017). Various heat-treated nickel–titanium rotary instruments evaluated in S-shaped simulated resin canals. Journal of Dental Sciences. 12(1): 14-20.
31. Giraki M, Bauer A, Barthel C, Rüttermann S, et al. (2016). Problems with a cordless endodontic hand piece when preparing severely curved root canals. Journal of Dental Problems and Solutions. 3(1): 40-44.
32. Fushimi H, Nishi Y, Shimomura K and Hasegawa K. (2017). Study on internal flow and performance of a dental air turbine handpiece. Proceedings of Ibaraki District Conference. 25: 304.
33. Nishi Y, Fushimi H, Shimomura K and Hasegawa T. (2018). Performance and internal flow of a dental air turbine handpiece. International Journal of Rotating Machinery. 2018: 1-11.
34. Nakamura H, Nakamura M, Osuga N and Miyazawa H. (2006). Application of an air-abrasive cutting apparatus in the pediatric dental field: Cutting using chitin-chitosan grains. Pediatric Dental Journal. 16(1): 57-66.
35. Singh R, Barua P, Kumar M, Safaya R, et al. (2017). Effect of ultrasonic instrumentation in treatment of primary molars. The Journal of Contemporary Dental Practice. 18(9): 750-753.
36. Chadgal S, Farooq R, Purra AR, Ahangar FA, et al. (2018). Ultrasonic activation of a bioceramic sealer and its dentinal tubule penetration: An in vitro study. Annals of International medical and Dental Research. 4(2): 51-54.
37. Jamleh A, Suda H and Adorno CG. (2018). Irrigation effectiveness of continuous ultrasonic irrigation system: An ex vivo study. Dental Material. 37(1): 1-5.
38. Kurokawa H, Shiratsuchi K, Suda S, Nagura Y, et al. (2018). Effect of light irradiation and primer application on polymerization of self-adhesive resin cements monitored by ultrasonic velocity. Dental Material. 37(4): 534-541.
39. Aljerf L and AlMasri N. (2018). Mercury toxicity: ecological features of organic phase of mercury in biota- Part I. Archives of Organic and Inorganic Chemical Sciences. 3(3): 1-8.
40. Aljerf L and AlMasri N. (2018). A gateway to metal resistance: bacterial response to heavy metal toxicity in the biological environment. Annals of Advances in Chemistry. 2(1): 32-44.