

## 牙體復形學 Operative dentistry

### Nomenclature and Instrumentation Application and Removal

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## 學習目標

■ 期許同學在瞭解病患的需求及材料的特性後，能依據所學善加利用，做到不僅是幫病患解決病痛的牙醫師，同時也是個讓病患永遠也忘不了的藝術家。

1. 牙齒的生理，解剖形態
2. 齲齒的生理，診斷及治療計劃
3. 窩洞的修形及材料的選擇
4. 窩洞的充填方式及其修飾
5. 美觀性材料的選擇及其運用
6. 變色牙的修飾

## 參考資料

1. Sturdevant's art and science of operative dentistry. 4th edition. Theodore M. Roberson.
2. Fundamental of operative dentistry. A contemporary approach 3rd edition, James B. Summitt.

## Summary

Operative dentistry is the basic science in clinical dental practices. It included dental physiology, morphology, cariology, tooth preparation for restoration. The purpose of Operative dentistry is to complete the function and create the aesthetic outlook.

## Preparation of the Mouth

Teeth should be cleaned, if necessary, and contacts should be checked with floss. The rapid passage of dental floss through each contact that will be involved in the isolation is very important and, if accomplished as a part of the routine, will save chair time. Any rough contact should be smoothed with the proximal contact disk (Fig 7-27), not only to facilitate dam placement, but to enable the patient to clean each interproximal area during routine flossing.

If a restorative procedure that involves an occlusal surface is planned, centric occlusion (maximum intercuspation) contacts should be marked with articulating paper or tape prior to application of the dam. Centric occlusion markings may be coated with a cavity varnish or light-cured resin to protect them from being rubbed off. If a cavity varnish containing a solvent is used, the cotton pellet or brush used to apply it to the centric occlusion markings should not touch the markings, or it may dissolve them and wipe them away. Instead, the pellet or brush containing the varnish is touched to the enamel adjacent to the markings, and the material is allowed to flow across the markings and dry (Fig 7-30). If lips are to be lubricated, this should be accomplished prior to application of the dam (Fig 7-31).

## Preparation Of the Dam

Use of a prestamped dark (gray or green), heavy (or extra heavy) gauge dam material is recommended. Various hole sizes should be used to ensure a seal around the variety of tooth sizes (Fig 7-32). For example, an Ivory punch has six hole sizes, numbered 1 through 6 from smallest to largest (see Fig 7-4). Hole sizes recommended are 5 for clamped molars; 4 for other molars; 3 for premolars, canines, and maxillary central incisors; and 2 for lateral incisors and mandibular central incisors.

Slight variation from the recommended hole sizes may be needed, depending on the size of individual teeth, operator preference, and gauge of the dam, but a range of hole sizes should be used to prevent leakage between the dam and the teeth.

For operative procedures involving posterior teeth, the tooth or teeth to be restored should be exposed, as well as at least one tooth posterior to the most distal tooth to be restored, if possible. In addition, all teeth around to the central or lateral incisor on the opposite side of the same arch should be exposed. This extension of the area of isolation to the opposite side will hold the dam flat in the arch to give room for fingers and instruments in the area of the teeth to be restored. It will also expose teeth in the anterior area for finger rests during the operation (Fig 7-33).

For anterior restorations, exposure of the first premolar through the first premolar on the opposite side is recommended (Fig 7-34). This will provide room for the mirror and for hand instruments on the lingual aspect of the anterior teeth.

When a prestamped dam or a template is used, holes should be punched away from the spots to accommodate atypical alignment of teeth. In addition, when the dam is being prepared to provide isolation for Class 5 restorations, the hole for the tooth to receive a facial Class 5 restoration should be punched approximately 1.0 mm facial to the spot to allow retraction with the No. 212SA clamp. No holes should be punched for missing teeth.

After the dam is punched, the tissue side of the dam should be lubricated with a water-soluble lubricant. A small dollop of lubricant is applied to the tissue surface and smeared over the surface of the dam in the area of the holes (see Fig 7-29). The rubber dam frame can then be attached loosely to the dam to hold the edges of the dam away from the holes during application (see Fig 7-35b).

