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Restoration of the periodontally treated tooth

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Abstract

Conservation of tooth structure while achieving a return to form and function with a lasting prosthetic restorative procedure are the goals of the restorative dentist. The approach taken with direct or indirect restorative procedures is aimed at the recapture of oral health and long - term stability, through the use of materials that will replace missing or damaged tooth structure without violation of biological tenets or compromise of mechanical principles. To overcome shortcomings and improve preparation marginal design, a subcategory has evolved that incorporates the use of a beveled margin. Such a bevel has great application with the heavy shoulder margin design. Most often the area in need of prosthetic therapy demonstrates loss of attachment apparatus, and the clinician is confronted with the tooth root anatomy, in addition to the coronal tooth structure. The furcations of multirooted teeth introduce a complexity to tooth preparation that is all too often missed or disregarded. Hence the preparation design is influenced by the unique anatomical features of each tooth type, the extensive periodontal therapy that has been performed, and the planned restoration.

Summary

The modern concepts of tooth preparation emphasis on conservation, and hence many of the G. V. Black

principles of cavity preparation have been put aside. Marginal areas that will be required to support porcelain need to have a design that permits the laboratory to fabricate a substructure with sufficient strength to prevent distortion in the fabrication of the restoration, flexure at delivery of the restoration, and destabilization of the porcelain at the porcelain metal interface. The use of the bevel as a subcategory in the shoulder or heavy chamfer design combines the positive aspects of these two major preparation design categories, resulting in aesthetics, increased retention, and ease of impressioning. Prosthetic preparation of tooth structure in a healthy environment with no history of disease requires knowledge of the restorative materials chosen, as well as the marginal geometry necessary to achieve the restorative endpoint. Unfortunately, this is frequently not the environment the clinician faces. Most often the area in need of prosthetic therapy demonstrates loss of attachment apparatus, and the clinician is confronted with the tooth root anatomy, in addition to the coronal tooth structure. The furcations of multirooted teeth introduce a complexity to tooth preparation that is all too often missed or disregarded. The naturally occurring undercut, or “furcation roof” of a multirooted tooth that has suffered attachment loss and exposure of the furcation must be considered and treated in the preparation of these teeth. A molar with multiple roots, around which attachment and bone loss have not occurred, permits a straightforward approach to the preparation of the tooth. Reduction that is uniform, appropriate, and anatomically directed, with marginal geometry suitable for the projected restorative goal, is indicated. Preparation design is influenced by the unique anatomical features of each tooth type, the extensive periodontal therapy that has been performed, and the planned restoration.

Keywords: Periodontally treated teeth, tooth preparation, Bevel, Marginal geometry.

Introduction

The modern concepts of tooth preparation emphasis on conservation, and hence many of the G. V. Black principles of cavity preparation have been put aside.[1] Improvements in dental materials and evidence - based procedures have shown minimally invasive treatments to be meritorious. It is a well - accepted concept that naturally occurring tooth structure is superior to its artificial substitutes. Therefore, tooth preparation decisions are made that tend to preserve tooth structure, protect vital pulpal structures, avoid violation of the periodontium, and reestablish healthy contacts with the neighboring teeth. When preparing a tooth, marginal placement angulates from the buccal in an occlusal direction through the interdental spaces, and terminates on the lingual aspect of the tooth. Creating a continuously flat surface in a 360 - degree tooth bound space requires a certain level of skill. Another drawback to the shoulder design is the difficulty in capturing it in an impression. In circumstances where there is little space between the marginal tissue and the finished margin, marginal material tears and inaccuracies within the impression may occur. The resultant dies will reflect these inaccuracies. Because there is a flush right angle fit of restorative material to tooth surface, any distortions will result in an open margin or a failure of the restoration to seal. Considering the context of the distortions inherent in impression materials, die fabrication materials, and restorative materials, this concern is a considerable impediment to overcome. To overcome these shortcomings and improve preparation marginal design, a subcategory has evolved that incorporates the use of a beveled margin. Such a bevel has great application with the heavy shoulder margin design. Hence this review article will elllaborate on the

preparatory steps of managing a periodontally treated tooth to receive a restoration.

