

Review Article

A review of the role of etched cast restoration in the current context of digital advances in fixed prosthodontic treatment options

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ABSTRACT:

Implant supported restorations are conservative treatment options than convention fixed partial dentures (FPD) in which natural adjacent abutment teeth are required to be prepared to receive a retainer that retains and supports the missing tooth. Conservative designs in fixed partial denture that utilize the advantage of enamel etching, dentin bonding and retentive strength of resin cements provide variations in FPD designs. This review provides brief overview of etched cast restorations (ECRs) and various clinical and non clinical factors that form the basis of selecting such treatment options in a dental clinic. The various types of ECR are suitable for a particular situation the basis of which are primarily occlusal in nature. A brief review of current cements and cementation procedure has also been discussed.

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INTRODUCTION

Not until the time a dental patient asks the question that is it really necessary to cut the normal natural tooth, one realizes that conventional fixed partial denture treatment is a non conservative treatment option that sacrifices natural tooth structure for its existence. Dentists have faced difficulty in recommending the replacement of missing teeth due to this question. The prostheses' periodontal, occlusal, and aesthetic benefits have been considered alongside the impact on the abutment teeth. Various solutions for this problem have been tried through the year like inlay retainers, cantilever fixed partial denture, unilateral removable partial denture [1]. Etching of the mineralized enamel to improve retention of resin as first described by Buonocore (1955) [2], led to the development of conservative fixed partial denture treatment options that are designed to primarily meet the minimum requirement of restoration retention and stability [3]. The first person to describe the use of composite bonding resin to attach an acrylic resin pontic to an unprepared tooth was Ibsen [4]. A fixed prosthetic that uses resin is made up of one or more pontics that are supported by thin metal retainers

situated on the lingual and proximal surfaces of the abutment teeth [5]. Such types of fixed dental prosthesis have been generally called as etched cast restorations (ECR), with many individual types being named according to the founder of such prosthesis design. In contrast to conventional fixed prosthesis that depend on the geometric shape of a circumferential tooth preparation, these prosthesis are based on adhesive bonding between the etched enamel and the metal casting [2]. The resin is responsible for holding them in place, and it locks mechanically into the chemically etched enamel and microscopic undercuts in the casting. An etched cast restoration is traditionally referred to a prosthesis that has been luted to one of the tooth structures primarily enamel, which has been first etched to provided a form of mechanical mean of retaining such restoration [6]. While, the focus initially has been on enamel due to paucity of dental bonding systems, the current status has completely diversified and more emphasis is now on dentin bonding agents rather than mere acid etching.

HISTORICAL CONTEXT

The use of an acrylic resin denture tooth as a pontic was first published in 1973 [7]. In addition Ibsen [4] and Buonocore [8] have also described the use of the extracted tooth as a pontic. Buonocore described cutting a mesio-distal retentive groove in the lingual surface of an acrylic denture tooth and then roughening all the bonding surfaces of the pontic prior to treating these surfaces with methyl methacrylate [8]. In 1978, Jordan describe a technique in which he used autopolymerizing resins instead of ultraviolet light curing materials, and class III preparations were cut in to pontic crowns, rather than lingual retentive groove [9]. Successful composite resin pontic on partial fixed prosthesis were created that have been functional for more than five years. Others used acrylic resin pontics and prefabricated attachments to create pontics [3], [7]. Electrolytic etching saw the development of perforated retainers in 1973 [8], which were further refined to cause etching of metal and enamel. Proper enamel preparation for etched cast restorations plays significant roles in creating single insertion path, decrease less displacing forces and more importantly direct loading forces parallel to axial inclination of root, which transfer the pressure force into tension through the periodontal ligament fibers [3], [6], [10]. Correct framework design utilizes a large area for bonding and engages the proximal surface for sufficient resistance form, and it provides for optimum esthetics by minimizing visibility of the metal frame work.

TYPES

Broadly they are studied into either direct or indirect types [6]. The chairside designs are classified mainly according to pontic type employed in the design (acrylic denture tooth, composite resin tooth, avulsed natural tooth, self curing acrylic tooth) [11]. These pontics may be used conjunction with wire or wire-mesh strengtheners for increased retention [8]. The indirect types are further subdivided into two subtypes depending upon the type of framework which is either cast metal framework or acrylic framework with each having distinct advantages, disadvantages and clinical indications [6]. The cast metal framework can be either perforated (rochette bridge), electrolytically etched (maryland bridge), void containing surface framework (sand abraded surfaces) and mesh surface frameworks example Duralingual bonded bridge (unitek) and the Klett-O-Bond bridge (Renfert) [12], [13]. ECRs provide economic advantage to the patient especially in clinical situations where restorations are sought for temporary time periods while pursuing larger treatment goals. The clinical procedure of ECRs is usually painless as no anesthetic is required in any form (topical or infiltration). The rehabilitation procedure is highly conservative for both tooth structure (only enamel preparation) and periodontal health (supragingival margins) [14], [15]. Other less relevant but important advantages include the

possibility of rebonding [16], less technique sensitive impression procedures and less chair side time with no need of provisionalization of the prepared crown and least toxic in terms of material biocompatibility [17]. The chief disadvantage has been its longevity in term of clinical success which has drastically improved with the advent of bonding agents.

