

# PROVISIONAL RESTORATIONS

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The utilization of provisional restorations in dentistry can have many functions. They act as a diagnostic tool to determine occlusion, function, esthetics and phonetics, tooth position, length and width, occlusal plane and smile design. They maintain tooth position and prevent occlusal changes during the fabrication process of an indirect restoration. This is crucial for an easy delivery of a restoration. Additionally a provisional eliminates sensitivity and allows for the development of gingival contours before the final restoration is delivered.

## Biological Criteria

A provisional should protect the underlying tooth structure from the oral cavity. The main function is to seal out bacteria and thermally protect the tooth. The sealing of tooth structure decreases osmotic activity between the dentinal tubules and the oral cavity. Saliva leakage is another cause of sensitivity which can be prevented with a low solubility provisional cement and good marginal adaptation of the provisional. Exothermic temperature setting of the provisional material can also effect the pulpal tissues causing possibly irreversible damage to the pulpal tissues necessitating future endodontic treatment. <sup>[1,2]</sup>

Good marginal adaptation, anatomical contour and a smooth surface are critical for a provisional to facilitate oral health. This is particularly important when placing subgingival margins so that tissue health is ideal for cementation. Rough, over contoured or under contoured margins can contribute to plaque accumulation and make it difficult for proper oral hygiene.

This may lead to compromised gingival health which can significantly affect the overall health of gingival tissues. <sup>[3]</sup> This could compromise the esthetics of the final restoration due to gingival inflammation or gingival recession. The restoration should promote healing of the gingival tissues and the development of proper gingival contours so that the final restoration can be delivered without any tissue damage or bone loss. <sup>[4]</sup>

The positioning of the tooth is also maintained by the periodontal tissues such that any provisional not keeping the tooth in a stable position may lead to adjustments or potential remakes of the restoration. <sup>[5-8]</sup> Difficulty to place the final restoration may also occur due to bleeding or hypertrophied gingival tissues being incorporated under the margin during the seating process.

## Mechanical Criteria

Functional loading during mastication causes the highest stress levels imparted on a provisional restoration during the day (80-100 lbs/in<sup>2</sup>), while parafunctional habits may place 8-10 times higher loads nocturnally. This makes it crucial to have an ideal stable occlusion on the provisional whether it be a single unit or more critically for a provisional with numerous teeth involved and/or pontic spaces. The longer the span of a provisional bridge the greater the flexure which creates high stresses on the connectors potentially causing premature failure. <sup>[9]</sup> The correction of occlusal problems is often done with provisionals to develop the proper bite pattern. Provisional restorations provide an opportunity to develop proper occlusion prior to the fabrication of the final prosthesis. <sup>[10]</sup>

Obviously provisionals fabricated from methacrylates, BIS-Acryls, and BIS-GMAs are inherently weaker than ceramic or metal restorations hence the thickness of the material at the connectors needs to be larger due to the forces it must withstand during provisionalization. <sup>[11]</sup> In the anterior dentition it may be more difficult to achieve ideal esthetics due to the increased size of the connectors, or strength may need to be compromised to accommodate for esthetics. That does not mean that the connectors should be over contoured though, this may lead to plaque accumulation and potentially poor oral hygiene by not allowing for adequate space for hygiene.

If a provisional bridge is under a lot of functional loading and requires additional strength they may be reinforced with fibers or metal wire. In some instances a cast metal provisional is the best option for optimal strength and gingival health. The methacrylates offer the highest strength properties when compared to the typically more brittle BIS-Acryls. The newer BIS-GMA based provisional materials offer strength levels comparable to the methacrylates in addition to the esthetics of the BIS-Acryls.

In the case of implants or large restorative cases, provisionals must withstand occlusal loads and remain functionally stable so as not to allow the teeth to have micro-movement which could lead to failure of an implant to integrate or necessitate re-fabrication of the final prosthesis.

