Marginal Adaptation of Stainless Steel Crowns

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Abstract

The chief goal of full coronal restoration using preformed stainless steel crowns (SSC) is replication of normal crown form and function. Marginal adaptation of SSCs involves appropriate crown size selection, trimming the crown form to achieve proper length, crimping crown edges to proximate the prepared tooth, and finishing and polishing the crown form. This report about SSC restoration focuses on the procedure of adapting, finishing, and polishing crown margins. (*Pediatr Dent*. 2003;25:249-252)

KEYWORDS: STAINLESS STEEL CROWN, PEDIATRIC RESTORATIVE DENTISTRY

Received November 1, 2002 Revision Accepted April 25, 2003

Marginal adaptation is an important part of the stainless steel crown (SSC) restorative procedure. Axial extensions of the preformed crown should replicate, as closely as possible, dimensions and contours of the original tooth form (Figure 1). Poorly adapted SSC margins can affect associated periodontal tissues and also hinder eruption of adjacent teeth. An example of this problem is when an overextended distal margin on a second primary molar SSC engages the mesial marginal ridge of the permanent molar in its eruptive course. One case was reported in which a poorly adapted SSC on a permanent molar engaged and impacted the adjacent second premolar and second molar, resulting in serious malocclusion and caries (Figure 2).[1]

Some SSC forms, such as the 3M Unitek stainless steel crown (3M ESPE, St. Paul, Minn) and the DENOVO stainless steel crown (DENOVO, Baldwin Park, Calif), have flat axial surfaces and require marginal adaptation as well as axial contouring to replicate natural crown configuration. Such crowns work well if spatial relationships of teeth in an arch necessitate broader and flatter proximal crown design. Today's most popular SSC forms, 3M ESPE Stainless Steel Crowns (formerly "ION"), are manufactured with a curved axial design and anatomically defined occlusal surfaces, resembling normal tooth form. Precontoured SSCs require less manipulation to accurately fit a prepared tooth, but with careful handling, any of the available crown forms usually can be adapted suitably.

Regardless of the brand chosen, edges of SSC forms cannot be machined to curve sufficiently inward to precisely abut the tooth around its entire periphery. That final adaptation phase must be achieved by the dentist, customizing marginal fit to the individual tooth preparation. There has never been a SSC form that by sheer coincidence of the manufactured product adapts ideally at the margins without further manipulation by the dentist.

Figure 1. Well adapted stainless steel crowns, as shown in bitewing radiographs left and right. Open mesial and distal margins are evident in the middle radiograph.

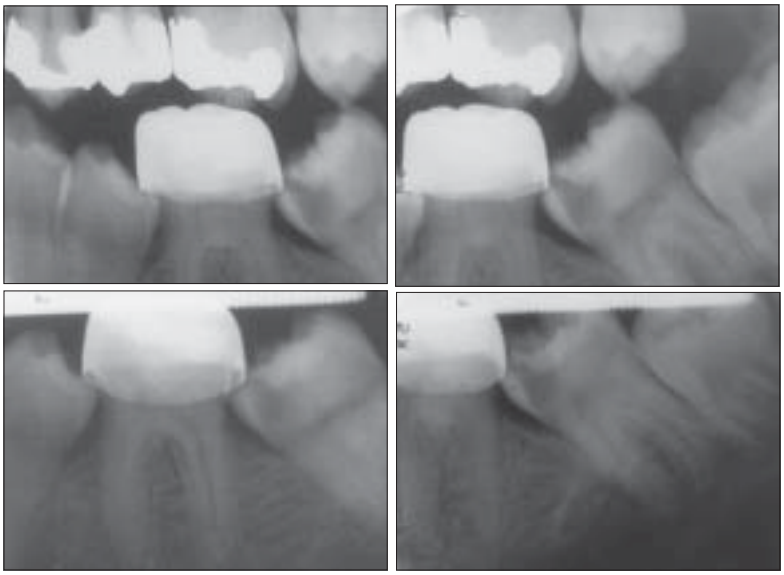

Figure 2. Unadapted stainless steel crown margins impact adjacent teeth causing malocclusion and predisposing teeth to caries (radiographs courtesy of Dr. M.S. McKay; originally published in reference no. 1).

This report details a method of adapting SSC margins as precisely as possible to prepared teeth. The goal is to contour, finish, and polish the edges of the crown form so that they curve smoothly toward the tooth surfaces circumferentially, replicating natural cervical contours of enamel at the crown/root interface (Figures 3 and 4).

