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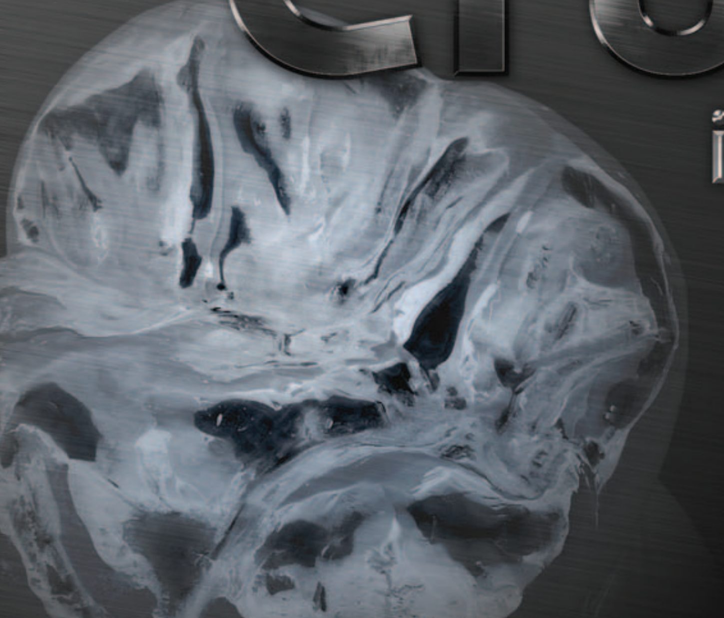
Technique for Use of Stainless-Steel Crowns in Primary Molars



by Joel Berg, DDS, MS & Jenn-Yih (Simon) Lin, DDS, MS

Abstract

This course will guide the clinician through the steps involved in successful placement of the stainless-steel crown. The stainless-steel crown can be easily placed by following the step-by-step approach outlined in this article. When placed properly and with good case selection, the stainless-steel crown should remain in place until the natural exfoliation of the primary molar.

Educational Objectives

After reviewing this program, participants will be able to:

1. identify the need for stainless-steel crowns in primary molars.
2. describe the steps involved in tooth preparation for primary molar stainless-steel crowns.
3. describe how to fit a stainless-steel crown into place on the prepared primary molar.
4. describe how to contour a stainless-steel crown when it is too wide mesio-distally.
5. describe how to properly cement a stainless-steel crown onto a primary molar.

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The stainless-steel crown (SSC) is one of the most important procedures in pediatric restorative dentistry. Stainless-steel crowns cover and protect the entire tooth and are very durable (Fig. 1). They also are very difficult to dislodge if placed properly, with excellent adaptation to the tooth.

They represent the preferred therapy for primary molar teeth after pulpotomy.

The stainless-steel crown is readily retained (often for the lifespan of the primary molar), because it fits over the contour of the buccal, lingual, mesial and distal surfaces of the tooth (Fig. 2). This "snap-on" feature of stainless-steel crowns causes retention of adapted stainless-steel crowns. This is obviously distinctly different from the way in which precision laboratory-fabricated cast restorations are placed in permanent teeth, after parallel preparation of the tooth and avoidance of any undercuts during tooth preparation.

The pre-cut, pre-contoured and pre-crimped stainless-steel crown is intended to fit over the cervix of the crown preparation with the same "snap-on" effect as the older generation, non-contoured crowns, but without all the trimming/reduction and contouring procedures. Additional crimping can also be done on the pre-contoured crowns (Fig. 3) to further improve the mechanical retention. It is desirable to avoid as many of the cutting and crimping steps as possible in order to save time during the procedure. This was the reason for the development of the pre-contoured crowns. The mechanical snap-on retention feature is important, although the degree of importance is changing with the advent of modern cements. During the era when zinc phosphate or zinc-oxide/eugenol cements were the primary cements of choice for stainless-steel crowns, the cement was mainly present to fill the void between the crown and the tooth.

