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Hydraulic and Hydrophobic Impressions

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0ne of the most frustrating aspects of making final impressions for crowns and bridges involves the management of finish lines that extend subgingivally. The dentist must contend with many problems like relapsing gingival tissue which can obstruct the flow of impression material into the sulcus. This is most often managed by packing retraction cord which is time-consuming, difficult and often uncomfortable for the patient.

The dentist must also contend with gingival hemorrhaging which may fill the sulcus with blood and interfere with the flow of impression material. This is most often managed with hemostatic agents which may require multiple applications and taste bad. Moreover, hemorrhaging may recur spontaneously or when the cord is removed. And hemostatic agents which contain sulfur inhibit the setting of vinylpolysiloxane impression materials.

Then there is the problem of saliva which may flood the field if the assistant fails to maintain adequate suction and isolation. With some patients this may be very difficult, if not impossible.

All in all, making final impressions of subgingival finish lines can be a challenge, even under the best of circumstances. We have developed an impression technique that eliminates the need for retraction of the gingival tissue, application of hemostatic agents, or the need for maintaining a dry field. We will illustrate this technique with a simple example of making a final impression of a mandibular first molar crown preparation with deep subgingival margins.

Clinical Technique

Prepare the tooth for a crown and place the margins subgingivally as dictated by the preoperative condition of the tooth or treatment plan **(Figure 1 and Figure 2)**.

Figure 1

Figure 2

Select a dual arch impression tray that passively fits the quadrant. Insert the tray and have the patient close all the way down into MI (Maximum Intercuspation). A correctly sized tray will fit loosely and you should be able to wiggle the tray around without it binding against the teeth or arch. Have the patient practice biting all the way down into MI with the tray in place.

Fill both sides of the tray with a vinylpolysiloxane bite registration material and insert to the proper position. Have the patient bite all the way down into MI. Examine the orientation of the cusps on the contralateral side to check if the patient has closed all the way down into MI.

After the bite registration material has set, hold the tray and impression on the arch opposing the prepared tooth and have the patient open. Stabilize the tray and impression on the opposing arch.

Wash and dry the bite registration impression of the prepared tooth **(Figure 3)**. This will act as a highly customized tray **(Figure 4)**. Wash and dry the prepared tooth to remove excess blood and saliva. Inject a small amount of hydrophobic, low viscosity, vinylpolysiloxane material into the bite registration impression or the prepared tooth **(Figure 5)**. Only a small amount of low viscosity material is required **(Figure 6)**. Then have the patient close again all the way down into the bite registration impression **(Figure 7)**.

Figure 3

Figure 4

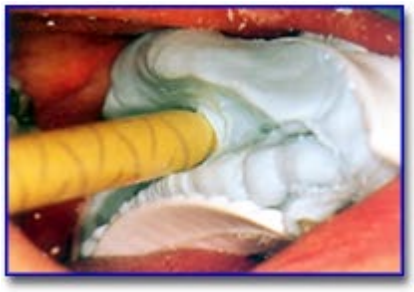

Figure 5

Figure 6

Figure 7

In this second step of the impression procedure, when the patient closes into MI, the prepared tooth is thrust into the low viscosity impression material like a piston and generates a hydraulic force. This force propels the low viscosity material into the sulcus under sufficient pressure to displace blood and saliva. In fact, the low viscosity material is propelled under such a strong hydraulic force that it will fill the entire sulcus and will reproduce the entire subgingival finish line as well as the submarginal anatomy of the root. The subgingival finish lines will be reproduced with great detail and will be sharply defined. Since the low viscosity material is hydrophobic, it will not incorporate blood or saliva but rather will bodily displace them.

There is no need to stop and place retraction cord to produce a space between the tooth preparation and the free marginal gingiva. The hydraulic force will drive the low viscosity material even through a narrow gap between the gingiva and the tooth. There is no need to apply hemostatic agents since the low viscosity material is driven with such force that it readily displaces any blood and saliva that may be in the sulcus **(Figure 8)**.

Figure 8

The dentist can proceed directly from preparing the tooth to making the final impression. This reduces the number of steps required to make the final impression, decreases the cost of the procedure, conserves chair time and vastly improves patient comfort. And best of all, this technique yields a final impression with very sharply defined finish lines **(Figure 9)**.

Figure 9

Troubleshooting

A few tips to help things along. Don't overload the tray with bite registration material. You only need enough bite registration material to act as a custom tray and to capture the prepared tooth, adjacent and opposing teeth. In the second step of the impression procedure, the patient will have to bite down into the bite registration impression. If there is too much excess set bite registration material, this may be difficult and the patient may not be able to bite all the way down.

