Color Stability of Two Novel Provisional Restorative Materials With and Without Polishing

Thesis

Submitted to the Faculty of Dentistry

Ain Shams University for Partial Fulfillment of the Requirements

For Master Degree in Fixed Prosthodontics

BY

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2015

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

{ .. رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي

أَنْعَمْتَ عَلَيَّ وَعَلَىٰ وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا

تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ

الصَّالِحِينَ }

صَدَقَ اللهُ العَظيم

(سورة النمل، جزء من آية 19)

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To my

Role model Dad, my beloved Mum

And my Sister, Brothers, Wife & My Brave Boys

Thank you for your endless love, support & sharing my hard times.

You sincerely light my path and bless every step

*First of all, I am deeply thankful to **ALLAH** for granting me power to accomplish this work.*

*My deepest gratitude to **Dr Amina Mohammed Hamdy, Professor of Fixed Prothodontics, Faculty of Dentistry, Ain Shams University,** for her precious help, encouragement, guidance and great effort during this thesis. She is an example of constant source of knowledge and inspiration for her candidates.*

*I am also grateful to **Dr. Tarek Salah Morsy, Professor and Head of Department of Fixed Prothodontics, Faculty of Dentistry, Ain Shams University,** for his generous help, support, advice and discussions during this study. These moments will be unforgettable ones and will be remembered throughout my whole life.*

I would also like to sincerely thank My Cousin, Dr. Asmaa Youssif Harhash, Assistant Professor of Conservative Dentistry for her support with passion, encouragement and great help throughout all stages of my master degree and this research.

Last but not least I would like to thank my backbone, the rock I lean on, my family, my close friends , professors and colleagues for their patience, continuous support and above all understanding.

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The importance of a provisional crown to treatment outcomes is well established. The term "provisional" denotes "serving for the time being", as a necessary step in providing for the final arrangement. The prognosis of a fixed prosthodontic restoration depends on the quality of this provisional restoration. Fabrication of these provisional crowns uses variety of materials and techniques. (1)

The prepared tooth need to be protected from the oral environment its relationship with the adjacent and opposing tooth need to be maintained, moreover, this environment contains several discoloring agents. Thus, in order to protect these prepared abutment teeth, provisional restorations are 1 fabricated and the process is called as Temporization.

The provisional crown protects the pulp from thermal and chemical insults after crown preparation and enamel removal. It serves to maintain gingival health and contour while providing for an esthetic and/or functional interim restoration. They should exhibit a good shade match and have a highly polished surface so that are esthetically pleasing to the patient. These factors are extremely important to the success or failure of treatment outcomes. (2)

Color stability of provisional materials is of prime concern, particularly when the restorations involve esthetic zone and must be worn for extended periods of time. Discoloration of

provisional materials may lead to patient dissatisfaction and even additional expense for replacement. This is particularly problematic when provisional restorations are subjected to colorants during lengthy treatment. Hence, color stability is a significant criterion in the selection of a particular provisional material for use in esthetically critical area. [3]

The quantitative evaluation of color difference with a spectrophotometer confers advantages such as repeatability, sensitivity, objectivity despite some limitations [4]. If a material is completely color stable or unstained, no color difference will be detected after its exposure to the testing apparatus. Various studies have been reported on the influence of staining materials like tea, coffee, red wine on the provisional materials [5, 6]. Mouth rinses have been routinely used to prevent bacterial colonization and maintenance of oral hygiene. But there is a lack of literature evidence on the effect of these mouth rinses on the color stability of provisional crowns [7]. Hence, this study has been designed to evaluate the color stability of two different commercially available provisional restorative materials when exposed to different coloring agents.

A provisional restoration could be defined as an interim dental prosthesis that maintains esthetics, provides masticating surfaces, and protects the hard and soft tissues prior to the delivery of the final prosthesis [(8)].

In other words; it is designed to enhance esthetics, stabilization or function for a limited period of time, after which it is to be replaced by a definitive dental prosthesis. In esthetically critical areas, the provisional restoration must not only provide an initial shade match, but also must maintain its esthetic appearance over the period of service. Perceptible color change of the provisional restorative material may compromise the acceptability of provisional restorations [(9)]. Discoloration of provisional materials for fixed prosthodontics may result in patient dissatisfaction and additional expense for replacement. This is particularly problematic when provisional restorations are subjected to colorants during lengthy treatment. Hence, color stability is a significant criterion in the selection of a particular provisional material for use in esthetically critical area.

