

## SELECTION OF BURS FOR FINISH LINE CROWN PREPARATION

Mohiddin R. Dimashkieh, DDS, MSc\*

لقد اعتاد أطباء الأسنان في الماضي أن يحضروا خط الانتهاء للتيجان الاصطناعية تحت خط اللثة في الميزاب اللثوي بغض النظر فيما إذا كانت الحالة السريرية تستدعي هذا الاجراء أم لا وقد رفض هذا المبدأ التقليدي السابق لأن اللثة من أكثر النسيج الداعمة تأثراً بالرضين أثناء التحضير ويمكن للرض أن يحدث التهاباً وتراجعاً لثوياً وكلما كان امتداد التحضير عميقاً في الميزاب اللثوي كلما كان الضرر على اللثة أكبر. وإن مكان خط الانتهاء له تأثير مباشر على انطباق التاج وعلى سهولة فحص وتقويم خط الانتهاء بالعين أو بالمسبر.

إن خط الانتهاء الذي يعطي زاوية حادة للذهب يدعى خط انهاء بشكل حد السكين. وتحضير خط انهاء بشكل حد السكين شاق وصعب التحديد أثناء تحضير السن لذلك فإن خط الانتهاء بشكل حد السكين ليس الشكل المفضل ويجب تجنبه ما أمكن واستعماله فقط في حالات سريرية خاصة.

إن خط الانتهاء بشكل كتف ليس بخط الانتهاء الشائع ولا يفضل استعماله في التيجان المصبوبة. إذ يصعب تحضيره على الأسنان الخلفية ويجب تجنبه لأنه يؤدي إلى زيادة الجهد على الأسمت اللصق، ويستدعي إزالة كمية كبيرة من النسيج السنية دون الحاجة لذلك ويؤدي إلى صعوبة في الحصول على انطباق حفاقي جيد، إلا إذا عدل بإضافة شطب على حواف الكتف، والكتف المشطوب يؤدي إلى إزالة الكثير من النسيج السنية السليمة. لذلك يجب الاهتمام بنوعية خط الانتهاء المختار بحيث يؤمن حواف ذهبية دقيقة مع سبائك كافية من المعدن.

الكثير من أطباء الأسنان يؤمنون بأن خط الانتهاء المثالي للتيجان المعدنية المصبوبة هو خط الانتهاء شبه الكتف.

شبه الكتف هو تصميم متعدد الاستعمال لأن شبه الكتف الفضل (٣, ٠) ملم (القليل العمق) هو أكثر عمقاً بقليل من حد السكين ويعد مثالياً للحواف المعدنية. وشبه الكتف العميق يعتبر كافياً ومناسباً للتيجان الخزفية المعدنية. شبه الكتف (٨, ٠) ملم يمكن تحضيره باستعمال سنابل ماسية مخروطية الشكل ذات نهاية دائرية بينما يتم تحضير الكتف باستعمال سنابل ماسية مخروطية ذات نهاية مسطحة ولعمق ٠,٨ إلى ١ مم. على طبيب الأسنان أن يحدد شكل خط الانتهاء أثناء تحضير السن. إن الطريقة الشائعة في السيطرة على تحديد مقدار قطع النسيج السنية لتحضير شبه كتف هو استعمال سنبل ماسية مخروطية ذات نهاية دائرية. يجب أن لا يتجاوز عمق شبه الكتف منتصف عرض رأس السنبل المخروطية ذات النهاية الدائرية، وإلا فإنه يمكن إحداث شفة مينالية غير مدعومة. وإن دقة خط الانتهاء تعتمد على استعمال سنابل ماسية بمواصفات عالية وقبضة ذات دوران مركزي وفحص متكرر أثناء التحضير للتأكد من أن نصف رأس السنبل خارج حدود السن المحضر. وإن القياس الدقيق لعرض وشكل خط الانتهاء المحضر حول سطح السن بالكامل أمر شاق وصعب ولكن مرغوب به واستعمال السنابل التقليدية

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\* Professor and Chairman, Department of Restorative Dental Sciences, and Head, Division of Fixed Prosthodontics, King Saud University College of Oenfetry, P.O. Box 60169, Riyadh 11545, Saudi Arabia

السابقة الذكر لا يؤمن الدقة المطلوبة في تحديد خط الانتهاء لذلك فإن استعمال السنبله المعدلة والمصممة من قبل محيي الدين رضا دمشقية (م.د.د.) والتي تحتوي على نهاية ملساء يمكنها تحدد بسهولة عمق التحضير ومقدار القطع وشكله وتساعد على توفير النسج مع اعطاء خط الانتهاء المرغوب به بدقة ومن ميزات هذه السنبله الجديدة أيضاً انها لا يمكن أن تسمح لطبيب الأسنان أن يحدث منطقة تثبيت لثوية معها أخطأ الطبيب بطريقة وأسلوب استعمالها أثناء تحضير تاج السن.