## Placement of the Dam

If a local anesthetic agent has been administered to provide pulpal anesthesia for the tooth or teeth being restored, at least a portion of the gingival tissue will have also been anesthetized. If an inferior alveolar block has been given, the lingual nerve will almost always have been anesthetized as well, so the gingival tissue lingual to the mandibular posterior teeth will also have been anesthetized. If infiltration anesthesia has been administered to maxillary teeth, the facial gingival tissue will have been anesthetized. For application of a rubber dam clamp, the portions of the gingival tissue that have not been anesthetized along with the delivery of pulpal anesthesia will not normally need to be anesthetized. When the clamp is applied, as long as the points of the clamp's jaw are firmly on the tooth and have not penetrated gingival tissue, the patient may feel some discomfort for a few seconds where the jaws are pressing against tissue. This pressure discomfort will usually disappear within 1 minute due to "pressure anesthesia," and injection anesthesia for the gingival tissue is usually unnecessary. If additional gingival anesthesia is necessary, topical anesthetic solutions or gels may suffice. When the clamp is applied to the tooth with the clamp forceps, the clamp should be expanded only enough to allow it to pass over the crown of the tooth. Overexpansion of the clamp will permanently distort it so that it will be weak, unstable, and more likely to dislodge from the tooth.

There are several methods of dam placement: Dam over clamp. A wingless clamp is placed on the tooth. It is recommended that a finger be maintained over the inserted clamp to prevent its dislodgment until its stability on the tooth has been confirmed. The operator checks stability by engaging the bow of the clamp with an instrument and firmly attempting to pull it occlusally (Fig 7-35a). If the clamp rotates on the tooth, it is not stable and should be repositioned or replaced.

The top and bottom attachment points of the Young frame are engaged at the top and bottom of the dam to give a slackness or pouching of the dam (Fig 7-35b). The tissue side of the dam is lubricated in the area of the holes. Then, with a finger on each side of the distal hole in the dam, the dentist (or assistant) stretches the dam so that the hole is enlarged and appears to be an open slit; the hole is then carried over the bow and jaws of the clamp (Fig 7-35c). The hole at the opposite end of the row (usually for the lateral or central incisor on the opposite side) is then passed over the appropriate tooth, and the septa are worked through the interproximal contacts.

A gloved fingernail used to slightly separate the anterior teeth is very helpful, and floss is rarely needed to carry the dam through anterior interproximal contacts (Fig 7-35d). Good lubrication of the dam is necessary for easy and quick application. The dam should be passed through each contact in a single layer. This may be accomplished by stretching a septum over one of the teeth adjacent to the contact and sliding the edge of the rubber to the contact so that a leading edge of dam is touching the contact (Fig 7-35e).

In posterior areas, the leading edge should be touching the occlusal portion of the contact in the occlusal embrasure. Waxed tape (ribbon floss) or waxed floss is then used to move the dam progressively through the contact (Figs 7-35e to 7-35g). Tape will carry more of the rubber through the contact in a single pass than will floss. If tape is used, like the rubber, it should be taken through the contact in a single layer, not twisted or bunched up.

If the dam goes through with one pass of the floss, the floss may be removed from the contact without pulling the rubber back out. To accomplish this, the tail of the floss that is on the lingual side of the contact is doubled back across the occlusal embrasure of the contact so that both ends are on the facial aspect; then the tape is pulled facially through the contact. If only a portion of the septum goes through the contact with the first pass of the floss or tape, the floss should be doubled back and passed through the contact again; it is then pulled facially out of the gingival embrasure (Fig 7-35h). The tape should be passed through repeatedly until the entire septum has been carried through the contact.