Don't inject too much low viscosity impression material into the bite registration impression of the prepared tooth. The bite registration impression will reproduce the axial walls of the preparation but will generally not extend into the sulcus. The objective of using a wash in the second step is to propel the low viscosity material into the sulcus to capture an impression of the subgingival finish lines. You only need a small amount of low viscosity material to accomplish this.

We use 30-Second Blue Velvet (J. Morita), a thixotropic vinylpolysiloxane bite registration material to load the tray. It has the advantage of setting up within one minute after the tray has been inserted. We used 90-Second Flexi Velvet (J. Morita), a thixotropic vinylpolysiloxane low viscosity impression material for the wash in the second step. Because this material is thixotropic, it does not run out of the bite registration impression of the prepared tooth after it has been deposited. It also has the advantage of setting up within two minutes after it has been injected into the bite registration impression of the prepared tooth and the patient closes into it. A typical impression takes us no more than four minutes.

Discussion

This impression technique has enabled us to vastly increase our productivity and decrease our chair time while reducing overhead. We do not stock retraction cord, cord packing instruments, or hemostatic agents. We use only a fraction of the impression material utilized in other conventional impression techniques. Also, we do not need custom acrylic trays. We need only a fraction of the time usually required to make final impressions with conventional impression techniques. We generally get a perfect impression on the first try and rarely have to repeat the impression sequence. Our patients are far more

comfortable during our impression procedures and do not have to suffer through cord packing and the application of hemostatic agents. They suffer far less postoperative pain since their gingiva has not been stretched to the tearing point and has not been traumatized with chemicals.

Just in the last two years we have successfully inserted over 3,000 units using this impression technique. The cases have sharply defined finished lines that are easy for the technician to read. The occlusion has been very accurate and has required minimal adjustments. And last but not least, our frustration factor with this very challenging aspect of making crowns and bridges has plummeted. In fact, for us, making impressions of subgingival finish lines is no longer a challenge.

Sculpture/FibreKor Inlay Bridge

With the Sculpture/FibreKor system (Jeneric/ Pentron), you can replace missing teeth with minimal reduction of the adjacent abutment teeth while producing maximum aesthetics. Most patients demand the ultimate in aesthetics while demanding minimally invasive treatment. The Sculpture/FibreKor system enables the dentist to accomplish both these objectives.

Conventional porcelain fused to metal bridges can produce highly aesthetic results under certain circumstances. However, conventional tooth preparation for this kind of restoration involves major and irreversible tooth reduction which may occasionally result in the need for root canal treatment or periodontal surgery. Moreover, in cases where there is a metal margin on the facial, if the gingiva later recedes, the patient may develop "black line disease" where the metal margins become exposed. This becomes a very difficult aesthetic problem.

The Sculpture/FibreKor system can often resolve all of these problems. In many cases, the use of this system involves removing just enough tooth structure to produce an inlay retainer. And the aesthetics are incomparable. In this article we describe one case where the use of the Sculpture/FibreKor system produced remarkably good aesthetics with minimal amount of tooth reduction and chair time. than four minutes.

Clinical Case

A handsome, upwardly mobile 34-year-old male presented with a failing resin-bonded bridge replacing a missing mandibular premolar **(Figure 10)**. The patient had never been entirely satisfied with this prosthesis because of the amount of metal that showed. He wanted the quadrant to be restored to its previous natural look.

Figure 10

We presented a treatment plan using an inlay retained Sculpture/FibreKor bridge to replace the failing resin-bonded bridge. Conservative inlay retainer preparation would be done on the mesial of the first molar and the distal of the premolar. This treatment plan would respect his concerns about minimal tooth reduction while providing maximum aesthetics.

A pre-operative impression was made using 30-Second Blue Velvet (J. Morita), a bite registration material. This would later be used as a matrix to make a provisional bridge. The resin-bonded bridge was easily tapped off with the ATD Bridge Remover (J. Morita). This system utilizes a flexible metal cable which is inserted under the pontic and attached to the hammer mechanism.

Removal of the failing resin-bonded bridge revealed extensive carious enamel and dentin around and under the metal wings and rest seats. These areas were stained with Caries Detector (J. Morita) to ensure adequate detection **(Figure 11)**. All carious dentin and enamel were removed. The second premolar was then prepared as though it were to receive an MO inlay. The path of insertion was perpendicular to the occlusal plane and in line with the long axis of the tooth. The axial walls were each

flared out 10 degrees from the vertical. All the internal line angles were rounded. No bevel was placed on any of the cavosurface margins. The finish line was a deep chamfer. For ideal resistance, the occlusal reduction should be at least 2-2.5 mm deep. The buccolingual width of the proximal box should be at least 2 mm as should the buccolingual. width of the occlusal cavity preparation. The isthmus should not be as narrow as for a gold inlay preparation.