The dentist must determine the gingival location and configuration of finish line during tooth preparation. Rotary instruments are selected to prepare teeth and to develop a well-defined smooth and uniform finish line. Subgingival finish lines damage and traumatize gingival tissues due to the contact with rotary or dental instruments used during preparation. Crown tooth junction enhance plaque accumulation and its harmful effect on the periodontium. Subgingival crown margins are difficult to clean, and the relation between gingival tissue and restoration can never be the same as with natural tooth. Supragingival margins that are fully exposed to cleaning action are easier to prepare and biologically acceptable. The efficacy of conventional diamond cutting instruments when used with high or low speed handpieces as compared to the Mohiddin R. Dimashkieh (MRD) rotary cutting instruments are reviewed. Conventional instruments may produce inaccurate finish lines or may remove more tooth structure than required and traumatize the gingival tissue due to doubtful running handpiece and operator's ill judgement that half of the diameter of the conventional bur is outside the contour of the tooth during preparation. On the other hand the use of MRD instruments, designed by the author, with its depth stop tip and safe end will ensure that only half of the instrument will be embedded in the tooth, giving control of adequate and uniform tooth reduction and gingival safety.

### Introduction

Some dentists formerly prepared the finish lines for artificial crowns as subgingivally as possible despite clinical conditions. This traditional concept is universally rejected<sup>1,2</sup> because gingival tissues can easily be injured during subgingival tooth preparation, causing gingival recession.<sup>3</sup>

The purpose of this article is to highlight the role of rotary instruments used to prepare and determine the location and configuration of the different types of finish line, to emphasize the harmful effect of subgingival finish line, and to point out the benefits of the chamfer finish line.

The epithelial attachment is the most vulnerable of the supporting structures, and procedural trauma can be initiated during tooth preparation. The deeper the subgingival extension of the tooth preparation, the greater the potential of insult to the epithelial attachment.<sup>4</sup>

The location of finish lines has a direct influence on the fabrication of the restoration including the ability to evaluate the margins visually or manually with an explorer. The efficacy of the examination becomes increasingly questionable the deeper the subgingival margin.<sup>5</sup>

The greatest tolerance can be expected from gingival margins that are fully exposed to cleansing action so, if possible, the finish line should be prepared supragingivally in enamel. The margins are then more accessible for inspection and finishing, and oral hygiene.<sup>4,6</sup>

Subgingival marginal location is only justified where esthetic is of prime consideration. Also, where dental caries, erosion and abrasion cavity, or old restorations extend subgingivally and should be covered by crown margins.

The finish lines that create an acute margin of gold is the knife edge finish line. Developing definite finish line with a knife edge configuration is an arduous and inordinately demanding tooth preparation.<sup>7,8</sup>

The construction of the artificial crown is also difficult because the thin margins of the restoration are commonly indistinct on the impression and die.<sup>9</sup> Overcontoured crowns are routine with this design<sup>10</sup> and there is an increased potential for plaque retention which may affect gingival health.<sup>11,12</sup> The restoration that fits this thin finish line is difficult to accurately cast. Knife-edges are not a preferred configuration and should be avoided or restricted to specific clinical situa-

tions.<sup>2,13</sup> Shoulder finish lines are unpopular as finishing lines for cast restorations. They are commonly inaccessible on posterior teeth, and routine use is indefensible if stress analysis, microleakage, and pulpal response are considered.<sup>14</sup> Shoulders are unnecessarily destructive and unsuitable for marginal finishing,<sup>6,14</sup> unless modified with a bevel.<sup>2,15-17</sup> Bevelled shoulder may be used for metal-ceramic crowns but it sacrifices a lot of tooth substances.<sup>18</sup>

The type of finish line selected is worthy of attention because it must provide for a fine edge of gold with sufficient bulk of metal.<sup>2</sup> Many dentists believe that the optimal gingival finish line for cast restorations is a chamfer.<sup>2,14</sup> This finish line with increased width permits easier evaluation of the margin during all stages of construction with less chance of overcontouring the casting, allows adequate rigidity, and exhibits the best stress distribution, so that the cement is less likely to deteriorate.<sup>14,19</sup>

The chamfer is a versatile marginal design<sup>2,5,13</sup> because the light chamfer (0.3 mm) is only slightly more severe than the knife edge and ideal for metal margins. A heavy chamfer (0.8 mm) is considered adequate for porcelain-fused-to metal restorations.<sup>1,20</sup> A shoulder configuration on the labial surface, with or without a bevel, allows space for a coping design with sufficient bulk of metal and ceramic.<sup>17</sup> The preparation of a complete crown with a light chamfer is commonly performed with a chamfer diamond, then all the axial surfaces are smoothed with a chamfer carbide finishing bur.<sup>1,2</sup> A heavy chamfer can be developed more effectively with a rounded end tapered diamond instrument<sup>19,20</sup> and is easier to prepare with a precision than a shoulder.