## Aesthetic Criteria

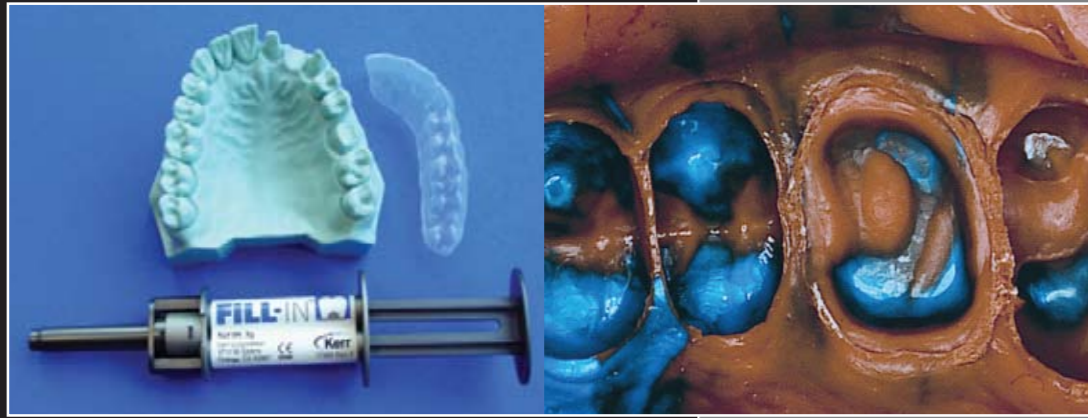
The appearance of a provisional restoration is important when working in the anterior dentition. The ability to match adjacent tooth color, create good marginal adaptation, ideal tissue adaptation and allow for good oral hygiene. Being able to modify a temporary after it has been placed to allow for additional esthetic modification is important. Out of the three different types of provisional materials the methacrylate based materials offer the least amount of color modifications. The use of BIS-GMA based materials allows for additional color modification with the use of resin tints and composites due to the similar material chemistries. The same modifiers can be used with the BIS-Acryls however they are not as durable and can potentially peel off due to the differences in material chemistries. Color stability for highly demanding esthetic cases and or long term provisionalization can influence material selection.

Some resins are porous and can absorb or trap stains which may be esthetically unappealing for long term use as a provisional. <sup>[12]</sup> A highly polished surface is less likely to trap stains and can look esthetically appealing for months. Numerous provisional sealants are made to provide a smoother surface after modifications have been made as well as to reduce any potential surface defects that may collect stain. These sealants decrease water absorption and staining. Some resins may have a yellow discoloration over time due to the amines within the catalyst but for short term provisional uses it is typically not an issue.

Provisionals are often utilized to determine the aesthetics, gingival architecture and function of the final restoration as well as providing critical information to the laboratory for the fabrication process. A material such as the BIS-GMA based systems are ideal due to the ability to contour and shape the material but also the ability to add to the material by using resin adhesives and composites followed by light curing. Once the final contour is achieved, an over impression may be taken and sent to the laboratory to create a model for the technician to utilize to fabricate the final restoration with the same dimensions that are functioning and acceptable to the patient.

## Selection of Provisional Materials

As previously outlined the provisional material must fulfill the biological, mechanical and aesthetic criteria previously outlined. There are two basic categories based on the chemistry of the materials. Both types have advantages and disadvantages for their use. The methacrylates can be divided into four subgroups: methyl-methacrylates (Jet/Lang Dental), ethyl-methacrylates (Snap/Parkell), vinyl-ethyl-methacrylates (Trim II/Bosworth) and methylethyl-methacrylate (Unifast LC/GC America). These materials have been available the longest. These materials have good fracture resistance and polishability but have a higher capacity for shrinkage and less esthetic appeal compared to other materials. "The other categories of provisional materials are the composites BIS-Acryl and BIS-GMA resins. BIS-Acryl resins have an aesthetic advantage over the methacrylates but are often more brittle and not suitable for long spanning bridges." BIS-GMA resins have the fracture resistance properties of methacrylates and the aesthetics of BIS-Acryls allowing for the best properties from both materials to allow for ideal aesthetics and the ability to utilize the material in long span bridges. Materials in this category include Fill In/Kerr, Luxatemp/DMG.



## Provisional Fabrication

The utilization of a pre-made stent can simplify the chair side fabrication process. There are numerous ways to fabricate a stent utilizing different materials. Stents may be formed prior to a patient's appointment or fabricated at the time of treatment.

## Stents

A 0.020 in (0.5 mm) vacuform polypropylene thermoplastic can be used as a stent for provisional fabrication chair side. The sheet material needs to be rigid enough to maintain the shape of the teeth while also being flexible enough to remove easily. This technique utilizes a preliminary model, vacuform machine, and thermoplastic sheet material. The initial model can be waxed up to ideal contours and then duplicated to use in the vacuform machine (as a wax up would distort and melt if used in the machine) or small contouring of the original model and or the addition of composite to alter the shapes of teeth along with denture teeth to be used as hollowed out shells or use in pontic spaces to create missing teeth. The advantage of this technique is that any aesthetic modification of the model can be done prior to the patients appointment such that the patient can leave the appointment with provisionals that closely resemble the shape of the final prosthetics and allows the patient the opportunity to test drive the new teeth prior to fabrication of the final prosthetics.<sup>[13]</sup> The disadvantage of this technique is that the diagnostic model requires an additional appointment to take the impression as well as the lab time involved to fabricate. Additionally, the stent does not recreate the fine detail very well such that contouring and adjustment will still be necessary as well as the removal of excessive material at the margins of the restorations.