Beveled Margins – A new light shed

Marginal areas that will be required to support porcelain need to have a design that permits the laboratory to fabricate a substructure with sufficient strength to prevent distortion in the fabrication of the restoration, flexure at delivery of the restoration, and destabilization of the porcelain at the porcelain metal interface. The use of the bevel as a subcategory in the shoulder or heavy chamfer design combines the positive aspects of these two major preparation design categories, resulting in aesthetics, increased retention, and ease of impressioning. The best solution to aesthetic margin placement is the use of metal at the tooth restoration interface, due to the accuracy of the casting and design of the metal at the margin to support the porcelain. The margin design of choice has traditionally been a heavy chamfer, which provides for the required thickness of material at the margin for stability of the restoration's margin, and porcelain placement with an improved tooth restoration gap over the all - porcelain margin. This design also has a rounded axial gingival contour, which is more favorable to the placement and support of porcelain. Due to the semicircular nature of the margin design, the fit is optimized and marginal gap is minimized by concept of inclined planes. The shoulder design will allow for adequate marginal dimensions to place metal and porcelain, or all porcelain, margins. However, because the final marginal design is at right angles to the long axis of the tooth, the fit of such a margin is often less accurate than desired, resulting in an unacceptable margin gap. To overcome this drawback of the shoulder design, and improve the fit of the restoration, a bevel is placed 0.5 mm into the sulcus. The aesthetics of the porcelain at the margin, coupled with the fit of a beveled margin hidden in the sulcus, has proven to be a successful solution to this quandary. Such a bevel has also been applied to the heavy chamfer margin design taking advantage of the curved internal angles of the preparation, which favor the placement and support of porcelain, and the aesthetics achieved by hiding the margin in the sulcus.

Uses of Bevel Margins

The use of a bevel adds to the retentive nature of the preparation. In areas where dislodging stresses require compensatory resistance to dislodgment, the use of a bevel adds extra resistance form. These two designs that employ a bevel offer the added advantage of opening the sulcus for the placement of impression materials. When making an impression in the case of a heavy chamfer or shoulder preparation, the gap between the sulcus and the prepared margin is narrow. Even when the soft tissues are retracted, the tissues will rebound, resulting in a thin deposit of impression material at that critical junction. The resultant impression may tear at the tooth margin gingival interface because this area could not receive sufficient impression material bulk. A bevel opens this environment and allows the sulcus to receive impression material in sufficient quantity to avoid tearing and to provide more accurate detail. A literature review conducted in 2001 "suggested that margin design selection should be based on the type of crown, applicable aesthetic requirements, ease of formation and operator's experience. The expectation of enhanced fit based on a particular marginal geometry was not validated".[2]

It is critically important to have the flexibility of using various margin designs in the preparation of a tooth, as a particular tooth may require several different marginal geometries to achieve an optimal result. An example is the maxillary first premolar. The anatomy of this tooth does not lend itself to a 360 - degree aggressive, aesthetic preparation, be it a shoulder or a heavy chamfer. There may be sufficient tooth structure to permit a shoulder or

heavy chamfer preparation on the facial aspect of the tooth. However, the mesial root groove/ furcation, and the resultant thin tooth structure in this area, require a less aggressive preparation to fulfill the principles of conservation of tooth structure and protection of the pulpal tissues. Additionally, it is unnecessary to aggressively prepare the distal, proximal, or lingual areas of the maxillary first premolar, as they are often not in the aesthetic zone and can therefore be prepared with a much gentler and less aggressive marginal geometry. By utilizing knowledge of the various marginal geometries, and coupling that knowledge with the necessary skills to execute the various marginal designs, the clinician might select the use of a heavy chamfer for the mesiobuccal aspect of the maxillary first premolar, taper to a chamfer preparation that would be carried distally into the distal interproximal space and on to the lingual tooth structure, and culminate in a feather preparation through the mesial interproximal area and the furcation area where the tooth structure is thin in an axial direction. The margin would then terminate at the buccal inset of the heavy buccal chamfer. The use of a chamfer at the distal, interproximal, and lingual surfaces of the tooth takes advantage of a marginal design that is less invasive and preserves tooth structure, while allowing for aesthetics where the demand is not as great as the mesiobuccal aspect of the tooth.[3]

Marginal Geometry

Finally, the most demanding anatomical area of the tooth can be prepared with a marginal geometry that avoids undercuts, is minimally invasive, allows preparation into the furcation, avoids leaving tooth lips, and provides for a flat, healthier emergence profile. Consideration of margin designs is not complete without a discussion of all ceramic restorations. The early all ceramic restorations presented with significant shortcomings, as they required exacting marginal geometry and accurate impressions to capture that preparation. Failure to adhere to the preparation guidelines for a ceramic restoration led to fracture of the restoration. The risk for failure limited the use of ceramic restoration to the anterior zone, where the stresses of occlusion were less and the demands of the preparation were easier to accomplish. The reward was generally a more aesthetically pleasing restoration. The presence of a large margin gap required the use of cements that were aesthetic, non – water soluble, strong, and did not expand over time. Resin cements were championed as an answer to the marginal weakness of the all - ceramic restoration. Newer ceramics are stronger. In addition, the use of milling or pressing technologies with ceramic materials has improved the accuracy of the fit, lowered the marginal gap size, and reduced the need for aggressive tooth preparation. Fortified ceramics such as zirconium and lava have the strength of metal and can be used in areas where preparations are minimal. The recommended marginal reduction is now in the range of 1.25 mm, which represents a 60% less aggressive preparation than the 2 mm or better of tooth reduction required for ceramometal restorations. Load - bearing areas require 1.50 mm to 2.00 mm of reduction for a ceramic crown, which is the same requirement called for with ceramometal restorations. [4]

