The Journal of Indian Prosthodontic Society is indexed/listed with DOAJ, Health and Wellness Research Center, Health Reference Center Academic, InfoTrac One File, Expanded Academic ASAP, ProQuest Databases, Genamics JournalSeek, and Ulrich's International Periodical Directory.

The journal is official publication of the Indian Prosthodontic Society, and issues are published quarterly in the last week of March, June, September and December.

The Journal is printed on acid free paper.

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Published by
Medknow Publications,
A-109, Kanara Business Centre,
Off Link Road, Ghatkopar (E),
Mumbai - 400075, India.
Tel: 91-22-6649 1818/1816,
E-mail: publishing@medknow.com
Website: www.medknow.com

Websites
www.jprosthodont.com
www.journalonweb.com/jips

The Journal of Indian Prosthodontic Society

Official Publication of Indian Prosthodontic Society
ISSN 0972-4052

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The Journal of Indian Prosthodontic Society

July-September 2007 - Vol 7 - Issue 3

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Review Article

Clinical tips in full veneer tooth preparation

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Tooth preparation in fixed prosthodontics represents the equilibrium between the conservation of the tooth structure and pulp health, whilst achieving an esthetic and strong crown. A well planned approach coupled with the understanding of pertinent theories underlying each step is critical for a successful tooth preparation. The reduction of the tooth structure must be preceded by a mental image of the design of the artificial crown and the anticipated occlusion. This paper discusses certain important clinical tips in the procedures used for full veneer tooth preparation.

Key words: Clinical tips, full veneer, tooth preparation

Tooth preparations in fixed prosthodontics represent a balance between the conservation of the tooth structure and pulp health, whilst achieving an esthetic and strong crown. It is the single most important aspect of restorative dentistry because it establishes the foundation for whatever restoration is being placed. A well organized approach coupled with the understanding of pertinent theories underlying each step is crucial for a successful tooth preparation. Procedures in full veneer tooth preparation can be executed easily and efficiently by following certain important clinical tips.

BURS

Burs are the main armamentarium in tooth preparation. Burs are available in different shapes, grit sizes and diameter. The self-limiting instrument differs from the conventional one in that it has a smooth end or edge that can be pressed against the gingiva. It has certain advantages such as the prevention of excessive reduction of tooth, obtaining a smooth margin and the reduction of trauma to the gingiva. It is less technique sensitive. Its usage depends upon tactile sense more than visual perception; therefore, it can be used for the distal surface of the molars, which is difficult to prepare by vision.[1]

The disposable (single-use) diamond burs are available only in a limited range of shapes and grit sizes, but their clinical use has increased over the recent years. These burs may cut up to three teeth preparations before adversely affecting the leakage behavior.[2]

Before the initial use, burs should be checked for concentricity, which is determined by viewing the rotary instrument in profile, while it is being rotated at the maximum recommended speed. A non concentric instrument produces a "whipping" action, which is observed as a blurred image at the tip of the instrument.

The non centric appearance of the bur may be due to the non concentric bur itself or a defective hand piece. This can be differentiated by the fact that a defective hand piece will run all the burs in a non concentric manner.

Non concentric bur causes major preparation irregularities and also pulpal damage.

Burs of known diameter should be used because the reduction of tooth structure is dependent on the size of the cutting instrument. Finishing burs should have a finer grit and a larger diameter than the corresponding cutting bur.[3]

PATIENT AND OPERATOR POSITIONS[4-6]

The primary objective of the operator in positioning himself and the patient is to have maximum access and an unobstructed view of the operating field. The ideal position for the operator is the one in which he is seated well back on the chair with his feet flat on the floor, legs relaxed and relatively together and thighs slightly sloped to the floor. The back is straight and supported by the backrest. The head and neck are slightly bent toward the patient so that the eyes are directed downward [Figure 1]. Patient should be positioned in such a way that his mouth is in the same horizontal plane as the elbows of the dentist when his arms are comfortably dropped at the sides. Sixteen to eighteen inches is regarded as the optimal

eye-to-work distance.

MANDIBULAR RIGHT QUADRANT

When working in the mandibular right quadrant, the chair should be positioned with its back lowered to about 45 degrees to the horizontal. The operator is seated in the 7-9 o'clock position facing the back of the chair with legs relatively together and knees angled in behind the chair. At times, the added height of the operator provides a better view of the quadrant with a more favorable eye-to-work distance and also allows the elbows to be in a more relaxed position. Having the head of the patient turned to some extent towards the operator permits a better vision of the quadrant without leaning forward.