Figure 11

The distal of the premolar was prepared as though it were to receive a DO inlay. The path of insertion of this inlay preparation was aligned with that of the MO inlay preparation in the molar so that they would both be parallel.

After the preparations had been completed, Liner Bond 2V was applied to all surfaces of the cavity preparations and light cured. The purpose in doing this was to seal the open dentinal tubules to increase patient comfort and reduce post-operative sensitivity. Another advantage with this technique is that when the patient returns for cementation of the permanent fixed partial denture, it will not be necessary to administer local anesthesia since the dentinal tubules will already have been sealed **(Figure 12)**.

Figure 12

A final impression was made using a quadrant arch, double arch tray utilizing the hydraulic and hydrophobic impression technique.

The preliminary impression was made after the teeth had been prepared for the Sculpture/FibreKor bridge. Next, 30-Second Blue Velvet was loaded onto both sides of a tray and inserted into place. The patient closed into MI and held that position until the material had set **(Figure 13 and 14)**.

Figure 13

Figure 14

The patient opened and the impression was held against the opposing arch. A small amount of 90-Second Flexi Velvet (J. Morita), a thixotropic, low viscosity material, was injected into each Blue Velvet impression of each tooth prepared for an inlay. The patient then closed back down into the impression and held that position until the material had set **(Figure 15, 16, 17, and 18)**.

Figure 15

Figure 16

Figure 17

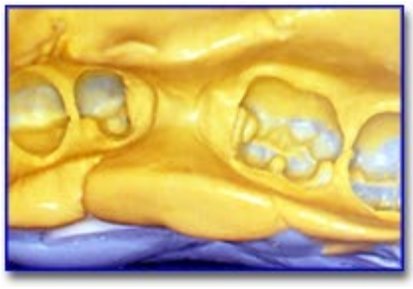

Figure 18

One advantage of using the hydraulic and hydrophobic impression technique was that it reproduced the preparations with a very high degree of accuracy. The hydraulic pressure generated when the patient closed into the 90-Second Flexi Velvet propelled the low viscosity material into every "nook and cranny" of the preparations. If some of your finish lines are subgingival, the hydraulic pressure will propel the 90-Second Flexi Velvet into the sulcus which will reproduce the finish lines exactly as well as all of the root anatomy in the sulcus. This is because the 90-Second Flexi Velvet is propelled under so much hydraulic pressure that it completely fills the sulcus and reproduces the entire anatomy of the root contained within the sulcus. Because you are using a closed mouth, double arch impression technique, the master and opposing casts will be articulated with great accuracy. All of this translates into highly accurate finished restorations requiring minimal adjustments. In fact, most of our cases drop into place and require almost no adjustment.

A second advantage of the hydraulic and hydrophobic impression technique is that it is very comfortable for the patient. You do not have to pack cord or place hemostatic agents. You can proceed directly from preparing the teeth to making the final impression. This. also saves chair time because you do not have to wait for the gingival tissue to stretch out and you don't have to wait for the gingival tissue to finally stop bleeding.

With the hydraulic and hydrophobic impression technique, we were able to achieve a highly accurate impression with maximal patient comfort. We also used materials which set rapidly, enabling us to make the final impression in under three minutes.

After the final impression was made, the preparations were coated with a water soluble lubricant. The pre-operative impression in 30-Second Blue Velvet was loaded with Photocore (J. Morita), a highly filled hybrid resin-composite used for building cores. The loaded pre-operative impression was inserted over the prepared teeth and light cured through the walls of the Blue Velvet impression. After being light cured, the provisional bridge was easily removed, finished, polished and cemented provisionally with Durelon (ESPE/ Premier), a polycarboxylate cement. The aesthetics during the interim were excellent and the patient was comfortable **(Figure 19)**.

Figure 19

When the patient returned for cementation of the permanent Sculpture/FibreKor bridge, no injection of local anesthesia was needed. The Liner Bond 2V applied at the prior visit scaled the dentinal tubules and protected the pulp from adverse stimuli. The ATD Bridge Remover was used to gently tap out the provisional Photocore bridge. The inlay preparations were debrided of Durelon cement and were pumiced clean.