Periodontal Ramifications And Prosthetic Adaptations

Prosthetic preparation of tooth structure in a healthy environment with no history of disease requires knowledge of the restorative materials chosen, as well as the marginal geometry necessary to achieve the restorative endpoint. Unfortunately, this is frequently not the environment the clinician faces. Most often the area in need of prosthetic therapy demonstrates loss of attachment apparatus, and the clinician is confronted with the tooth root anatomy, in addition to the coronal tooth structure. The furcations of multirooted teeth introduce a complexity to tooth preparation that is all too often missed or

disregarded. The naturally occurring undercut, or "furcation roof" of a multirooted tooth that has suffered attachment loss and exposure of the furcation must be considered and treated in the preparation of these teeth. A molar with multiple roots, around which attachment and bone loss have not occurred, permits a straightforward approach to the preparation of the tooth. Reduction that is uniform, appropriate, and anatomically directed, with marginal geometry suitable for the projected restorative goal, is indicated.[5] However, when the milieu requires a preparation that includes the area below the cementoenamel junction (CEJ) and involves the root system, the restorative dentist must have a keen understanding of the anatomy of the tooth and the restorative options available to fit the particular circumstances. When the furcation in question is periodontally involved, a restorative form must be employed in these instances, which will be conducive to the health of the area and will not trap plaque or impede a patient ' s ability to maintain the area. The ability to anticipate the restorative complexities that may be encountered is grounded in an understanding of molar root anatomy. The mesiobuccal and distobuccal roots are biconcave and have a distal curvature of varying degree towards the distal. Second and third maxillary molars root configurations are more likely to have fused roots than first molars. The location of the distal furcation is more apical than that of the mesial furcation. [6]

Furcation involved molars

Treatment of a maxillary molar with furcation involvement is realistic and predictable, provided that the prepared tooth configuration is in an easily cleansable area and is manageable for the patient. The mandibular molar generally is found with two roots, the mesial root and the distal root. The mesial root has a flattened appearance buccolingually with a concave proximal surface on each side of the root. This root generally curves distally. The distal root is more robust than the mesial root, being wider buccolingually, and usually has a proximal concavity only on the mesial aspect of the root. The proximal concavities found on the mesial and distal roots create an osseous chamber in the area where the roots divide from the crown. This area is wider mesiodistally than either the lingual or buccal furcation openings and poses a potential restorative problem when it is exposed following attachment loss. If this area is left intact, it cannot be restored predictably. In addition, achieving an acceptable flat emergence profile that is not plaque retentive and is cleansable is difficult or impossible in this scenario, because of the anatomy of the interradicular space. A maxillary or mandibular molar with a Class I furcation will require a marginal crown preparation that includes the furcation, or that is far enough coronal to the furcation as to not be involved in its anatomy. As the root trunk of a tooth emerges from the coronal structure of the molar, at the point of defi nition of the root into a mesial and distal root system for mandibular molars, or a mesial buccal, distal buccal, and palatal root system for maxillary molars, there is an anatomical concavity that develops and increases in an apical direction until there is separation of the individual roots. As a result, the natural protective curvatures of the tooth are no longer effective at directing food away from the cervical areas of the tooth once recession has exposed the root trunk area of the molar. Additionally, the naturally occurring undercut of the root trunk area is plaque retentive. Therefore, the prosthetic crown contours must be adapted to reestablish a form that will provide protection from insult and minimize plaque retention. A treated Class I furcation involvement is managed by increasing the axial coronal preparation in the area coronal to the reshaped furcation region, permitting the fabrication of a crown with a flat emergence profile

coronally to ensure that there is no undercut to trap food or plaque. Molars are not the only teeth with furcations or root anatomies that must be taken into consideration when full coverage restoration is anticipated. When restoring multirooted bicuspids, the principles remain the same. The objective is to create a sealed marginal area and a crown profile that are conducive to maintenance and lack plaque retentive areas.[7]

Conclusion

When faced with deeper furcation involvements, the restorative dentist, periodontist, and endodontist may elect to reconfigure the anatomy of the tooth by removal of a root, to eliminate the furcation. Following maxillary molar root resection, the marginal preparation must be minimal, as it occurs on root structure, and the tooth root dimensions will not allow aggressive preparations. The area where the root was removed must be prepared in a fashion that allows for a flat emergence profile and manageable surfaces that can be kept plaque free. Following mandibular molar root resection, the preparation of the remaining root structure must utilize a preparation geometry that minimizes the depth of the margin placement and eliminates root concavities to create flat emergence profiles, which are easy to maintain. In such a situation, a feather margin preparation is indicated. Preparation design is influenced by the unique anatomical features of each tooth type, the extensive periodontal therapy that has been performed, and the planned restoration.

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