Technique

The SSC procedure for both primary and permanent posterior teeth has been reviewed, along with adaptation of anterior crowns.[2-10] The steps of tooth preparation for the SSC procedure include debridement of carious tooth substance and placement of dentin liner (such as resin-modified glass ionomer cement) as indicated, followed by miniaturization of the coronal form with high-speed, water-cooled diamond burs. Tooth preparation is designed such that the anatomical form of the adapted SSC will replicate, as closely as possible, original tooth

Figure 3. A stainless steel crown form ideally adapted to extracted permanent molar and sectioned. Note crown orientation, marginal adaptation, and resin-modified glass ionomer luting cement.

Figure 4. Adapted, finished, and polished first primary molars crowns (buccal side) compared to crown forms as manufactured (lingual side).

Figure 5. A heatless stone used for trimming crown margins to proper length.

Figure 6. The crimping pliers bends edges inwardly.

configuration, spatial relationships in the arch (including proximal contacts), and occlusal or incisal function. After the proper size crown form has been selected, marginal adaptation can be accomplished as follows:

1. With a large abrasive wheel ("heatless stone") or diamond wheel on a straight slow speed angle, crown length is custom cut (Figure 5). Although most pediatric restorative dentistry textbooks suggest crown and bridge scissors for cutting down crown edges, the authors find that the large diameter rotating abrasive stone makes for more precise reduction. The aim is to recreate marginal ridge heights in relationship to adjacent teeth and have sufficient marginal extension to overlap the cervical bulge of the crown. Ideally, the crown margins for a primary molar can approximate the anatomical location of the cementoenamel junction, or slightly occlusal to it, around the full periphery of the crown. For permanent posterior teeth, the contoured crown margins should be more coronal, so that ultimate preparation for a precision cast crown in adulthood is not compromised in any way. This goal is generally easy to attain, because in young patients, permanent posterior teeth are continually erupting and only a portion of the crown is available for preparation. During selection of a suitable crown form size, one should remember that if a selected crown does not fit a prepared tooth, either the tooth is insufficiently prepared, the chosen crown form too small, or both.
2. With crimping pliers, the edge of the crown form (0.5-1 mm) is bent slightly inward around the crown periphery (Figure 6).
3. The abrasive wheel is then applied to the edges, rotating toward the margins from the occlusal direction (counterclockwise in Figure 7). Such action thins the marginal stainless steel material and curves it slightly more toward the axial walls of the tooth (Figure 7).
4. The crown surfaces are then smoothed and polished with a rubber wheel, applied in the same direction (Figure 8). A double attachment mandrel which can accommodate the abrasive wheel and the rubber polishing wheel simultaneously is an ideal instrument for this procedure (Practicon, Inc, Greenville, NC).
5. For final finishing, the crown form can be smoothed and polished with a cloth or chamois wheel on the dental lathe, using Tripoli polishing agent and jeweler's rouge (iron oxide) (Figure 9). Debris from the finishing process, accumulated inside the crown, can be removed with a wet cotton swab. An adapted, finished, and polished SSC form is shown, along with a crown form as supplied by the manufacturer in Figure 10.

Discussion

The authors have found several commercially available crimping pliers that can be used effectively for manipulation of preformed crown margins. DENOVO's small crimping pliers (#800-421) and regular crimping pliers (#800-417) are particularly useful for both anterior and

Figure 7. Rotating counterclockwise in this view, the heatless stone thins the margin and applies a "minicrimp" to crown edges.

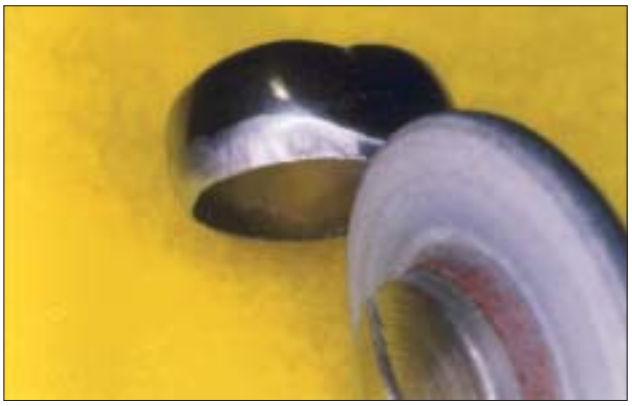

Figure 8. A rubber wheel smoothes crimped margins.