The bridge was cemented with Panavia 21 (J. Morita), a filled resin-composite cement. The undersurface of the pontic was coated with a water soluble lubricant to make it easier to remove excess cement without damaging the undersurface after cementation. E&D conditioning liquid was applied to the inlay cavity preparations and blown dry after one minute. The intaglio surfaces of the inlay portion of the bridge were sandblasted with 50 micron aluminum oxide particles, then washed and dried. The intaglio surfaces of the inlays were etched for 10 seconds with Etching Agent V (37% phosphoric acid) and then washed and dried. One drop of Porcelain Activator was mixed with one drop each of the Liner Bond 2V base and catalyst and then applied to the intaglio surfaces of the inlays.

The Panavia 21 cement was applied to the intaglio surfaces of the inlays and the bridge was seated and held in place for one minute with finger pressure. Excess cement was removed with a stiff brush and explorer. A floss threader was inserted under the pontic to remove excess around and under the pontic. The margins of the inlays were covered with Oxyguard to eliminate the air inhibited layer and to ensure complete polymerization. After three minutes, the Oxyguard was washed off.

After the bridge had been cemented, excess set cement was removed with a scaler or twelve-fluted, 7406 finishing bur. The occlusion was checked and required minimal adjustment. Occlusion should not be checked until the bridge has been permanently cemented when all margins are bonded to the enamel and supported by cement. A finishing cup (Enhance, L.D. Caulk) was used for the final polish **(Figure 20 and 21)**. The aesthetics were great. And needless to say, the patient loved it!

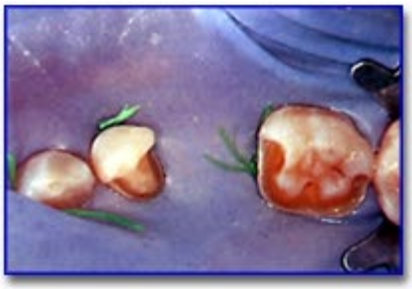

Figure 20

Figure 21

Multiple Single Units

Previously, we introduced an impression technique that relied on hydraulic pressure to produce highly accurate impressions of subgingival finish lines.

With this technique, you do not have to pack retraction cord and wait for the gingival tissue to be stretched out. You do not have to apply caustic, foul tasting hemostatic agents repeatedly to achieve hemostasis. You do not even need to completely isolate the prepared teeth from saliva.

The hydraulic and hydrophobic impression technique (a/k/a H&H) will consistently reproduce subgingival finish lines with unparalleled accuracy and definition, even in a hemorrhagic and wet field. And you will need only a fraction of the time and materials that are part and parcel of conventional crown and bridge impression techniques. And best of all, your frustration factor with capturing subgingival finish lines in the impression will drop to zero.

You should also consider just how much more comfortable the H&H impression procedure is compared with conventional impression techniques. Have you ever sat in the chair and had somebody shove retraction cord down into your sulcus? Hurts quite a bit during the procedure (and for several days after). And, have you ever tasted some of these hemostatic agents?

And then what happens when you do not get the impression the first time? You have to pack cord again and stretch out the gingiva some more, maybe tear some more of the periodontal attachment. Apply more of the foul tasting hemostatics. Waste more chair time. Is there anything you can say to the patient that will really make them understand why they have to go through all of that again?

Today, time is very important for most patients. With H&H you will have your patients out of the chair in record time. You can use impression materials that set rapidly so the entire impression procedure will require under four minutes! You will make a perfect impression the first time around and will not need to repeat the impression sequence a second or third time. Never a need for cord or hemostatics. No other impression technique can compete with the H&H impression technique for maximizing patient comfort and reducing chair time as well as reducing your frustration.

In this article we describe how you can use the H&H for multiple single units. To demonstrate this technique, we have selected a case with four adjacent teeth to be prepared for metal ceramic crowns, all with finish lines located subgingivally and all with gingival hemorrhaging immediately after the teeth have been prepared.

Clinical Case

The preoperative view shows the teeth in the maxillary left quadrant with failing amalgam restorations **(Figure 22)**.

Figure 22

The teeth were prepared for single crowns, the finish lines were placed subgingivally as dictated by the preoperative condition of the teeth **(Figure 23)**.

Figure 23

A dual arch impression tray was selected that passively fit the quadrant containing the prepared teeth. A correctly sized tray will fit loosely and you should be able to wiggle the tray around without it binding against the teeth or arch. Have the patient practice biting all the way down into MI with the tray in place.

Both sides of the tray were loaded with 30-Second Blue Velvet (J. Morita, 1-800-752-9729), a vinyl polysiloxane bite registration material and inserted to the proper position. The patient was coached into biting all the way down into MI (Maximum Intercuspation).

When the patient bites all the way down into MI during the impression procedure, observe how the teeth interdigitate on the contralateral side. The pattern of cusp-fossa interdigitation should indicate that the patient has closed all the way down into MI.