Winged clamp in dam. Prior to lubrication of the dam, the clamp is placed into the distal hole so that the hole is stretched over the wings of the clamp from its tissue side (Fig 7-36a). The dam is then lubricated, and the frame is attached. The forceps are inserted into the holes of the clamp, and the clamp, dam, and frame are carried as a unit into place (Figs 7-36b and 7-36c). After the stability of the clamp is confirmed, the dam material on the wings of the clamp is pulled off the wings with finger tension or with a bladed instrument such as a plastic instrument (Fig 7-36d). The remainder of the dam is placed as previously described.

Wingless clamp in dam. The distal hole of the lubricated dam is passed over the bow of a wingless clamp, such as the No. W8A, so that the hole comes to rest at the junction of the bow and the jaw arms (Fig 7-37a). The frame is not attached to the dam at this point. The dam is gathered up and elevated to expose the jaw arms of the clamp, and the forceps are then inserted into the forceps holes (Figs 7-37a and 7-37b). The gathered dam is carried to the mouth with one hand and the forceps with the other. After the clamp is applied to the distal tooth and the dam has been pulled over the jaws of the clamp, the frame is attached and the other teeth are isolated as previously described. Clamp alter dam. The dam is applied to the teeth and then the clamp is placed. This technique, occasionally necessary, is the most difficult.

## Completion of Application

Application of the napkin. For longer procedures, the use of a rubber dam napkin is recommended. The napkin may be positioned before or after the dam is in place on the teeth. For placement of the napkin after the dam has been applied, the frame is removed, the napkin is placed so that the edges of the napkin remain on the skin and not in the mouth, and the frame is replaced. Adjustment of the dam in the frame. The frame and dam are adjusted so that there is a minimum of folds and wrinkles and so that the dam does not obstruct the nostrils.

Washing of the dam. The dam and isolated teeth are washed with an air/water spray to remove the lubricant. After they are washed, the dam and teeth should be dried with air from the air syringe. Inversion of the dam. The dam should be inverted around the necks of the teeth, at least in the area of the tooth or teeth to be restored. The edge of the dam that is against the tooth acts as a valve. If the edge is directed occlusally (Fig 7-38a), when a positive pressure is created by the tongue and cheeks under the dam, the valve opens, and saliva and other liquids under the dam are pushed between the tooth and dam to flood the operating field; then when a negative pressure is created under the dam, the valve closes and the saliva is trapped in the field. When the dam is inverted, a positive pressure under the dam simply serves to push the valve more tightly against the tooth (Fig 7-38b) so that no flooding of the field occurs.

Almost any instrument may be used to tuck the edge of the dam gingivally (see Figs 7-25a to 7-25c). A steady, high-volume stream of air should be directed at the tip of the instrument used to invert the dam, and the instrument should be moved along the margin of the dam so that the inversion is progressive.

Floss may be used to invert the dam in interproximal areas (Fig 7-39a). When it is used to carry the edge of the dam gingivally, the floss should not then be pulled occlusally for removal because it will frequently pull the edge of the dam with it, eliminating the inversion. Instead, the floss can be doubled over on itself on the lingual aspect and passed again through the contact. Then one end is pulled in a facial direction so that it rolls from the sulcus, leaving the dam inverted (Fig 7-39b). In this floss-facilitated inversion, a steady stream of air is as helpful as it is when inversion is accomplished with an instrument. The dam inverts more easily when the surfaces of the tooth and adjacent dam are dry.

## Protection of the Dam



Torn dams provide poor isolation, so expenditure of a little effort to prevent tearing is worthwhile. An example of protection would be the use of a wedge interproximally when rotary instruments are used in the proximity of the dam. Another example is the use of a second clamp to retract the dam below a margin that is near, or below, the level of the gingival crest (see Fig 7-46).

## Removal of the Dam



The interproximal septa are stretched and clipped with scissors (Figs 7-40a and 7-40b). The scissors are held so that the tips are not in contact with any tissue (Fig 7-40b). When all septa are cut, the clamp is removed with the forceps and the dam is snapped from the teeth.