The preparation features for ECR's depend upon the location either in the anterior or in the posterior regions. Irrespective of the location, the preparation is limited to enamel thickness which becomes a limiting factor in indication of such prosthesis [7], [14]. In posterior areas, one must have sufficient enamel thickness to allow placement of occlusal rests which ideally are two in number for replacement of single missing tooth [15]. Two occlusal rests are also recommended for increased rigidity. The minimum thickness for the connector of an etched metal bridge is same as that for the connector used in the same position in a unit cast conventional bridge made from same alloy [18]. If there is an existing foundation (amalgam) restoration, all of the amalgam, or at least all of its surface, is removed so that the box form can be utilized [19]. If the retainer margins cross over an amalgam-enamel margin, there is high probability of leakage occurring around that margin. Placing rest seats of an acid-etched composite resin bonded casting framework on natural tooth structure produced minimal or no leakage [17]. Preparing the rest seat margin in amalgam produced moderate to gross leakage, with the leakage pattern beginning at the interface of the cementing resin and the amalgam. When an amalgam restoration exists in the tooth, it is advantageous to cover the restoration with the rest seat to minimize leakage patterns [20]. Different restorative materials like composite resin, depending upon the anterior or posterior resin will require individual modifications if and when a rest for ECR is placed on it. In anterior region, if the restoration is that of multishaded composite restoration, then the metal backing of the ECR will affect the translucency of the multishaded composite [21]. Similarly for bulk fill composites in the posterior region, different effects will be produced on strength and durability [22]. The preparations used on different teeth include those made for a maxillary or mandibular incisor, a canine, maxillary premolars and a mandibular second premolar, all of which have a proximal groove near the facio- proximal line angle adjacent to the edentulous space. There is second groove on opposite side of the cingulum or lingual cusp of the tooth, which creates a wraparound effect in the retainer and produces resistance in the process. Both grooves should be placed in enamel. The preparation for a mandibular first premolar is slightly different from that for other premolar preparations. Because the placement of a rest seat would leave very little solid tooth structure in the small lingual cusp of many first premolars, coverage of entire small lingual cusp is

substituted which should not interfere with occlusion and is an excellent means of increasing surface area and reinforcing the retainer [10]. The last preparation to be considered is that for the molar. Its preparation in either maxillary or mandibular arch is very similar to the preparation used on a premolar. The framework can be bolstered by capping the lingual cusps as described for premolars, which produces rigidity. Occlusal inlays can be attached to anatomic grooves, such as lingual or distolingual grooves [23]. Axial coverage can be extended through the proximal contact to connect with occlusal rests or inlays. Any extension of an occlusal groove can be used to good advantage in preventing the flexing of the ends of axial coverage, or a “wing”.

CEMENTATION

A lot of research focus has been on improving retentive abilities of cements especially resin based cements in the concluding decades. Resin cements are available in both chemical and light cure options which prevents compromises in retention strengths under metal or where light cannot reach [24]. The cements also have been supplied that are esthetically enhancers especially in terms of translucency [25]. Many cements are available with each cement having a particular advantage on each other. Other than resin there are other cements which are ionomer based and glass based and have high retentive strengths for either metallic or ceramic retentive wings. Initial high failure rate of ECR was mainly attributed to improper case selection and lack of appropriate preparation [26]. This was later improved by refined tooth preparation that included incorporation of grooves with/without pins that enhanced retention of the ECRs. However, the high retentive strength of resin based cements has also played a significant role in the long term success rates of ECRs [27]. Most clinical failures are generally due to those factors that affect the success rate of any fixed partial denture irrespective of whether one uses a metal ceramic or all ceramic [28]. Among them one of the most influential factor is the patients existing occlusion in both centric and especially during lateral movements. In certain clinical situations the ECRs are not indicated especially when a pier abutment is present [29]. It has also been reiterated that while preparing conventional fixed partial denture or more complex form of it, one should not rely on the retentive strength of the dental cements to retain the restoration, since it is bound to fail in such cases [30]. Different etching techniques (Electrochemical) of the metal have been shown to improve retentive strength of such restorations [31]. Electrochemical etching is however technique sensitive with overetching producing an electropolished surface, and contaminating surface that in turn reduces bond strength. Among other reasons for clinical failures, marginal discrepancy that is inherent to contraction or shrinkage of base metal alloys and lack of self cleansing proximal areas have

been implicated. To overcome such issues, patients receiving ECRs in any form are supposed to maintain a high level of oral hygiene using multiple hygiene maintenance aids [32].

CONCLUSION

This review provides a brief overview about factors that influence using ECR as treatment alternative to conventional fixed partial dentures. The review discusses the advantages and disadvantages of such restorations and in the light of advances in different fields, the current scenario of such restorations. It may be noted that such designs have been in less use since the advent of implants in replacing missing single teeth.

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