Mechanical retention was the main force holding the crown in place. However, with modern cements, such as glass ionomer cements, there is chemical adherence to the tooth structure and mechanical adherence to the stainless-steel crown. This makes mechanical retention still desirable but not necessarily as critical. The marginal seal of the combination of a well-fitting crown and the cement interface is critical however.

Pre-contoured stainless-steel crowns make the practice of dentistry for children much easier by saving significant time. If a patient has lost space around the tooth to be crowned, the pre-contouring (with natural contours) can mean the mesial and distal surfaces of the crown are too bulbous to be fitted down on the tooth. Sometimes it is necessary to remove additional tooth structure from the mesial and distal surfaces of an adjacent primary tooth to create enough mesio-distal space for the crown to be placed, if squeezing the crown to reduce the mesio-distal width is not effective (Fig. 4). This can be easily accomplished with Howe pliers which exert a slight squeeze on the SSC while holding it on the mesial and distal aspects. When two SSC are prepared adjacent to one another, interproximal preparation must be made on each to the same extent as if there were only one of them prepared.

Rubber dam isolation for SSC procedures is strongly recommended. The entire procedure is typically accomplished with the rubber dam in position; including crown preparation, crown try-in and cementation.

There are at least two situations when one might want to remove the rubber dam prior to final placement of the crown. These involve cases where the opposing occlusion might interfere with crown placement and where the rubber dam clamp interferes with crown placement. This latter scenario often occurs when preparing a second primary molar for a SSC prior

Fig. 1

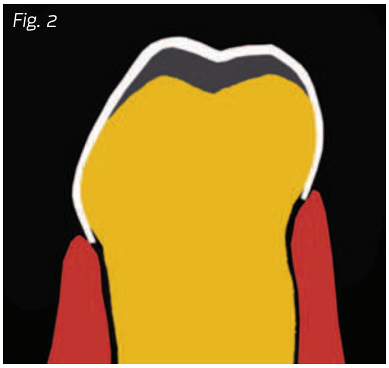

Fig. 2


Fig. 3


Fig. 4


Fig. 1: Pre-contoured and pre-crimped stainless-steel crown (Pedo Crown, Hu-Friedy, Chicago, Illinois)

Fig. 2: Drawing of stainless-steel crown showing "minimalistic" tooth preparation

Fig. 3: Additional crimping can also be done on the pre-contoured crowns to further improve the mechanical retention.

Fig. 4: If a patient has lost space around the tooth to be crowned, the pre-contouring can mean the mesial and distal surfaces of the crown are too bulbous to be fitted down on the tooth.

to the eruption of the permanent first molar, and therefore where the rubber dam clamp must be placed on the second primary molar.

Once the rubber dam is placed after local anesthesia is obtained, tooth preparation can begin. There are three basic steps to tooth preparation for SSCs – (1) occlusal reduction, (2) buccal and lingual reduction/beveling, and (3) proximal reduction. Wedges can be placed between the teeth during the tooth reduction phase of the stainless-steel crown preparation (Fig. 5) so that cutting is done into the wedges rather in the interproximal soft tissue. A carbide bur or a diamond bur can be used for preparation. Some pediatric dentists use diamond burs to speed up the procedure to minimize the likelihood of behavior management problems by extending beyond the desirable time of cooperation for the child. Tapered burs are good choices for interproximal tooth reduction. Using one type of bur for the entire operation reduces the time required by eliminating the steps involved in changing burs. Some prefer to use a carbide bur for the entire crown preparation procedure, where changing burs is unnecessary. Regardless, using time efficiently is very important to exhibit good behavior management in providing dental care to children.

Depth cuts can be used as a gauge to help establish the depth of the occlusal reduction (Fig. 6).