After the dam is free from the mouth, the teeth should be examined to ensure that no rubber remains around them or in the contacts. The frame should be removed from the dam, and the dam should be laid flat on a surface and examined to ensure that no pieces are missing (Figs 7-41a and 7-41b). If a piece is missing and unaccounted for, the mouth should be reexamined in the area of the missing piece of dam; any remnant should be removed (Fig 7-41c). A small piece of dam left subgingivally can cause inflammation, gingival abscess, or even significant loss of periodontal support.



## Special Considerations



## Bite Block



Patients often have difficulty keeping their mouths open or are uncomfortable with wide opening. A rubber bite block can relieve their discomfort, allow them to relax musculature, and permit them to keep the mouth open without effort. Bite blocks are available in a variety of sizes (Figs 7-42a and 7-42b). A piece of floss or tape may be attached to the bite block to allow retrieval if necessary (Fig 7-42c). Figures 7-43a and 7-43b show placement of the bite block after the dam is in place.

## Isolation for a Fixed Partial Denture



Whenever possible, it is best to achieve isolation without incorporating a fixed partial denture into the isolated operating field. When a fixed partial denture must be included, there are several techniques that can be used; they are all somewhat time-consuming but often valuable. Two methods are described. Cyanoacrylate method (Fig 7-44). Holes for the teeth are punched in the dam. The holes for the abutment teeth are connected with a cut that is in an arc to give a "tongue" of dam material between the holes. The tongue of material is folded back, and a piece of dam material is attached with cyanoacrylate glue over the opening left when the tongue was folded back. This piece is glued into place so that there is a slit connecting the abutment holes and a tongue of material that is free to swing down over the attached piece of dam material.



The dam is inserted over all teeth for which holes have been punched, and the tongue of material is pulled under the pontic(s) and glued into place on the added piece of dam. Tension on the tongue while the glue is setting (10 to 15 seconds) will ensure that the dam is tight around the abutments after tension is released. Ligation of septa around the retainer-pontic connectors ([Fig 7-45](#)). This procedure is for three-unit fixed partial dentures or splinted teeth. Holes are punched for each abutment, and, for three-unit fixed partial dentures, another hole is punched for the pontic. A piece of floss or suture material is used to tie through the holes so that the septum between adjacent holes is stretched around the retainer-pontic connector. If floss is used, a "floss-feeder," made for carrying floss under bridge pontics for oral hygiene measures, may be used to guide the floss under the pontic and pull it through. If suture material is used, the suture needle may be blunted and used for that purpose.

## Facilitation of Inversion



If there is a problem with inversion, the teeth are dried and a copal resin varnish is applied to them. The tacky layer will usually allow easy inversion.

## Use of Multiple Clamps



In addition to the clamp on the distal tooth, which retains the posterior portion of the dam, a second (or third) clamp is often needed. When the No. 212SA or other butterfly clamp (retractor) is used to retract tissue and dam for a Class 5 or other restoration, it is almost invariably used in addition to the posterior clamp. If a cavity that is at least partly subgingival is to be prepared, a clamp on that tooth will prevent the dam from riding up over the margin ([Fig 7-46](#)).

## Placement of Clamp Over Dam



When it is desirable to clamp a tooth that was not considered when the dam was punched, the clamp may be applied over the dam (see [Fig 7-15](#)). The clamp jaws should be dull, so as not to cut through the dam, and the dam should be stretched loosely over the tooth being clamped.

## Gingival Relaxation Incisions



When using a No. 212SA retractor for isolation for a Class 5 restoration, the jaw of the retractor should be positioned at least 0.5 mm (preferably 1.0 mm) gingival to the gingival margin of the planned restoration. This can usually be accomplished without laceration of tissue, because the free gingiva is elastic enough to be retracted. If, however, the free gingival margin is fibrous and difficult to displace gingivally, forced retraction could lacerate the tissue. In such a case, it is preferable to make one or two small incisions to allow the tissue to be displaced without tearing.

