Oral splints - It's all about the bite!

By Terence Whitty

Oral splints come in a plethora of designs and are amongst the most popular non - surgical means by which dentists treat pain in the jaw muscles and TMJ, often known as temporomandibular disorders (TMD). They are also used for bruxism, clenching and repositioning the mandible. In orthodontic specialties, splints are often used as a device to assist in permanent bite opening and also to stop brackets being dislodged. Splints are also great at reducing damage to veneers and other long term dental restorations.

Despite the extensive use of oral splints in the treatment of TMD, bruxism, etc their mechanisms of action remain controversial and the jury is still out on a definitive scientific explanation of their effect. The good news is that if the various hypotheses that have been proposed to explain their apparent efficacy (i.e., true therapeutic value) are inconsistent, then results of anecdotal evidence from patients would appear to keep the treatment success relatively high. Even if treatment is not completely explained, they can still be used effectively for many cases.

There are many ways splints are constructed traditionally; splints are made from hard acrylic using the "pack and press" method or the newer, advanced "low residual monomer" injectable self-curing acrylics. Acetyl resins and polyolefin are gaining popularity too, as are materials like PEEK (Polyether Ether Ketone). Thermoforming is another popular method of fabricating splints as it allows various materials to be used such as polycarbonate and polyurethanes. Other materials that are popular include methyl methacrylate and some composites.

Figure 1. Flat plane Michigan-style splint.

Figure 2. SVED-type splint.

Figure 3. Non-Permissive splints are gaining popularity.

Figure 4. GELB Splint.

Regardless of the process used to manufacture the splint, the main clinical objective is ease of fit and durability. Considering that the splint is mainly tooth borne and covers all of the maxillary or mandibular teeth, it is reasonable to assume that an accurate impression with impeccable cross arch accuracy is mandatory.

Unfortunately, this is often easier said than done. Alginates are fine to use for the impression, however, these need to be treated with care and the impression should be poured up as soon as possible. From experience, polyvinyl siloxanes give the best result, however it's always important to use the correct trays and follow the manufacturer's instructions.

Often an overlooked issue when taking any impression is impression trays that are too flexible. Looking at Figure 5 you can see a diagram where the ductile impression tray is flexed during impression taking, then on removal the tray will revert back to its former shape causing distortion of the impression see Figure 6. Often this distortion is hard to notice when checking the impression as it may be minute, however, in a full arch appliance such as an oral splint, it is detrimental to the fit even if only slightly.

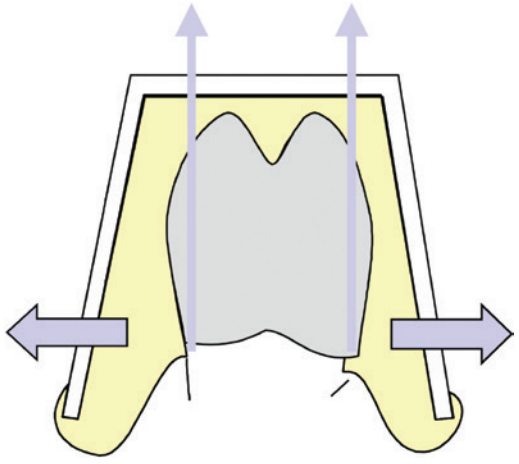


Figure 5. Bending open a ductile tray while using some impression materials.