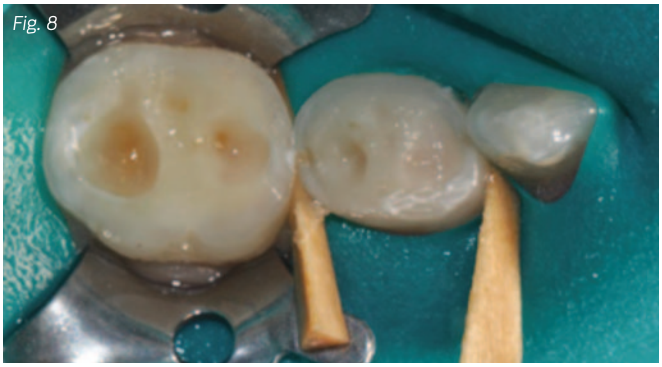
As has been mentioned, occlusal reduction can be done by generally following the external contours of the tooth (Fig. 7). However, if a pulpotomy is planned, simple reduction of the occlusal aspect straight across by removing 1-1.5mm of tooth structure should be accomplished. A large football-shaped bur or round bur is good for accomplishing this step rapidly and effectively.

The next step involves the buccal and lingual reduction/beveling elements of the preparation (Fig. 8). It is best to only slightly reduce the cervical bulges of *some* teeth just above the gingival tissue. Generally, most experienced practitioners only prepare the occlusal half of the buccal and lingual surfaces, above the bulges on the gingival aspect of these surfaces. This reduction is also generally limited to a 45-degree angled bevel from the reduced occlusal surface onto the occlusal half of the buccal and lingual surfaces (Fig. 2). Ordinarily it is not necessary to reduce tooth structure subgingivally during the buccal reduction process. This is true for lingual reduction as well. However, in the case of first primary molars, the buccal bulges often are very prominent, it is sometimes necessary to remove the buccal bulge in order to allow the preformed crown to fit over the buccal prominence (Fig. 9). The preparation will be somewhat below the height of the free gingiva in these cases.

Beyond coping with the buccal bulges of some primary molars, various authors have suggested different approaches to the buccal and lingual reduction/beveling step of SSC preparation. We will review the various approaches. The buccal and lingual reduction/beveling steps are started after the occlusal

Fig. 5: Rubber dam isolation with wedges before tooth preparation
Fig. 6: Depth cuts used to gauge preparation depth

Fig. 7: Occlusal reduction generally follows external tooth contours



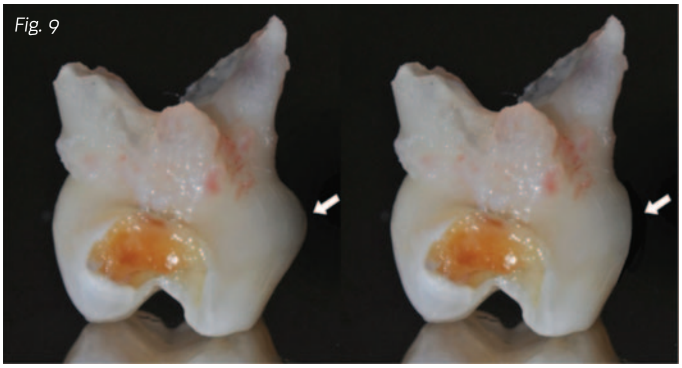
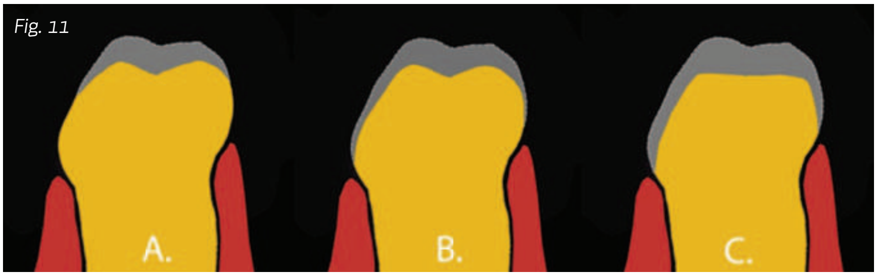


Fig. 8: Buccal and lingual beveling followed by complete removal of caries was performed with a low-speed round bur.
Fig. 9: Mesial view of a mandibular right first primary molar and clearly demonstrates the presence of the large buccal bulge (left). Some reduction of the bulge area often is necessary (right).