For this technique (sometimes referred to as a miniflap procedure) to be successful, the periodontium must be healthy. The incisions should be confined to the keratinized gingival tissue and kept as short as possible (just long enough to allow adequate exposure for isolation). Incisions can often be limited to the free gingiva, and, although reattachment to previously unexposed cementum can be expected, unnecessary severing of attachment should be avoided. Full-thickness vertical incisions should be initiated at the mesial and/or distal aspects of the facial surface and should be directed perpendicular to the root and surface of bone, first slightly toward the interproximal papilla, then apically ([Figs 7-47a to 7-47c](#)).



The blade of a plastic instrument or a beavertail burnisher may be used to push the tissue and rubber dam back while the facial jaw of the No. 212SA clamp is being situated on the root of the tooth. Again, the jaw should be dull, not sharp, so that it will not damage the root surface. A finger should be used to hold the clamp in place while it is stabilized with compound (see Figs 7-24a to 7-24c). After the restorative procedure is completed, the No. 212SA clamp is removed (see Figs 7-24d to 7-24i), and the dam is removed. Any blood in the area is washed away. The reflected gingival tissue is returned to its original location and held there with a dampened gauze sponge and finger pressure for about 2 minutes to allow initiation of a fibrin clot. As long as the incisions were confined to keratinized tissue, no sutures or periodontal dressing are needed, and healing should proceed uneventfully.



## Evacuation of Fluid from Dam

If the dentist must work without an assistant, a very effective method for evacuation of fluid from the rubber dam involves the use of a suction tube anchored within the operating field.



Modified saliva ejector. One evacuation method involves the modification of a saliva ejector, as described by Lambert.<sup>12</sup> The molded plastic tip is cut off with a pair of crown scissors; then an additional 0.5 inch of the plastic tube is cut off without cutting the wire within the plastic. The 0.5-inch length of plastic tubing is then pulled off the wire, leaving the wire extending from the end of the tube (Fig 7-48a); the wire is bent at its end to form a hook. The hook is attached to the bow or a hole of the rubber dam clamp to provide anchorage of the tube within the field (Fig 7-48b), and the suction is activated. This method will supply continuous fluid evacuation during the operative procedure.



Washed field apparatus. Another method employs inexpensive plastic tubing that is attached to the saliva ejector hose at one end and to the clamp or the rubber dam itself at the other (Figs 7-49a to 7-49c). Childers and Marshall<sup>4</sup> have recommended the use of clear vinyl tubing with an inside diameter of 0.0625 inch and an outside diameter of 0.125 inch (No. C1001A, Mojak Plastic). As a connector for the saliva ejector hose, they recommended the use of clear vinyl tubing with an inside diameter of 0.125 inch and an outside diameter of 0.25 inch (No. C1003S, Mojak Plastic). A short section of the larger diameter tubing is cut to provide an adaptor or connector from the saliva ejector hose to the smaller tubing. A longer section of the smaller tubing is cut, and its end is fitted inside the section of larger tubing. The end of the small-diameter tube is carried under the rubber dam frame and tucked under the bow or a wing of the rubber dam clamp in the back of the dam; tubing may also be attached to the rubber dam with cyanoacrylate adhesive (Figs 7-49a and 7-49b). Small holes may be punched in the side of the tubing near the end with a rubber dam punch to provide several inlets for suctioned fluids. A similar apparatus, described by Benavides and Herrera,<sup>2</sup> involves a Y-type connector (DCI International) to which two small-diameter plastic tubes are attached (Fig 7-49c).



## Sealing a Root Concavity

The rubber dam seals well on convex tooth surfaces. If the dam is retracted so that its edge goes across a root concavity, however, saliva will leak into the operating field. A solution is to seat the gap between the edge of the dam and the concave root surface. This may be accomplished with a provisional restorative material, such as Cavit (ESPE Premier), which hardens with moisture (Fig 7-50).



## Repair of a Torn Rubber Dam

A small tear in a dam may often be patched. A piece of dam material is cut to cover the tear and extend 1.0 cm or so beyond the tear on all sides. The piece is attached over the tear with cyanoacrylate. Placement of a Second Dam Over the First If a dam is torn beyond repair during a procedure, the dentist might choose to remove the dam and replace it. Alternatively, another dam may be placed over the top of the first. Brownbil recommended that this technique be used when there is leakage around teeth through incorrectly sized holes and when strong chemicals are to be used.