Chair side fabricated stents can be done much more quickly providing more surface detail and less contouring and adjustments will be necessary to achieve an aesthetically pleasing result. Various materials can be utilized ranging from alginate, polyvinylsiloxane (PVS), polyether, and thermoforming wax. An over impression of the area to be worked on as well as some adjacent teeth so as to reposition the over impression upon completion of the tooth preparations is necessary. Alginate impressions are easily distorted and are not very rigid. For only one or two restorations this may not pose a problem, however for more involved restorations or longer spans this may contribute to more occlusal discrepancies or having to remake provisionals which will increase chair time. Additionally, alginate requires a moist environment so as not to dehydrate and distort. Therefore an alginate can not be stored and used again in the future should the patient break or loose their provisional a stent for refabrication would not be available.

PVS materials are an excellent choice for chair side and lab fabricated stents due to their ability to capture fine detail and be stored for future utilization. PVS materials vary in their rigidity and viscosities. One should experiment with the handling of the materials to find one that works for their specific requirements. The author suggests using PVS bite registration materials for posterior restorations where occlusion and shape of existing tooth structure does not need to be modified. In the anterior dentition it works well also for crown and bridge, however for veneer provisionals it may be too rigid and cause the final provisionals to fracture upon its removal from the mouth. A light body with a heavy body or a medium body viscosity material may be better suited for veneer provisionalization.

Polyether materials work the same as the PVS however their limitations for being more expensive and having distortion over time make it less desirable.

Thermoplastic waxes can be utilized at chair side for posterior provisionalization where the shape and occlusion of the existing tooth structure is to be maintained. This can also be used for the anterior however for veneer provisionals it again may be too rigid causing possible breakage of the provisionals upon removal.

The utilization of clear stents made from either polyvinyl impression materials or polypropylene vacuforms along with dual-cure provisional materials (BIS-Acryl and BIS-GMA) can allow for faster fabrication due to the ability to cure the material thru the stent. If a stock tray is to be utilized with a polyvinyl impression it needs to be clear so as to allow for light transmission to the underlying provisional material which may cause incomplete curing of the material and or possible distortion upon removal. However, it should be noted that the set times on many provisional materials currently available are within 1-2 minutes which is usually fast enough to not require the utilization of clear materials.

## Fabrication of PVS Provisional Stents

A prefabricated tray is loaded with the impression material or bite registration material of choice depending on ones desired rigidity and set times. Typically the material should extend one tooth in front and behind the prepared tooth/teeth to act as vertical stops when seating the stent. Place the loaded tray over the tooth area to be prepared wait for the material to set and then remove and set aside for later use. This process can also be done on a diagnostic model that has been waxed up to the desired contour to mimic the form and function of the final restorations.<sup>[14]</sup> Any areas that have large embrasures or where there is interproximal flash it may be desirable to remove it so that the impression stent will be reseated easily. Prior to utilization of the stent it should be tried in to verify complete seating. Upon completion of the provisionals the stent can be placed in a plastic bag with the patients name and tooth number(s) so as to be reused should the provisional break. Should a tooth be fractured or missing or simply need recontouring prior to fabricating the stent some composite can be placed on the tooth structure and cured without the use of a bonding agent such that it can be easily removed but still hold its shape to fabricate the stent. A missing tooth can be replaced by bonding in a denture tooth also.

Placement of the stent with the uncured resin in it on the tooth structure does not need a lubricant placed on the tooth structure. However, it should be noted that if there are undercuts in a preparation or if adjacent preparations are not paralleled in their line of draw a provisional will not come off of the preparation after it is fully polymerized or it will break in the removal process or be distorted. Upon completion the provisional is removed from the stent and any flash is trimmed off. The provisional is tried in to verify the fit, contacts and occlusion and adjusted if necessary then polished.

## Finishing and Polishing the Provisional Restoration

Gross shaping can be achieved utilizing an acrylic bur, diamond or stone. Final finishing can be done with finishing discs and or pumice and a rag wheel on a lathe. A surface sealant for temporaries may be applied to anterior teeth to give a high luster and stain resistant surface. The surface of the provisional should be wiped with alcohol gauze prior to the sealant placement to remove any debris as well as the remaining oxygeninhibited layer and ensure proper adhesion. A thin layer of provisional glaze can be brushed on to the restorations surface, air thinned to avoid further occlusal adjustments and then cured with a handheld light.





## Provisional Repairs

Should it become necessary to add material to the provisional due to bubbles, chips or defects the area can be added to with a flowable composite provided it has not been contaminated and an oxygen-inhibition layer still exists. If this is no longer present the surface can be roughened with a diamond which will allow for mechanical retention for new composite to be placed. An adhesive resin can be placed over the roughened area followed by a flowable or traditional composite and then cured to completion. If a margin is damaged continue to finalize the provisional and upon cementation the marginal defect can be filled with flowable composite with no addition of a bonding agent. The flowable will have some adhesion to tooth structure but nothing permanent due to not utilizing a bonding agent or etchant. However, it should be noted that it may take slightly more pressure to remove the provisional in the area of marginal repair due to the inherent adhesion of the flowable to cut tooth structure.