MANDIBULAR LEFT QUADRANT

The patient is seated with the chair usually set as low as possible. The back is set at about 25 degrees above the horizontal. The patients head is turned towards the operator, who is seated at approximately 10-11 o'clock position. The head of the patient may be tilted slightly back to increase the visibility.

MANDIBULAR ANTERIORS

Good visibility and access to the labial surface of the mandibular incisors is obtainable from the position for the mandibular right quadrant. The lingual surfaces may be viewed by the use of a mirror. An alternative approach to the lingual surfaces is from the 10 or 11 o'clock position with the chair tilted and its back positioned as for the mandibular left quadrant.

MAXILLARY ARCH

The patient is seated and the back lowered to about 10 degrees above the horizontal. The chair is sufficiently raised for the operator to position his legs under the back. A completely tilted chair position with the back fully reclined to about -10 degrees is uncomfortable for the patient and not essential for the visibility if the mirror is used. The completely tilted position should not be used routinely. The head of the patient can be moderately tilted back. The operator is seated at the 11-12 o'clock position. The operators back and neck should be relaxed and relatively straight with the elbows down in a relaxed position.

POSITION FOR LOCAL ANESTHESIA

Infiltrations in the maxillary arch may be given with the patient in the usual operating position. The inferior alveolar block is a more difficult procedure. For the mandibular right quadrant, the patient should be in the recommended position, but if the access is difficult, the operator may opt for a standing position. The mandibular left quadrant is usually more easily approached from the seated position.

AIDS FOR BETTER VISIBILITY[4,5]

Achieving an optimal tooth preparation requires a good visual access.

Visibility may be impaired by the mirror splatter from the air water coolant. The application of a wetting agent to the mirror surface or warm air jet may assist in improved visual access.

Fiber optic hand piece lights can be used. Fiber optic technology involves the transmission of light through long, thin fibers of glass or transparent material. The light travels, non electrically, through the fiber by reflecting from wall to wall without transmitting or generating heat. This renders fiber optics completely safe for use in the oral cavity. Most fiber optic systems are activated by touch or an air electric switch. Many systems also have an intensity control that permits the adjustment of the light intensity to suit individual preferences and requirements.

Use of a large mirror facilitates the prepared tooth and other abutment teeth to be viewed effectively and simultaneously. While viewing the undercut in the mirror, only one eye should be used. When both the eyes are used, a slight amount of occlusal divergence can remain visually undetected.

HAND AND FINGER RESTS[4,5]

Proper tooth reduction requires the complete control of all rotary instruments. Ultra speed tissue removal should be carried out with adequate finger rests. A good grasp should be maintained on the handpiece while the hand rests firmly on other teeth in the arch. Further, the use of both hands for guiding the handpiece provides the maximum control of the cutting instrument. The bur action should be moved with a planning or wiping motion. The finger rests should be shifted as required to prevent the disfigurement of the finish lines.

SPEED OF REDUCTION[4,5,7]

Accelerated tooth-structure removal with ultra speed does have its own pitfalls. Certain precautions have to be taken. The refraining of tactile sense occurs, unlike in the case of slow-speed hand pieces; this may result in damage to the tissue. When operating in areas of low visibility like the distal surfaces of the molars, low speed should be preferably used. Considerable heat is generated by the friction between a rotary

instrument and the surface being prepared. Therefore, reduction should be performed intermittently in a steady controlled manner. By reducing the tooth for 5-10 s and then removing the instrument from the surface for a few seconds is helpful for avoiding excessive heat build up. Even with the lightest touch, the tooth will get overheated unless a water spray is used. This must be accurately directed to the area of contact between tooth and bur. The air water coolant in sufficient volume not only cools and cleans but also lubricates the rotary cutting instrument. The coolant is most effective at a temperature of 32°C. The retention features like grooves and pinholes should be prepared at low rotational speeds because the coolant cannot reach the cutting edge of the bur.

TOOTH PREPARATION[8,9]

During tooth preparation it is useful to learn to use the hand piece as both the measuring and cutting instrument. This is done by concentrating on the top surface of the head of hand piece, which is perpendicular to the shank of the bur and by using burs of known dimensions [Figure 2]. If the top surface is kept parallel to the occlusal surface of the tooth being prepared, the bur will automatically attain the correct orientation. The mandible in the posterior region is at an angle of 30 degrees lingually, thereby imparting an angulation to the molars. To avoid the excessive reduction of the lingual surface, the preparation must be parallel to the long axis of the tooth. This is effectively achieved by supporting the handpiece with a finger of the opposite hand.

OCCLUSAL PREPARATION[5,7-9]

Guiding grooves placed occlusally aid in accurate reduction. Burs of known diameter should be used to achieve accurate occlusal reduction. A 1.0 or 1.5 enamel chisel depending on the depth of the desired reduction can be used to precisely determine the depth of the groove. A 1-mm ball burnisher can also be used to check the occlusal clearance.