## Latex Allergies

There is an increasing awareness of latex sensitivity. One survey<sup>14</sup> reported 3.7% of patients to have a latex allergy; the investigators recommended careful questioning of patients regarding a history of sensitivity to latex-based products, so that the use of latex products, such as gloves and the rubber dam, may be avoided with these patients.

For latex-sensitive patients, use of the latex dam should be avoided, as should other latex products. Nonlatex rubber dam material is available and should be on hand for latex-allergic patients. One such product from Hygenic has elastic properties very similar to latex (Fig 7-51).

### Summary of Recommendations

### Following are some of the procedures that facilitate rubber dam use:


1. Use a heavy-gauge, prestamped dam.
2. Floss through contacts prior to dam placement, planing any contact that shreds or tears the floss.
3. Use a good water-soluble lubricant, such as Velvachol.
4. Use a clamp designed for four-point contact on the tooth, and avoid overexpansion of the clamp so that the clamp will maintain its strength and will be stable as a retainer.
5. Isolate enough teeth to hold the dam on the lingual aspect of the teeth away from the operating field and to provide exposed teeth for finger rests.
6. With waxed floss, floss the dam through interproximal contacts in a single layer and avoid doubling or bunching the dam in the contact.
7. Master the use of modeling compound to stabilize rubber dam retainers.

### Other Methods of Isolation

## Svedopter

The Svedopter (EC Moore) is probably the most commonly used tongue retraction device (Figs 7-52a and 7-52b). It is designed so that the vacuum evacuator tube passes anterior to the chin and mandibular anterior teeth, over the incisal edges of the mandibular anterior teeth, and down to the floor of the mouth, to either the left or the right of the tongue. A mirrorlike vertical blade is attached to the evacuator tube so that it holds the tongue away from the field of operation. Several sizes of vertical blades are supplied by the manufacturer. An adjustable horizontal chin blade is attached to the evacuation tube so that it will clamp under the chin to hold the apparatus in place.





Absorbent cotton rolls are placed adjacent to the Svedopter in the floor of the mouth and in the maxillary buccal vestibule adjacent to the opening of the parotid gland (Stinson's) duct. The Svedopter is especially useful for preparation and cementation of fixed prostheses. It is less effective than the rubber dam for procedures in which total isolation from the fluids and vapors of the oral cavity is desired.

## Hydoformic Saliva Ejector




The Hygoformic (Pulpdent) coiled saliva ejector is used in the same way as the Svedopter, but it does not have a reflective blade (Figs 7-53a to 7-53c). It is, however, usually more comfortable and less traumatic to lingual tissues than is the Svedopter. For use, the saliva ejector must be re-formed (re-bent) so that the evacuator tube passes under the chin, up over the incisal edges of the mandibular incisors, and then down to the floor of the mouth. The tongue-retracting coil should be loosened, or partially uncoiled, so that it extends posteriorly enough to hold the tongue away from the operating field. The Hygoformic saliva ejector is also used with absorbent cotton for maximum effectiveness.

## Absorbent Paper and Cotton Products



Absorbent materials are important in dentistry. Vacuum apparatuses remove fluids from the operating field by suctioning them; cotton and paper products help control fluids by absorbing them. Several types of absorbent cotton rolls are available in various diameters and lengths. These are placed into areas of the mouth, where salivary gland ducts exit, to absorb saliva and prevent salivary contamination of the operating field.



Isolation using absorbent materials with suctioning devices is less effective than using the rubber dam with suction, but in many procedures, the more complete isolation provided by the dam is unnecessary. In these situations, absorbent products are useful. Small gauze sponges may be folded or rolled to substitute for cotton rolls. In addition, absorbent paper triangles, or parotid shields, such as Dri-Aid (Lorvic), are useful on the facial aspect of posterior teeth to absorb saliva secreted by the parotid gland (Figs 7-54a and 7-54b).