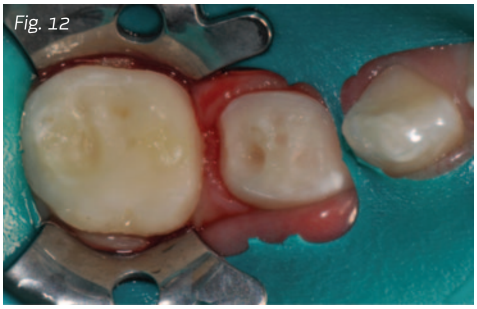


Fig. 10: The bur needs to be angled so as not to damage the adjacent teeth.
Fig. 11: Three approaches to the buccal and lingual reduction/beveling step
Fig. 12: Final preparation before fitting the stainless-steel crowns; all line and point and angles were rounded.

reduction step. As mentioned earlier, the occlusal reduction step involves the reduction of the occlusal surface by approximately 1.0-1.5mm (as displayed in the diagram). Some authors recommend roughly following the occlusal surface morphology. Other authors indicate that a flat occlusal surface preparation is preferred so that the procedure can be accomplished more rapidly. We believe that either approach is acceptable, although if the latter approach is taken, care must be taken to avoid exposing the pulp unnecessarily. The important consideration is to make sure that occlusal reduction is extended enough so that the crown will not be in hyper-occlusion once it is placed.

As noted, routine reduction of the entire buccal or lingual surface is not recommended, but rather reduction should only involve removal of very prominent buccal bulges and the beveling step (in rare cases). The advantage of this technique is that greater natural mechanical retention might be obtained from the buccal and lingual surfaces since no reduction occurs on most of those surfaces.

Generally, interproximal slices are made after the occlusal and buccal-lingual reduction steps, since the interproximal reduction phase is easier after reduction of the other surfaces. It is important not to damage the interproximal surfaces of adjacent teeth, particularly if an adjacent permanent tooth exists. Consequently, the bur needs to be angled so as not to damage the adjacent teeth. Figure 10 demonstrates the approximate bur angulation during mesio-interproximal reduction of the second primary molar. One of the most common errors in preparing teeth for stainless-steel crowns is to leave an interproximal ledge, as also shown in figure 10 (where the preparation is not yet complete). A preparation with a ledge will not allow the stainless-steel crown to seat completely, because the SSC will get caught on the ledge. An explorer or bur can be used to check for ledges by moving up and down the proximal surface to verify a smooth interface that is ledge-free. If a ledge is present, it needs to be removed with a bur.

All lines, points and angles should be rounded. The most important advantage of this approach is that the restored tooth will have an overall size and morphology that is closer to that of the original tooth. It is also possible that less tissue blanching will result when the buccal and lingual surfaces are reduced by the thickness of the stainless crown and the restored tooth will better simulate the original morphology of the tooth, but this can lead to less retention and take more time and expertise in preparation.

We have reviewed three approaches to the buccal and lingual reduction/beveling step (Fig. 11). They are as follows:

a. Beveling the buccal and lingual surfaces, but not reducing the overall surfaces.
b. Beveling the buccal and lingual surfaces and slightly reducing the buccal and lingual surfaces (to the approximate thickness of a stainless-steel crown).
c. Reducing the occlusal, buccal and lingual surfaces significantly, with a resulting trapezoidal-shaped preparation.

The determination of the approach might be made based on the ability to be consistent in methodology regardless of the majority of circumstances. In this way, dentists along with staff will gain familiarity with whatever technique is expected and be able to select and fit stainless-steel crowns more efficiently.

Our experience with SSCs is that they are highly durable, very well-retained and well-tolerated using each of the approaches described. Especially helpful is that all the preparation styles preserve the subgingival area of the buccal and lingual surfaces so that mechanical retention can be obtained. Rounding all line and point and angles is necessary before selection of the correct crown size in the crown preparation process (Fig. 12). Trial and error is the most practical approach at first. Experienced clinicians find they often can estimate the correct crown size simply by viewing the preparation. However, the trial and error method is used until the appropriate size is found. A gauge can be used to measure the mesio-distal space, which is then used to determine the correct crown size.

