Evidence has shown that one of the biggest challenges facing dentists today is restoring severely damaged teeth. In order for these restorations to be long lasting, certain biomechanical and biochemical criteria need to be met. Even the smallest of cavities can result in dramatic failure owing to poor material choice and incorrect biomechanical interaction between the tooth and the material.

We often see cases where a small cavity was restored with amalgam a few years prior. The amalgam itself meets the material criteria but the biomechanical issues are clearly evident and cause severe cracks to develop. These cracks could lead to complete failure of the restoration with loss of vitality of the tooth, and possibly even loss of the tooth. Amalgam has long been relied upon as a durable restorative material. But what value is a restoration itself if it fails? The final objective should be one that lasts for 20 years if the tooth fails. This means the surrounding tooth structure is strong enough to function with the restoration material inside. It is recommended that you need between 2-3 mm of wall thickness in order to maintain good intrinsic strength. It is clear that if we respect these criteria and the cavity ends up with very thin and undermined walls, biomechanical failure will occur.

Cavity design

When it comes to restorations of this nature there are two goals: to stop crack propagation and stopping new cracks from forming. To achieve this you will need a good material and a sound approach. When it comes to cavity preparation, the sharper the angles, the higher the stress is created in the cavity. The difficulty today is that as dentists we often have to redo restorations with existing cavity designs for amalgam but restore those cavities with another material.

In addition, the tooth will also be damaged to some extent. Our challenge is to minimize this damage by making good choices in cavity design and material. The principles of cavity design are well established: the width of the cavity should not exceed half of the intercuspal width. This means the surrounding tooth structure is strong enough to function with the restorative material inside. It is recommended that you need between 2-3 mm of wall thickness in order to maintain good intrinsic strength. It is clear that if we don’t respect these criteria and the cavity ends up with very thin and undermined walls, biomechanical failure will occur.

Fig. 2f: Pre-operative.—Fig. 2g: Occlusion and articulation should be considered to guide the layering for final morphology. Isolation with a rubber dam is recommended for a controlled protocol, optimal view and access.—Fig. 2h: Cavity after removal of the old restoration shows decay.—Fig. 2i: Another view of the decay under the old amalgam restoration.—Fig. 2j: Cavities removal and finalisation of the cavity preparation.—Fig. 2k: Cavity after the bonding procedure.—Fig. 2l: Sectional matrix placement and separation ring, a wedge adapts the matrix to the tooth in the cervical area.—Fig. 2m: Build-up of the mesial wall in two consecutive separately light cured layers.—Fig. 2n: Internal build-up with everX Posterior.—Fig. 2o: Finalised occlusal morphology.—Fig. 2p: Final result.—Fig. 2q: Follow up.

Our biggest problem here is that we get cavities like this to start with. It’s not necessarily our choice to drill a cavity like this for caries removal. Often times an old amalgam restoration can lead to this type of cavity and the temptation is to keep the remaining tooth structure to enable a direct restoration. The tendency is to keep those cusps tips, as references for occlusal morphology and to preserve as much tooth tissue as possible. Because the walls are clearly not thick enough the load bearing forces will create fatigue within the cusps. Even with a bonded restoration, this fatigue will eventually cause the wall to fracture. The following clinical situations call for cuspal coverage:

1. A wide isthmus and thin walls.
2. If there is no dental support and cusps are undermined—blocking out the unsupported enamel will not solve the problem because curing a composite inside a shell will fracture it.
3. A horizontal crack in the undermined base of the cusp.
5. Any crack inside the pulpal chamber.
6. An endodontically treated tooth with MOD restoration requires coverage for all cusps.
7. An endodontically treated tooth with a crack in the pulpal floor requires all cusps to be covered.

everX posterior

What is needed for these restorations is a material that will bond to the tooth. This is not a guarantee that the restoration will work, but some sort of adhesion is required that is not mechanically retained like amalgam. What is needed is a material that behaves like tooth structure, something that resists fatigue and also increases the load bearing capacity of the total restorative complex of the tooth with the restoration.

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Jonathan C. Ferencz, USA
Changing Daily Restorative Dentistry: CAD/CAM Dentistry

Changes to the type of problems we have discussed in this article. It is made up of three sections: an interpenetrating polymer network (IPN) resin matrix, e-glass fibres and fillers, initiators and inhibitors. What is really important in a material like this, is the way in which the e-glass fibres and the IPN matrix interact with each other because this makes it possible to absorb the loading forces. This transfer of pressure from the matrix to the fibres on a microscopic scale means that crack propagation can be stopped while at the same time giving the restoration the capacity to resist very high loading forces. The maximum bite force for humans is about 1,500 N. A conventional composite has a similar resistance. However, if you compare a combination of everX Posterior, which is a base material that should be covered with an overlaying composite, the total load bearing capacity is much higher than with composite alone, even “almost double”.

Fracture prevention

Some dentists are misguided when they think that a tooth can be saved by using a very strong material. In actual fact, when using such a strong material, the tooth inadvertently becomes the weaker part of the restorative complex. This means that if failure occurs, the tooth will fail first. With this everX Posterior, in the case of failure, the damage can be contained. Cracks can be deviated along the material inside the tooth, resulting in fractures which are more above gum level, instead of running through the entire tooth leading to catastrophic failure. It will still fail, but will allow for further restoration because the fracture line is still visible and accessible. Fracture toughness is another physical property which is twice as high in everX Posterior than in conventional composites. The flexural modulus is closer to that of natural dentine, so it behaves like natural tooth structure. While the build-up procedure of the material allows for a well-functioning restorative complex, it’s how the material shrinks that matters. The volumetric change and shrinkage stress of the material after and during setting is similar to that of conventional composite, but a very big difference is the presence of the fibres. By placing the material in the cavity and by pushing it down, you are able to align the fibres into a more longitudinal direction which reduces linear shrinkage. With the vertical shrinkage you can expect the entire restoration to shrink down, but this won’t create the same stress as a regular composite. The linear stress and shrinkage on the wall is lower giving you a more predictable outcome and minimised damage. By using everX Posterior as dentine replacement and layering it with a regular composite, the total load bearing capacity of the tooth complex will increase significantly. Therefore it makes sense in both direct and indirect approaches to have the support from a fibre-reinforced composite underneath.

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Stephanie Browet attended dental school the Free University of Brussels in 1995 and completed the Post Graduate programme Aesthetic Dentistry. Nationally and internationally he lectures on rubber dam isolation, microscope dentistry, posterior and anterior composites as well as indirect restorations. He maintains a private practice focusing on microscope assisted restorative dentistry. He can be contacted at info@stephaniebrowet.com.

Jennifer Tapia-Alliker currently owns a private practice specialising in aesthetic and restorative dentistry in Madrid, Spain, and frequently presents lectures on topics such as composite identification techniques, dental photography and computers in dentistry.

Additional tips for using everX Posterior

• everX Posterior should be completely enclosed by the other material.
• First close the proximal, then the occlusal.
• Use a ball plugger or microbrush to adapt the material to the floor and take your time.
• Light-cure in layers of 2mm thickness.
• When adding the final layer of regular composite, use air block during the final light-cure to create a surface with a good finish and without an oxygen inhibited layer.
• Always respect manufacturer guidelines for maximum rotation speed for polishing points – avoid heating because it will change the properties of the material.
• For final surface polishing.