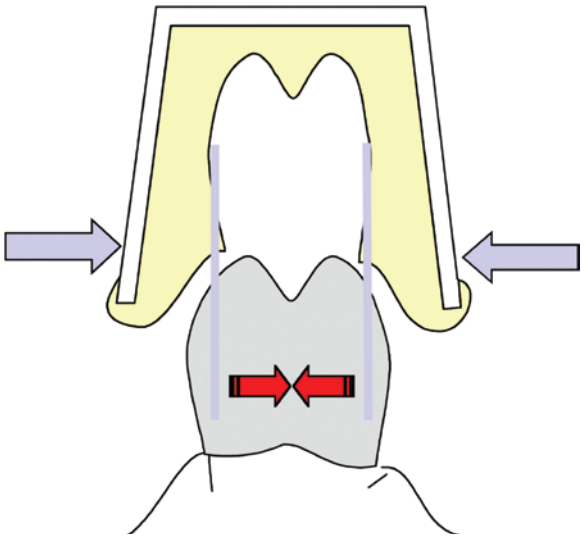
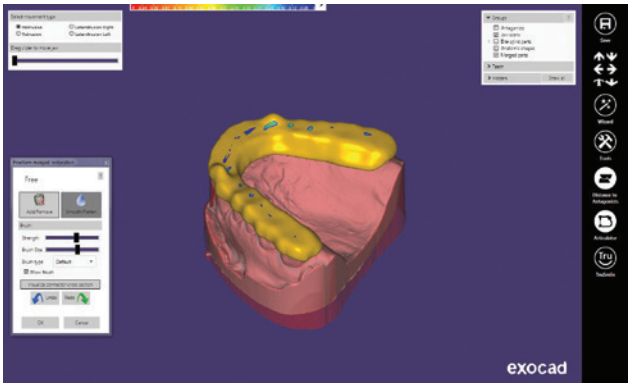
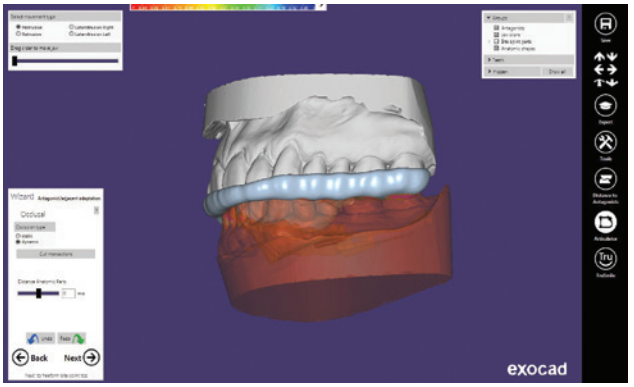
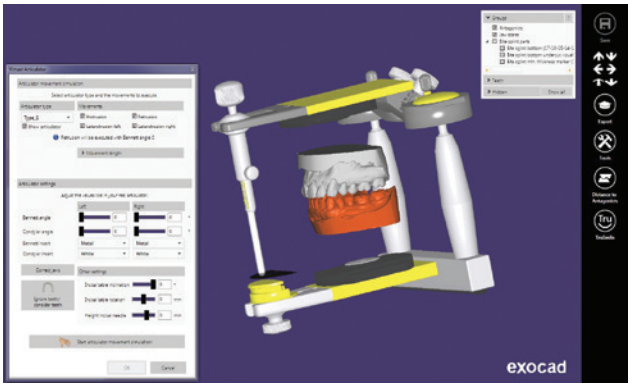


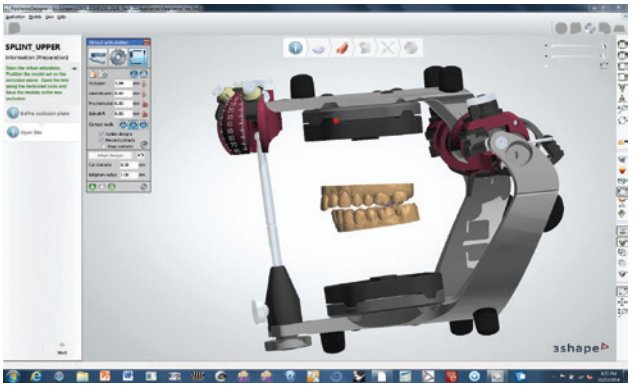
Figure 6. On removal, the tray flexes back and causes distortion.





Figures 7 and 8. CAD designing a splint.





Figures 9 and 10. In most cases, simply opening an articulator will not give you an accurate bite position for a splint.

Intraoral scans (i.e. digital impressions) are now becoming more common and are an alternative to conventional impression taking. Whereas digital impressions are popular in restorative dentistry, they are equally suited to splint making. Digital impression taking systems give immediate feedback as to the integrity of the scan (i.e. impression) and this helps in creating a higher level of precision and accuracy than traditional means. Intraoral scans have now reached a level of accuracy and repeatability that can easily be relied on if the scan is taken correctly. It's very rare for an intraoral scan to be distorted, however it can happen as nothing is 100% perfect.

If an intraoral scanner is used, then you will need a CAD package to take that digital information and design the splint. Once you design your splint, you can then send it to your favourite milling machine or 3D printer if the appropriate material is available. Common materials for milling are PMMA, PEEK and acetyl resins.

When constructing a splint, people often believe that placing two models or scans on an articulator - be it a real or virtual one - and opening the articulator to simulate a bite opening, then making the splint accordingly to that bite opening, will yield accurate results. This may work in some cases but often, especially with TMD patients and bruxers, nothing could be further from the truth. In the real world, it just does not cut it so a better way must be available. There is, read on.

Figure 11. Simple, effective wax bite.

Figure 12. Distorted bite registration material = headache.

Figure 13. This material is quite good but the bite is over-closed.