Temporary materials have changed immensely since their early days in the 1930s [(10)] from acrylics and premade crown forms to newer bis-acryl materials and computer-aided design/computer-aided manufacturing (CAD/CAM)-generated restorations. The dental professional now has many choices of materials from which to choose and must determine which material fits best for the patient.

From a historical perspective, acrylic temporaries are the oldest materials still in use today [(10)]. They are divided into two main groups: PMMA (polymethylmethylacrylic) and PEMA (polyethylmethylacrylic). They typically come in a powder/liquid format that necessitates a manual mixing of the two components, which is usually done in a dappen dish and delivered into a matrix. The matrix for the acrylic is usually made from alginate or alginate substitute, silicone matrix, vacuform matrix, polyvinyl siloxane material matrix, or polyether matrix.[(11)] Great care must be taken when using these acrylics on the tooth structure, especially if undercuts are present on the teeth. The provisional can easily lock into place and become difficult to remove, causing it to break or damage the existing tooth structure. Placing a small amount of petroleum jelly or glycerin on the teeth can help to alleviate this problem [(12)].

Both PMMA and PEMA materials can be used for single and multiple long-span provisionals. Both are low-cost materials that can be smoothed and polished relatively easily [(13)]. PMMA offers increased strength [(11)] and a stable color over the course of the couple of weeks that the final restoration is being fabricated. However, there is a greater exothermic temperature release as compared to PEMA material [(11, 14)]. The heat must be dissipated from the tooth structure to avoid possible pulpal or tissue damage. This can usually be accomplished by carefully removing the material and using a

cool water and air spray during the polymerization process. Both materials come in a multitude of shades, depending on the supplying manufacturer. These materials usually need to be relined prior to cementation to create a proper seal around the tooth. During the polymerization process a distortion of the materials will need to be adjusted in the patient's mouth. PMMA and PEMA materials both give off a distinct odor that patients and dental staff often notice. Yet, they both offer a cost-effective, adequate option for meeting the criteria of a proper provisional material.

Newer bis-acryl materials have helped to eliminate some of the challenges associated with traditional acrylic materials. Bowen developed bisphenol A glycidyl methacrylate (Bis-GMA) in the 1960s [(15)] a material that has been the backbone for most composite resins used today. This paved the way for bis-acryl materials, which are self-cured composites. Available in a wide variety of shades, including the more popular bleach shades, bis-acryls come in a convenient syringe applicator and have a low exothermic reaction,[(11,13)] decreased shrinkage,[4] and a less odorous smell. A disadvantage of bis-acryls is that they can break relatively easily when placed in areas of increased stress; however, since they are a composite-based material they are fairly easy to repair with either the same material, traditional composite or flowable materials [(16, 17)]. Bis-acryls also typically cost more than traditional acrylic materials [(17)].

Bis-acryl resins offer the advantage of improved aesthetics compared to methacrylates, yet they may not be suitable for multiple units when the pontic width exceeds 1 unit, as they are more brittle then the methacrylates.[11] A more recent provisional group introduced are the Bis-GMA resins. These offer the advantages of fracture resistance associated with meth-acrylates and the improved aesthetics associated with the Bis-acryls, [18]

The fabrication of bis-acryls typically is identical to their acrylic counterparts. A matrix is needed, into which the material is syringed and then placed on the tooth, removed, trimmed, and polished. There is less risk of pulpal damage with bis-acryls since these materials typically generate much less heat during the polymerization process [19]. Many of the problems associated with traditional acrylics have been eliminated with the bis-acryl materials, which are easy to use, flexible during insertion and removal, radiopaque, and color stable [20]. These materials are ideal for single-unit and some multiple-unit situations. The overall clinical situation of function and occlusion will dictate whether or not bis-acryl is the proper choice.

Preformed acrylic/metal crowns and self-cured bis-acryl materials have led to the evolution of light-cured composite resin preformed crowns for single-unit provisional applications, namely Protemp™ Crowns (3M ESPE). These crowns come in preformed molar, premolar, and canine shapes and can easily