

Impression materials— Are there any REALLY new ones?

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The most popular classifications of impression materials for precision restorations such as inlays, onlays, crowns and bridges are polyethers (PE) and vinyl polysiloxanes (VPS). But would you be amazed to know that PE were first introduced by ESPE (before the company was purchased by 3M) in 1965? Yes, Impregum has been around that long! How about DENTSPLY Caulk leading the way with VPS materials by bringing Reprosil to the market in 1982? A quick math check shows that there have been no other major category advancements on the material side of impression-taking in 28 years!

So what has changed and which of these changes really affect your chances of taking the perfect impression the first time?

Hydrophilicity

One of the main advantages of the PE over VPS products is the inherent hydrophilicity of the former. Actually, hydrocolloid, which still shares a very small segment of the market, is the epitome of this type of material. It is generally considered that the more hydrophilic a material is, the less likelihood that fluid in the sulcus or really anywhere else on the preparation will distort the impression. The hydrophilic material will merely

absorb the fluid and continue with its mission of registering an accurate and detailed impression. This property also goes hand-in-hand with the ability of the impression material to 'wet out' on the preparation and capture better detail. This latter property has enhanced my own personal experience over the years with PE, especially Permadyne (3M ESPE), which has long been one of my favourite materials.

But DENTSPLY Caulk trumped the market again with the first 'hydrophilic' VPS (Aquasil) in 1997. Since that time, there has been a race amongst manufacturers to create their VPS materials with as much hydrophilicity as found in PE. Note that hydrophilic properties in VPS products need to be additives, since these materials are not inherently hydrophilic as are PE. This race has escalated recently by several manufacturers showing what happens when you place a drop of water on a set or even unset mix of impression material. Presumably, if it beads up like water on a freshly waxed car, the material is not hydrophilic. But if it flattens out, it will do the same on a preparation in the mouth, showing it has enhanced hydrophilicity and wetting out ability.

The Reality Research Lab (RRL) has developed a more clinically relevant test, albeit more labour intensive. An acrylic model with prepared and intact extracted teeth is impressed with different materials after the teeth have been dried, coated with a glistening layer of water, or coated with a rather thick film of freshly captured saliva. Not only are the impressions and models from them examined closely, but full cast crowns are fabricated and marginal gaps measured under a stereomicroscope at 50x. A recent product comparison demonstrated virtually no differences between two popular materials.

On the other hand, bucking the hydrophilicity trend is one VPS marketed as 'hydrokinetic', which breaks down to simply mean 'moving water'. Well, you can't move water if you also love it, which is the essence of the meaning of 'hydrophilic'. There-

fore, another way of describing 'hydrokinetic' would be 'hydrophobic'. In other words, this product essentially returns to the early days when all VPS materials were hydrophobic. The RRL also tested this product, but the manufacturer did not specify another product as a control. This makes interpreting the data more difficult, although there were virtually no differences between the experimental groups, indicating that this product will perform as the manufacturer claims it will.

Does any of this matter when you are trying to take an accurate impression? Well, if the sulcus is filled with fluid, including blood, that is obscuring your margin, then it could definitely make a difference. If you are using a supremely hydrophilic material, you hope that the product will literally soak up the fluid similar to a sponge and, at the same time, register the impression.

On the other hand, if the material is hydrokinetic, the aim is to move the fluid out of the sulcus first and then capture the margin. Is this a better strategy? The answer is probably yes, since there is less chance that the fluid will distort the material, as it may do if it was absorbed. But if this strategy is preferred, why have virtually all manufacturers opted for the hydrophilic route?

One reason could be the mob mentality. If it works for one company, then other companies produce the same item with some slight tweaks. Another reason is that the concept flies in the face of the trend. Hydrophilic is the *in* concept, from bonding agents to cement to sealants. Why should impression materials be any different? And hydrophilic PE followed in the successful footprints of hydrophilic hydrocolloid. Finally, only one company thought of it.

So should you switch to a hydrokinetic impression material? Not necessarily. There are numerous other factors to consider, such as working and setting time, flow and availability in different delivery systems. All these criteria may be as or even more important than hydrophilicity.

And, of course, none of this matters at all if you use proper soft-tissue management BEFORE you even lay a diamond on the tooth. Preventing a bloody sulcus is much more effective than having to deal with it after the fact. This is my own personal mantra. I obsess over tissue management.

However, although this is an admirable goal, it doesn't always happen. Therefore, finding an impression material that will be 'forgiving' has significant value. This is why PE continues to

garner kudos from its devotees—these products tend to be less sensitive to moisture and have a terrific ability to wet out the preparation under adverse conditions.