After the bite registration material had set, the tray and bite registration impression complex was held on the arch opposing the prepared teeth and the patient opened wide. The tray and impression is stabilized on the opposing arch and is not removed. It is held in position on the opposing arch.

The bite registration impressions of the prepared teeth were washed and dried. These bite registration impressions of the prepared teeth act as a highly customized tray. The prepared teeth were washed and dried to remove excess blood and saliva. A small amount of 90-Second Flexi-Velvet, a hydrophobic, low

viscosity, vinyl polysiloxane material was injected into each of the bite registration impressions of the prepared teeth.

Do not inject low viscosity material into the bite registration impressions of the unprepared teeth or around the prepared teeth. Only a small amount of low viscosity material is required. The patient then closed again all the way down into the bite registration impression.

In this second step of the hydraulic and hydrophobic impression procedure, when the patient closes into MI, the prepared teeth are thrust into the low viscosity impression material like pistons and generate a hydraulic force. This force propels the low viscosity material into the sulcus under sufficient pressure to displace blood and saliva. The low viscosity material is propelled with such a strong hydraulic force that it fills the entire sulcus and reproduces the entire subgingival finish line as well as the submarginal anatomy of the root.

It is critical during this second step in the impression procedure that the patient closes all the way down into MI. You should again coach the patient to close all the way down and tell the patient to "bite down hard" until the low viscosity material has completely set. We have found it helpful during this phase for the dentist to cup his hand under the chin of the patient to help the patient to remember to keep closed all the way down.

In the final impression, the subgingival finish lines were reproduced with great detail and were sharply defined **(Figure 24)**. Since the low viscosity material is hydrophobic, it will not incorporate blood or saliva but rather will bodily displace them when propelled into the sulcus under hydraulic force.

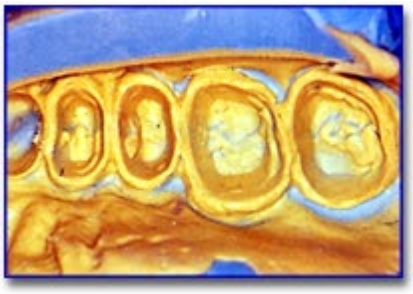

Figure 24

With this technique you can proceed directly from preparing the teeth to making the final impression. Do not stop to pack cord, apply hemostatic agents, etc. Just prep and impress. Insert your temps and the patient is out the door. The final restorations will require minimal adjustments because of the high degree of accuracy with which the dual arch impression procedure records the occlusal relationships of the opposing and prepared teeth.

The master dies had clearly defined finish lines and were easy to trim **(Figure 25)**. The crowns were prepared **(Figure 26)** and tried in **(Figure 27)**. They were easily seated and required minimal adjustments of the interproximal contacts **(Figure 28)**. Occlusal adjustments were minimal. MI was almost perfect. The patient had canine guidance and minimal adjustments in right and left lateral excursions were required **(Figure 29)**.

Figure 25

Figure 26

Figure 27

Figure 28

Figure 29

Troubleshooting

In order to save chair time' we recommend using 30-Second Blue Velvet (J. Morita), a thixotropic vinyl polysiloxane bite registration material to load the tray. It has the advantage of setting up within one minute after the tray has been inserted.

We also recommend using 90-Second Flexi Velvet (J. Morita), a thixotropic vinyl polysiloxane low viscosity impression material for the wash in the second step. Because this material is thixotropic, it does not run out of the bite registration impression of the prepared tooth after it has been deposited. It also has the advantage of setting up within two minutes after it has been injected into the bite registration impression of the prepared tooth and the patient closes into it. A typical impression procedure takes us no more than four minutes.

Discussion

This impression technique has enabled us to vastly increase our productivity and decrease our chair time while reducing overhead. By eliminating the need for retraction cord and hemostatic agents and all of the paraphernalia associated with them, we can reduce costs for materials and instruments.

By using a bite registration and low viscosity material that set rapidly, we save a tremendous amount of chair time. This is good for you and good for the patient. And we cannot emphasize enough just how much more comfortable this impression technique is for the patient as compared to conventional impression techniques.

And lastly we cannot emphasize just how accurate the occlusion will be on your crowns. You do not need to take a separate bite registration record which may introduce error into the articulation of your casts. You have the impressions and bite registration record all in one unit. This reduces steps in the procedure, reduces materials used, and increases the accuracy. We also cannot emphasize enough just how accurate the detail will be recorded in your final impressions. Every finish line will be sharply defined and easy for the technician to read.

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(The views expressed in this article are those of Dr. Kaplowitz and Dr. Hoos and do not represent the views of the U.S. Public Health Service or U.S. Coast Guard.)

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