Digital technology improves the contemporary splint

James Bonham and Dr. Mark Coreil discuss material and fabrication options for full occlusal splints

Full coverage occlusal splints are widely used throughout dentistry for the treatment of TMD and parafunctional jaw activity. The effectiveness of this simple device is well documented in the literature.[1-3] Splints come in a variety of designs and can be made of hard plastic, soft plastic, or a combination of both. The upper hard splint is the most popular choice, and this device is constructed using a number of materials and methods. This article will highlight available materials and fabrication options among the major laboratories.

Digital technology has changed the practice of orthodontics and is also providing improvements in the construction of the contemporary splint. These improvements have the potential to decrease clinical time associated with delivery and adjustments, resulting in increased profitability for the practice. Finally, splints can now be looked upon as a profit center within the orthodontic practice!

Optimal traditional splint construction involves submission of accurate upper and lower impressions along with a bite registration. The bite registration should be taken at the exact vertical dimension of the splint construction. The rule of thumb is a 1.5 mm vertical separation between the terminal molars or most prominent tooth vertically. We have found that 2 mm of clearance is preferred for the CR splint to allow for adjustments as the condyles seat vertically. A facebow mounting of the upper model will provide for the most accurate splint construction. The most common submission to the lab involves upper and lower models without bite or facebow. In this instance, the lab mounts the models on an adjustable articulator and opens the vertical to the desired setting. This technique leads to more clinical time during splint delivery when compared to submission using a physical or digital bite.

> This technique will allow for adequate splint thickness and provide for future adjustment, and improved longevity.

Intraoral scanning allows the doctor to now submit digital models of the teeth with an accuracy not previously seen in dentistry. There is universal agreement that appliances made from digital models of the teeth are exceptionally accurate and require minimal adjustment. Currently, one can capture intraoral scans of both arches along with a bite registration in less than 5 minutes, and this is followed by a total submission time to the lab of under 5 minutes. The total time for accurate digital submission is 10 minutes compared to 30 minutes for the traditional physical submission. The 20-minute time-savings is worth $250[4] to the practice.

Hard splints are made of a variety of materials that offer a variety of advantages at differing price points. Hard splint options include:

1. **Biostar® base/acrylic overlay** The 2.0 mm Biostar base is vacuum-formed over the occlusal model followed by a covering of cold-cure acrylic to make the occluding portion of the splint. The acrylic is placed in a pressure pot for the curing process. This virtually eliminates porosity in the splint and makes for a durable long-lasting appliance ($100).
2. **Injection molded acrylic** The splint design is created directly on the upper model, and all aspects of the occlusion are defined within the design-matrix material. Once finalized, this design is flasked, and acrylic is injected under heat and pressure. Manufacturers claim longevity of 3 times longer than traditional splints in addition to decreased surface wear and breakage due to increased hardness. The maker also claims no porosity in the finished product allowing for improved stain and odor resistance ($160).
3. **Computer-aided milling** The splint design is aided by a software-driven process through which either the outer surface or, in some cases, all surfaces of the splint are designed virtually then processed using computer-aided milling. This is the same technology used to mill ceramic crowns in dental offices and labs around the world. Our evaluation process found these splints to have excellent occlusal contacts ($187).
4. **3D-printed splint** Specialty Appliances' lab is developing what we

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Figure 1: 3D-printed splint using FDA-approved E-Guard material from EnvisionTEC

Figure 2: 3D-printed splints save time due to improved fit and occlusion

believe is the future of splint fabrication. The FDA recently approved a printable splint material called E-Guard from EnvisionTEC (Figure 1). This revolutionary technology will change the playing field for splint fabrication in both the dental and orthodontic industry. The splint is designed virtually from the digital model using computer-aided design software and then is printed with extreme accuracy. This clear biocompatible material provides precise fit and maximum visibility. The process is more efficient and should reduce the cost of splint fabrication.

Digital splints provide additional timesavings for the doctor at the time of delivery due to improvements in fit and occlusion (Figure 2). Typical timesavings during delivery exceed 20 minutes, thus improving the bottom line for the practice an additional $250.[4] The printed splint provides improvements in fit, occlusion, and profitability. Using a digital splint workflow within the office and a digital lab like Specialty Appliances will make occlusal splints a profit center within the orthodontic office. Contact Specialty Appliances to learn more about this exciting advancement in splint fabrication.

Digital bite registration technique

DeLar bite registration wax is a simple and accurate method of capturing the perfect splint construction bite. Patients presenting with normal or deep overbite will require two layers of wax, and patients with an open-bite tendency may need up to four layers of wax. The heated wax is placed between the upper and lower incisors. Position the mandible into the desired AP position, in this case CR; then have the patient close down slowly as the wax cools until there is a minimum of 2 mm vertical opening between the closest contact point, in this case the second molars. Remove the wax, and cool in ice water. After capturing the upper and lower arches with your intraoral scanner, re-insert the chilled wax bite for the final digital bite capture. Most scanners can register the bite as long as the upper and lower teeth are no more than 3 mm to 4 mm from contact. This technique will allow for adequate splint thickness and provide for future adjustment, and improved longevity. OP

Figure 3: Use wax in the anterior to position the bite; then scan the posterior bite registration

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