The occlusal surface is completed in two steps: half of the occlusal surface is completed first so that it can be used as a reference.

The incline of functional bevel should be made with reference to the opposing tooth [Figure 3]. It should be parallel to cuspal inclines of the opposing tooth.

The occlusal surface should be prepared first followed by proximal preparation, particularly in the posterior teeth. This facilitates a better visual access to the distal walls of the tooth and also the use of shorter axial instruments.

The posterior occlusal reduction should be scooped out buccolingually. This feature would maximize the surface area for cement bonding and also prevent the rotation of the crown. Moreover, it would ensure adequate occlusal thickness without sacrificing the axial-wall height or restricting the ceramic groove carving.

PROXIMAL PREPARATION[8,9,11]

During proximal reduction, one should observe the adjacent tooth rather than the tooth being cut to avoid any damage.

The adjacent teeth can also be protected with a matrix material like to fflemire or T band.

The proximal areas from both the sides are cut until only a few millimeters of inter-proximal island remains. Further, this area can be removed and the contact can be broken.

The proximal surface can also be reduced using bull's horns technique, *i.e.*, leaving thin enamel ledges proximally to protect the adjacent teeth and then breaking them by wedging a straight probe.

The bur should always be used in a sliding motion from the proximal area to buccal or lingual and not vice versa, as this can cause the side of the tip of the diamond point to come in contact with the gingival tissue, thereby inducing bleeding.

BUCCAL AND LINGUAL REDUCTION[8,9]

Bur should be parallel to the long axis of the tooth and not to the buccal surface.

When placing the grooves, reduction should be kept to a minimum at the tip of the diamond.

In order to prevent over reduction, pencil lines can be drawn into the prepared enamel guide cuts [Figure 4]. The reduction is completed immediately after the pencil lines are removed by the action of the reduction bur.

In the mandibular posterior teeth, if the lingual surface is the first axial surface to be prepared, it reduces the likelihood of producing an over-tapered preparation, particularly if the bur is held parallel to the long axis of the tooth. Subsequent alignments to the prepared lingual wall are then carried out on the buccal surfaces. In contrast, for the maxillary teeth, the buccal surface should be prepared first.

FINISH LINES[8,10-12]

The chamfer should not be wider than half the bur used to form it. Otherwise, a lip of unsupported enamel will be left that is more susceptible to fracture during cementation and this leaves an open margin. The contour of the gingival in the mesial and distal areas should be followed. The margins of the preparation should not be straight across but occlusally higher in

Figure 1: Ideal working position of the dentist

Figure 4: Pencil lines drawn in the depth cuts

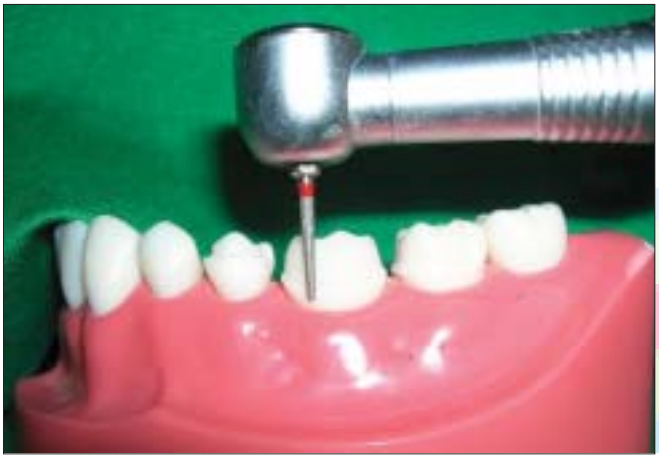

Figure 2: Top surface of the head of the handpiece parallel to the occlusal surface of the tooth

Figure 5: Occlusal wells to increase the retention of short coronal crown

Figure 3: Functional bevel parallel to cuspal inclines of opposing tooth

Figure 6: An occlusal view of the cast allows a clear visualization of convergence of single or multiple teeth

these areas because of the bone morphology and the attachment of soft tissues.

For subgingival preparation a line can be drawn with a sharpened pencil at the present location of the gingival cavosurface margin. This is because when retraction cord is placed, the gingiva is not only retracted labially but also gingivally.

A gingival guard can be used for the protection of the gingival tissues when subgingival margins are prepared.

TOOTH MODIFICATION IN SPECIAL SITUATIONS

Increasing the resistance and retention form of a short coronal tooth prepared for full veneer crown[13]

After finishing the conventional tooth preparation, an occlusal well is prepared using a number 6 round bur [Figure 5].