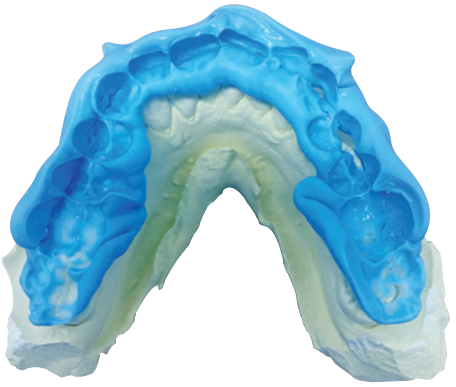


Figure 14. Complete bite through of registration material = not useful.

Figure 15. Using cotton rolls to assist with taking a construction bite.

Figure 16. Syringing bite registration material in 3 large places... it's important to have anterior support.

One of most frustrating aspects of splints tends to be grinding in of the bite in the mouth which can be a tedious task and just wastes valuable chair time. Amazingly this can be eliminated in most cases or at least dramatically reduced. A little extra time taking a "construction bite" while the patient is in the chair can really mean the difference between success and failure as this type of bite will definitely help.

The construction bite may be a new concept to some but in the orthodontic profession it's a must when making functional appliances for example. It's a bite that is taken in a specific position that the appliance will then be manufactured to exactly. The idea being if the jaw relationship can be captured at a specific point then it follows the appliance will fit exactly to that recorded jaw relationship.

This can easily be applied to oral splints as well. The concept is the same. Simply take a bite that simulates exactly where the splint will be in the patient's mouth and of course be careful not to over close the patient or have the patient go into protrusion during this bite taking.

Most importantly, always check the posterior opening of the construction bite - many agree that ideally this should be 2-3mm in the thinnest sections or largest cusp to shallowest fossa. The idea if a "micro thin" splint usually leads to breakage and the reality is a few mm or more posterior opening is easily tolerated by the majority of patients.

Figure 17. Bite registration material transferred to model.

Figure 18. Milled splint in PMMA.

Figures 19-21. PMMA milled finished splint; 3D Printed splint from thermo memory material; Polyolefin splint.

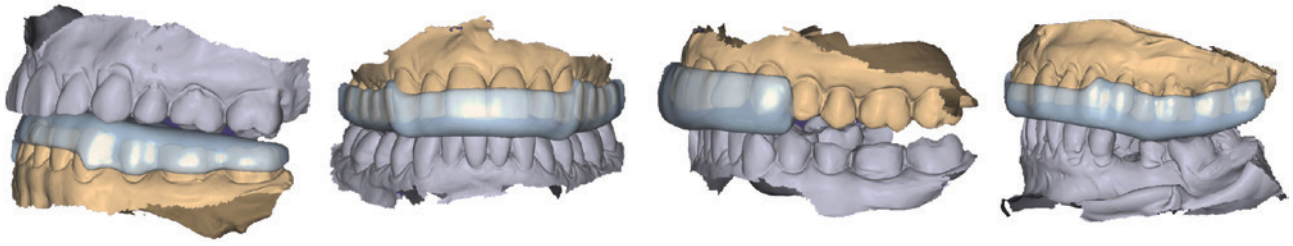


Figure 22 Various digitally designed splints.

There are many ways to take a construction bite and various tools to assist you but the simple use of bite wax is most likely the easiest method as long as the patient does not over close. Of course many opt for the convenience of various bite registration silicones as these are easily dispensed in the mouth and used with caution, can work very well. The downside of these materials are they can distort easily on setting and get brittle. Always go for a good quality hard but flexible material that can be trimmed with a scalpel if need be by the lab for a correct fit.

Leaf gauges and George gauges can be useful as they help with measuring the anterior opening but be aware it's the posterior opening that is often overlooked as it's the hardest to see and its very important that is the correct opening too.

Of course a construction bite can be used with an intraoral scan as well. It's done in the similar way and then the scan is taken of the bite relationship. The software will then match the upper and lower scans to this construction bite ready for design to the exact recorded bite relationship.

With practice, you will be taking a construction bite quite easily and quickly and ultimately it will have a massive difference to your whole splint experience and more importantly will save you a ton of time.

About the author

Terence Whitty is a well-known dental technology key opinion leader and lectures nationally and internationally on a variety of dental technology and material science subjects. He is the founder and owner of Fabdent, a busy dental laboratory in Sydney specialising in high tech manufacturing. Using the latest advances in intra- and extra-oral scanning, CAD/CAM, milling, grinding and 3D printing, most specialties are covered including ortho, fixed and removable prosthetics, computerised implant planning and guidance, TMD, sleep appliances and paediatrics.