## Temporary Cementation of Provisionals

Temporary cements should provide good retention with easy retrieval as well as sealing the tooth structure to reduce microleakage and sensitivity. Retention of the provisional is somewhat due to the film thickness of the temporary cement used. <sup>[75]</sup> Too thin a viscosity and the provisional may dislodge between appointments; and too thick may cause difficulty in seating the provisional completely causing potential fracture. These problems may be overcome by placing the temporary cement on the margin and lateral walls of the interior aspect of the provisional. Seating the provisional restoration slowly will disperse the material throughout the restoration and decrease the hydraulic forces that may inhibit complete seating.

Zinc oxide-eugenol (ZOE) cements have been shown to inhibit bond strengths of both composites and bonding systems. <sup>[76]</sup> Utilizing a sandblaster/microabraider on the dentin is advisable to remove any microscopic pieces of

provisional cement and provide better adhesion of the permanent luting agent. <sup>[77]</sup> Prophy jets which utilize sodium bicarbonate solutions are also good devices to remove debris.

Lots of different temporary cements are available to dentists. Auto-mixing has replaced most hand mixed cements for ease of use and cleanup as well as less waste. Durelon is an excellent temporary cement for provisionals that have low retention, such as onlays. The cement adheres well to provisionals but even better to tooth structure due to chelating to dentin. However, its film thickness is too thick

Non-eugenol based cements are utilized most often due to their ease of use and clean up. The adhesion of non-eugenol based cements is low, requiring more retention to be derived mostly from the provisional restoration. Eugenol based cements are utilized for their soothing effect on tooth structure but due to resin inhibition by eugenol based products they are not advocated for use under provisionals if a permanent restoration is to be placed with a resin luting or bonding agent.

Resin cements are appealing if a clear or colored material is desired due to aesthetics. Colored provisional cements are ideal due to the ability to mimic tooth structure whereas the chalky white provisional cements would often be undesirable in the anterior portion of the mouth. These materials typically have an antibacterial agent added to inhibit bacterial growth during provisionalization.

BIS-GMA direct placed resins for inlays and onlays. This category of materials is very convenient for the provisionalization of conservative inlays and onlays where traditional provisionals might lock into undercuts in the preparation design making it difficult to retrieve them. There are only a few of these materials on the market (Temp-Fill by Kerr and Syntace by Ivoclar). This class of provisionals are placed into the preparations and then contoured with hand instruments prior to light curing. Upon completion of curing any excess material can be removed with hand or rotary instruments. These materials have a higher level of water absorption than traditional provisionals it is by this means that the materials stay in place since they do not utilize any temporary adhesive. The swelling of the composite based material through water absorption allows the material to mechanically hold itself in the preparation.

However, most patients will start to have some discomfort upon chewing by day 10-14 due to the increased level of water absorption and percolation effect on the exposed dentinal tubules and odontogenic processes.

There are numerous types of restorations that require provisionalization, none of which are ever the same. This requires the ability to modify ones techniques and materials to obtain consistent quality provisional results. Provisionalization of teeth is not as simplistic as it is often portrayed. A conscious effort to select the proper materials and cements so as to get consistent marginal accuracy, a good sealing of the tooth structure, creating the ideal contours for gingival health, achieving perfect interproximal contacts and functional occlusion can be difficult.

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# BIOGRAPHY



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Dr. Snyder attended three years of college at the University of California at Riverside, forgoing the last year and a Bachelor's of Science Degree to enroll early into dental school. Dr. Snyder received his D.D.S. in 1994 from the University of California at Los Angeles, School of Dentistry. He subsequently completed a General Practice Residency at the V.A. Medical Center, La Jolla, California.

In 1995, Dr. Snyder returned to the UCLA School of Dentistry. As faculty in UCLA's Center for Esthetic Dentistry (CED) he co-developed and was co-director of the first and only comprehensive two-year postgraduate program in Esthetic and Contemporary Restorative Dentistry. He still maintains his faculty status at UCLA in the section of Biomaterials. Dr. Snyder is also a faculty member at Esthetic Professionals training facility.

Dr. Snyder distributes his time between private practice, teaching, and research. His research deals with all facets of contemporary aesthetic and cosmetic dentistry, dental materials and techniques. In addition to lecturing internationally, Dr. Snyder had authored articles for various dental journals and writes correspondence courses for home study continuing education. Furthermore Dr. Snyder is a consultant and clinical evaluator of materials and products for many prominent dental manufacturers. His current focus is on education and advancing the field of contemporary esthetic, cosmetic and adhesive restorative procedures in clinical dentistry.