Even with the newer crowns (Fig. 13), some trimming and adaptation occasionally will be necessary. For example, a necessary adjustment might occur where a size 4 crown is too small and a size 5 is too big (crowns are available in integer sizes from 2-7). A size 4½ would be perfect, but no such crown exists. A size 5 can be used in these cases by crimping to make the crown tighter or the tooth circumference can be decreased by trimming the periphery of the tooth to make the tooth fit the smaller size 4 crown, or by squeezing the larger-sized crown as described.


Fig. 13: Stainless-steel crowns after cementation with traditional glass ionomer cement (Ketac-Cem 3M ESPE, St. Paul, Minnesota)

SSCs might cause slight tissue irritation and are not as aesthetically desirable as resin composite, for example. The amount of tissue irritation generally is not significant in healthy children. However, parents should be instructed to make sure that the teeth are carefully brushed around the crowns. When problems arise with crowns, the cause is usually poor hygiene. Cement caught in the interproximal area is another potential problem. SSC margins should be placed right at or slightly below the height of the free gingiva. Fortunately, the advent of new preformed crowns has made most trimming unnecessary. SSCs might be cemented with a variety of glass ionomer cements depending on the preference of the clinician. Most commonly, traditional (pure) glass ionomer cement is used, but some clinicians prefer resin-modified glass ionomer cement. If resin-modified glass ionomer cement is used, one should be aware that the resin portion might not cure properly unless it is of the "tri-cure" variety, where there exists a self-curing mechanism of the resin components. Regardless of cement choice, after placement it is necessary to remove the excess cement carefully after the cement is fully set. It is particularly important to go between the teeth with a string of knotted floss to remove excess cement interproximally. It is best to gently use the knotted floss in the interproximal area and saw bucco-lingually, which will remove excess cement without dislodging the crown. Lifting up on the floss might dislodge the crown (glass ionomer cement is not fully set for 24 hours) and should be avoided. The next step is to go around the teeth with an explorer to check for excess cement. It is also important to check the bite, since the rubber dam probably has been used throughout the procedure. The crowns need to be checked with the rubber dam off, especially when the cement is not yet set so adjustments can be made if necessary. It is important to check the occlusion by having the patients bite on the newly cemented crowns. ■

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Author's Bio

Dr. Joel Berg became Dean of the University of Washington School of Dentistry in August 2012. Prior to that, he was the chair of pediatric dentistry, dental director for Seattle Children's and associate dean for Hospital Affairs at the School of Dentistry. Dean Berg obtained his DDS, a certificate in pediatric dentistry and an MS in oral biology from the University of Iowa. Before joining the UW, he also served on dental faculty at the University of Pennsylvania and the University of Texas. He is currently president of the American Academy of Pediatric Dentistry and was recently chosen to be a national spokesman for a public service advertising campaign to promote dental health.

Berg has authored or co-authored more than 100 abstracts, articles and chapters, and is co-editor of a textbook on early childhood oral health. His current research includes innovative new technologies for early detection of caries, one of his principal research and academic interests. He is a fellow of the American College of Dentists and International College of Dentists, as well as a board director of the American Academy of Esthetic Dentistry. In 2011, he was named the eighth Washington Dental Service Foundation Distinguished Professor for Dentistry.

Jenn-Yih (Simon) Lin, DDS, MS, is a Clinical Assistant Professor of Pediatric Dentistry at the University of Washington School of Dentistry. He has been the Predoctoral Program Director since 2007 and is a favorite with the dental students. Dr. Lin received his DDS in 1995 from National Yang-Ming University in Taipei, Taiwan. In 2002, he received his certificate in Pediatric Dentistry and a Master of Science degree from Tufts University School of Dental Medicine, Boston. He spent a year conducting molecular genetic research on Oligodontia at Harvard Medical School.

Dr. Lin is enthusiastic about integrating computing technology into effective instructional materials. He has implemented podcasting and an audience response system to facilitate students' learning. He is currently developing an app for mobile devices to improve students' learning experience in pediatric dentistry.