Shoulder preparations are performed by converting the heavy chamfer using the flat-end tapered diamond to a depth of 1 to 1.5 mm, and the reduction extends around the labioproximal line angles and diminishes on the lingual surfaces.<sup>2,21</sup>

The dentist must determine the gingival configuration prior to tooth preparation because there is a variation between 0.3 mm for the light chamfer and 1-1.5 mm in the shoulder design, depending on the restoration and selected materials. The principal method of controlling the amount of gingival tooth reduction for a cervical chamfer is the use of a taper diamond bur with rounded tip. The

chamfer should never be prepared wider than half the tip of the diamond lest an unsupported lip of enamel result. The accuracy of the margin depends on having a high quality diamond and a true running handpiece,<sup>19,21</sup> skill, judgement and repeated visual rechecking that half of the diameter of the bur is outside the contour of the tooth during preparation. This is time consuming with the possibility of uneven reduction of tooth substance that results in irregular margins. Accurate gauging of a predetermined, uniform width for the entire circumference of the tooth is arduous but highly desirable.<sup>14</sup> Excessive reduction of tooth structure using traditional burs during crown preparation is possible with adverse pulpal responses and inordinate preparation can lead to a weakened prepared tooth. The axial reduction may gradually diminish rather than terminate in a definite finish line producing a knife-edge while insufficient tooth reduction leads to an overcontoured restoration or thin margins.

#### **Conventional rotary instruments selection for finish line preparation**

Rotary instruments can be classified in two categories. These are (1) diamond abrading burs and (2) cutting burs. The suitable shape and diameter of rotary instruments are selected for tooth preparation with standard head designs namely, round ended or flat ended tapered diamonds, chamfer diamonds, and chamfer carbide burs. These instruments are used to develop several forms of cervical finish line. Limitation in visibility to the gingival area and slight vibration in handpieces prevents accurate judgement since only half of the diameter of the bur tip is embedded into the tooth.

To overcome the detriments previously stated, it is recommended to use the MRD\* instrument with its controlled cutting tip and safe end [Figs. 1a and b] to easily and accurately abrade tooth structure and develop a predetermined finish line preparation.<sup>22</sup> It is also possible to perform minimal axial tooth reduction using standard burs, followed by the MRD carbide or fine grit diamond bur to refine the final configuration of the finish line [Fig. 2].

When the cervical finish line reaches the required depth during tooth preparation, the depth stop tip and safe end of the MRD instrument will

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\* Designed by the author and accepted for manufacturing by Two Striper®, Premier Laboratory Prod. Co., 1710 Romano Drive, Norristown, Philadelphia, PA 19401, USA.



Figure 1a. Buccal view showing an even supragingival finish line preparation using the modified rotary design (MRD) diamond instrument.



Figure 1b. An overall view of a uniform supragingival finish line on a prepared mandibular molar.



Figure 2. Smoothing and finalizing the margin using the MRD carbide bur.

rest cervically on the tooth structure preventing the instrument from vibration, neither over embedding and abrading the tooth structure nor damaging the gingival tissue and avoiding contingent undercuts.

### Discussion

The optimal gingival finish line for the tooth preparation of a cast crown is a supragingival chamfer finish line.<sup>2,14</sup> This permits easier evaluation of the finish line during all stages of preparation<sup>2,6,7</sup> and encourages optimal contours and rigidity of the casting. There are also more tolerant stress conditions for the cementing media<sup>13</sup> with a less possibility of trauma to the supporting tooth structures. The chamfer margin is best made by a tapered diamond bur with rounded tip.<sup>18-21</sup> The establishment of a knife edge or shoulder finish line are not recommended for complete crowns because both have distinct disadvantages.<sup>19</sup> A knife edge finish line possesses an indefinite finish line that can defy identification by the dentist and the dental technicians with routine overcontouring of the restoration while bevelled shoulder is unnecessarily destructive.

High speed conventional rotary instruments with traditional head shapes are commonly used for tooth preparations and finish line termination, but these instruments are completely directed during cutting by the dentist without any limitation to the degree of cutting or bur's vibrations.

It is easy to inadvertently create undercuts or a finish line preparation deeper than is needed, such as shoulder, or fade away rather than terminating in a definite finish line to create a knife edge preparation.<sup>2</sup> With the use of the new rotary instrument that have a depth stop tip and safe end,<sup>22</sup> previously stated disadvantages associated with using traditional rotary instruments are controlled.

The depth stop tip limits removal of the desired amount of axial tooth structure and ensures adequate and uniform chamfer finish line reduction. It will not allow the MRD instrument tip to create undercuts or penetrate into the tooth more than one-half of its diameter.

The safe end of this instrument reduces gingival damage and assists in the supragingival stop location. The MRD instrument is not intended for subgingival finish line preparation.<sup>22</sup>

### Conclusion

The dentist desires specific gauging for the appropriate thickness and accurate configuration of finish line preparation. Traditional rotary instruments do not commonly provide control for the amount of gingival margin reduction during tooth preparation. Therefore, using conventional instruments is based on questionable assumptions. The newly-designed instruments are depth-gauged which allows the operator to precisely control the axial tooth reduction, and considerably reduces the chairtime required for tooth preparation. Furthermore, its depth stop tip prevents the instrument from creating undercuts, even if it is tilted away from the tooth during preparation.

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