Figure 9. Final finishing and polishing completed on lathe with Tripoli and jeweler's rouge on cloth wheels.

Figure 10. A finished and polished stainless steel crown form ready for cementation (left) and before adaptation (right).

posterior crown form crimping. In addition, The Groper Crimper (#230-750; Success Essentials, Chatsworth, Calif) is another pliers that works well. Regardless of the brand of pliers chosen, abrasive stones and rubber smoothing wheels can be used to adapt pliers tips to the practitioner's liking.

Over the last decade, the authors have found that SSCs are best bonded into place with resin-modifed glass ionomer luting cement.[7] Such cements are biocompatible, form a chemical bond to tooth structure and have high physical strengths and insolubility in the mouth. Properly adapted SSC forms luted with resin-modified glass ionomer cement do not detach. One might argue that, with such high quality luting cement, precise marginal adaptation is not critical. Because children do not often show irreversible periodontal consequences from SSCs that are not perfectly adapted, is it worth the extra effort to adapt crown margins so carefully?

It is important to remember that the methods described are used with both primary and permanent molar SSC forms that often are expected to remain in place for 5 to 15 years. Just like other overcontoured metallic restorations, resin-based composite restorations, or those made with any of the glass ionomer systems, there are biological consequences to every dental, surgical, and restorative treatment. SSCs are no exception, and periodontal considerations of such restorations have been considered.[11-13] Using the principles of "biomimesis" (using technology and materials to replicate biological essence), the clinician should strive to re-establish, as closely as possible, the natural state when repairing a tooth. That means restoring a tooth to its proper form, function, and purpose in the most biologically acceptable manner. Just because a treatment result that is not ideal may suffice, does not mean that a dentist should aim for less than ideal. That is why the authors recommend that stainless steel margins should be adapted, finished, and polished with the same care used to complete any dental restoration.

The principles for adapting posterior SSC forms can also be applied to fitting and finishing marginal areas of primary canine teeth and incisor crowns.[8-10] For the smallest of the anterior crown forms, alteration of the crimping pliers may be useful so that the tips fit internally.

Author's note

The authors have no financial interest in any product identified in this article. The senior author (TPC) has a licensing agreement with DENOVO for a patented dental product that is not mentioned in this work.

References

1. Croll TP, McKay MS, Castaldi CR. Impaction of permanent teeth by over extended stainless steel crown margins: report of a case. *J Pedod*. 1981;5:240-244.
2. Castaldi CR. Operative dentistry. In: Goldman HM, et al, eds. *Current Therapy in Dentistry.* Vol 2. St. Louis, Mo: CV Mosby Co; 1966:621-655.
3. Mink JR, Bennett IC. The stainless steel crown. *J Dent Child*. 1968;35:186-196.
4. Full CA, Walker JD, Pinkham JR. Stainless steel crowns for deciduous molars. *J Am Dent Assoc.* 1974;89:360-364.
5. Myers DR. The restoration of primary molars with stainless steel crowns. *J Dent Child*. 1976;43:406-409.
6. Croll TP, Castaldi CR. The preformed stainless steel crown for restoration of permanent posterior teeth in special cases. *J Am Dent Assoc.* 1978;97:644-649.
7. Croll TP. Preformed stainless steel crowns: an update. *Compend Contin Educ Dent.* 1999;20:89-106.
8. Croll TP, Blum JR. The stainless steel crown for a primary canine tooth: a pictorial essay. *J Pedod.* 1982; 6:301-314.
9. Croll TP, Helpin ML. Preformed resin veneered stainless steel crowns for primary incisor restoration. *Quintessence Int*. 1996;27:309-313.
10. Croll TP. Primary incisor restoration using resin-veneered stainless steel crowns. *J Dent Child.* 1998;65:89-95.
11. Webber DL. Gingival health following placement of stainless steel crowns. *J Dent Child*. 1974;4:186-189.
12. Myers DR. A clinical study of the response of the gingival tissue surrounding stainless steel crowns. *J Dent Child*. 1975;42:281-284.
13. Myers DR, et al. The effect of polishing technics on surface smoothness and plaque accumulation on stainless steel crowns. *Pediatr Dent*. 1980;2:275-278.