_Viscosity and flow

This is an issue that goes back to how you prefer to take an impression. I personally prefer a very light body/heavy body combination. Therefore, I look for a light body material that syringes easily and flows well without being too runny, combined with a heavy body tray material that will push the syringe material firmly against the preparation and, at the same time, not run down the patient's throat. Less popular is a monophasic material for both the syringe and tray.

But very low viscosity syringe materials combined with heavy body tray materials is not new, although the RRL tests on flow using the Shark Fin device developed by 3M ESPE have found more recent selections with high flow. This means if you're like me, you no longer have to stick with one or two brands to get better flow in your syringe material.

_Hardness/stiffness

With the increasing popularity of closed-mouth impressions, especially with sideless trays, a more rigid or stiff material should work better by providing lateral support, although to my knowledge, this has never been shown in a clinical comparison. Nevertheless, there have been a few materials that the RRL has measured using a digital durometer that are indeed stiffer than the rest. Just don't be tempted to use a very rigid material for a full-arch impression, especially if you are using a well-fitting custom tray—you may need a 'knee-on-chest' manoeuvre to remove it from a patient's mouth!

_Dispensing options

Another area with some significant changes is mixing/dispensing. The hand-mixing of tube-based products in the past has been largely replaced with cartridge-based products mixed and dispensed using a ubiquitous automix gun. However, these guns are no longer exactly cutting edge, look like you bought them in a home-improvement store, and can make filling a full-arch tray a real challenge for an auxiliary due to the hand and forearm strength required for heavy body materials.

To overcome the disadvantages of guns, ESPE introduced the first electronic mixer in 1995.

There have been tweaks and speed improvements in these machines, which have been cloned by a handful of competitors over the ensuing 15 years, but the overall design is largely the same as the original version.

For syringe materials, at least two VPS products have unidose versions. While I like unidose packaging, it doesn't seem to have caught on with impression materials and has not been a real factor in product selection.

Intra-oral working time

Our thirst for speed has resulted in the availability of a number of very fast setting materials, which can be a real time-saver when you impress one or two teeth. The problem is when you try to stretch the use of fast-set materials for more than the aforementioned one to two units. The intra-oral working time of these fast-set materials then becomes a major issue.

Unfortunately, the working times provided by manufacturers are typically determined at room temperature. While this provides somewhat of a comparison between products, it doesn't really give you much indication about how much time you have between the inception of syringing the material around your preparation and when you need to seat the tray. For example, if you are taking a ten-unit impression, how much time do you have from when you syringe material around the first preparation and when you need to seat the tray? This is critical to know because the material syringed around the first of the ten preparations is already starting to set, which is accelerated by the heat and moisture of the mouth. If it sets too fast, the tray material will not bond adequately to the syringe material and you'll most likely end up with wrinkles or other types of distortion.

To my knowledge, there are only two extended working time VPS materials on the market, both of which were introduced in recent years. For large cases, it would be prudent to consider using one of them.

Tear strength

If you have ever removed an impression from a patient's mouth and found that it has torn on a critical marginal area, you know how important this property is. I recently took an impression for ten veneers in a patient who had open gingival embrasures. Normally, I would block out these embrasures from the lingual to prevent the im-

pression material from locking into them and tearing on the way out of the mouth. But I was using an 'improved' formula of a well-known material that had claims of high tear strength. Therefore, on this case, I decided to go for it and dispense with the block-out procedure. Sure enough, the impression tore. I took a second impression and it also tore.

The guru of tear-strength testing in my opinion is Dr Alan Boghosian, a member of the REALITY Editorial Team. Dr Boghosian and his colleague recently completed a test of eight impression materials for the RRL. The material I used that tore in the mouth scored in the middle of the pack, not quite matching the strength forecast by the manufacturer. To be fair, even though the impressions I took did indeed tear, the margins were still captured and the veneers seated beautifully.

Nevertheless, since a torn impression can ruin an otherwise perfect effort, it would be wise not to tempt fate and block-out areas that could cause tears, such as the aforementioned open embrasures, assuming, of course, these areas don't need to be captured.

What to use?

Many aspects of taking an impression are personal. For example, you get to select the material that meets your flow and set-time requirements. But beyond that, don't get too caught up with marketing slogans such as "vinyl polyether silicone" or "polyeasier". There are still only two real classes of impression material, same as they've been for the past 28 years. And remember—no impression material can do it all. To get the best of all worlds, you probably need to stock two or three different types to cover all clinical situations as efficiently and productively as possible.

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