Width - 1.5 to 2 mm
Depth - 2.5 to 3 mm
Shape - ovoid

To prepare a knife-edged finishing line on the elongated teeth; a full shoulder preparation at the cementoenamel junction is first performed to ensure the removal of the adequate tooth structure. Further, a bevel or knife-edged finish line to the desired gingival margin is prepared.[10]

FINISHING[5,14-18]

A bur of larger diameter and finer grit should be used to smoothen out any ripples that may have been created.

The gingival surface should be finished with a bur with a roughness index of less than 20 microns because the burs with a higher roughness index impart roughness to this margin, which gets transferred to the impression, die and subsequently to the casting. Diamond burs are not recommended for finishing margins. Even the super-fine burs create a rough finish. The surface roughness produced by them is directly proportional to the grit grains of the bur. Tungsten carbide burs prove to be better in finishing, giving a smoother margin. A tungsten carbide finishing bur (20,000 rpm) produces the ideal surface smoothness.

Hand-planed margins show less cement-film thickness, better adaptability and a greater control of the angulation of the gingival floor.

Air spray and intermittent cutting is beneficial. Attention should be paid to the line angles in the preparation. These should not be made scalloped.

The final completion of the surface of a tooth prepared should be done with a medium grained diamond point which fulfills the ideal requirement of 20 microns roughness, which provides sufficient retention for the cemented restoration.

CHECKING FOR UNDERCUTS[19,20]

A wax strip with parallel lines can be placed intraorally along the side of the teeth that are prepared and can be a good visual guide in checking the under cuts. A strip of baseplate wax that is approximately 15 mm long and 8 mm wide is cut. The wax strip is laid on the buccal aspect of the diagnostic cast apical to the free marginal gingiva. The lines should be at the approximate place on the tooth to be prepared at which the mesial and distal walls will be reduced.

An easy method to check undercuts is by evaluating the cast. An irreversible hydrocolloid impression is made using a perforated tray after the gross tooth reduction; it is poured into a fast setting stone. The lead of a pencil, which is similar to the analyzing rod of the surveyor, is placed parallel to the axial wall of the prepared tooth. Two lines are drawn that encompass the entire circumference of the prepared tooth. The first one must be coincident with the junction between the axial wall and the cervical margin. The other one must correspond to junction between axial reduction and external cusp reduction [Figure 6].

An occlusal view of the cast allows a clear visualization of convergence of single or multiple teeth. Undercuts can be detected.

ERRORS IN TOOTH PREPARATION[3]

The most common deficiencies in the posterior preparation are:

1. Axial reduction ignoring the cervical circumferential morphology of the tooth;
2. Insufficient axial reduction;
3. Insufficient reduction at the occlusal third, buccally and lingually;
4. Inadequate reduction at the central portion of the occlusal surface;
5. Occlusal reduction ignoring the general morphology of the occlusal pattern;
6. Sharp edges and angles on the finished preparation.

The most frequent error of axial reduction is the inadequate reduction in the area of transitional line angles. This results in the restoration with insufficient gingival embrasure space to accommodate the gingival papilla and restricts proper oral hygiene, which leads to poor periodontal health.

The proximal surface of posterior teeth is always flat or slightly concave buccolingually and occlusocervically. For practical hygienic reasons, a flat surface is preferred for the ease in using a dental floss. However, in an excessively conservative preparation, it is impossible

to restore this contour without jeopardizing the health of the gingival papillae.

Inadequate reduction of the central portion of the occlusal surface is also one of the common mistakes. Sufficient occlusal reduction allows the reproduction of proper occlusal anatomy, restores function and the distribution of stress equally.

The amount of occlusal reduction varies between 1 and 2 mm, depending on the following parameters:

1. The length of the tooth;
2. The size and the configuration of the pulp chamber;
3. The quality of the masticatory muscles (or occlusal forces);
4. The type of material used;

The common errors in posterior teeth preparations lead to the following:

1. Harmful periodontal effect due to over sizing or over contouring of the artificial crown.
2. Unaesthetic results in the crown caused by disclosing the opaque layer.
3. Improper occlusal relationship if proper canting is not provided.

CONCLUSION

A disciplined tooth preparation can determine the success of fixed prosthodontic treatment. It should repair, restore and modify the components of a dentition to enhance function, esthetics and the health of the hard and soft tissues.

Reduction of the tooth structure must be preceded by a mental image of the design of the artificial crown and the anticipated occlusion. In addition to mathematical principles limited to tooth preparation, the operator must consider the importance of burs, the position of the patient and his own position, hand and finger rests and the speed of reduction in order to achieve a sound tooth preparation.

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Source of Support: Nil, **Conflict of Interest:** None declared.