Use and abuse of bite splints

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Use and Abuse of Bite Splints

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Summary

Bite splints (BS) are often used in the treatment of patients with oral parafunctions, temporomandibular joint (TMJ) dysfunction or temporomandibular disorders (TMD). The most common reasons for prescribing a BS are to protect the teeth in patients with bruxism, to improve jaw-muscle and TMJ function and to relieve related pain. The risk for negative side effects is small in conservative bite splint treatment. Complications from long-term use of splints, however, can be severe and irreversible. The risks are especially high when mandibular advancement splints, or splints that make contact only with parts of the opposing dentition, are used for more than 4 to 6 weeks without appropriate supervision. As a general rule, a dentist should not encourage a patient to use any type of splint for more than a few months except for cases in which the teeth need to be protected because of persistent oral parafunctions. Appropriate record keeping, including signed consent forms, is necessary; when neglected it becomes difficult for the dentist to defend himself from false accusations of malpractice.

A bite splint (also called bite plane, deprogrammer, intraoral orthotic, night guard, occlusal splint) is a removable appliance, usually fabricated of acrylic or composite, most often designed to cover all the occlusal and incisal surfaces of the teeth in the upper or lower jaw1-4 (Figures 1-3).

Bite splints can be classified according to the material used for fabrication; the location of placement; and their purpose and effect on jaw muscles, condylar position, and occlusion.

This article briefly describes different types of splints, and discusses why and when a conservative splint may be useful and why non-conservative splints should be prescribed only in carefully selected cases and never without fully informing the patient about possible harmful effects.

Main Reasons for Bite Splint Treatment

A common reason for prescribing a bite splint is to protect the teeth from excessive abrasion in patients with bruxism (Figure 4). Splints are also used frequently to treat patients with internal TMJ derangement and other TMDs with associated pain symptoms, such as tension headache and cervical-, neck-, and oral/facial pain1-4. A common goal of bite splint treatment is to protect the TMJ disks from dysfunctional forces that may lead to perforations or permanent displacements (Figures 5 through 8). Other goals of treatment are to improve jaw-muscle function and to relieve associated pain by creating a stable balanced occlusion.

An important advantage of bite splints is that they can be used to make reversible changes in the occlusion. Occlusion affects the way jaw muscles function, and jaw muscle function affects the way the TMJ functions. Therefore changes in the patient’s occlusion will always have some effect on the jaw muscles and the TMJ structures. A stable, balanced occlusion is important for maintaining normal jaw muscle and TMJ function.

The role of occlusion in TMD etiology, however, is complex, and there is no general agreement about its significance5-6. Many patients seem to have good TMJ and jaw-muscle function with no history of pain in spite of bad occlusion. Clearly patients react differently to having less-than-ideal occlusion. TMDs also can be caused by a number of other factors, such as head trauma or diseases that affect the internal TMJ tissues1.
There is no general agreement about if or why splint treatment may have a beneficial effect. Too few clinical studies have used adequate control groups and/or standardized recording methods. There are those who claim that the only effect is placebo. However, by definition double-blind placebo studies are impossible to design because it should not be possible to find dentists who can deliver and adjust a bite splint without immediately recognizing if the splint is a "placebo type".

Suggested indirect effects, difficult to prove or disprove, are that splints promote jaw muscle relaxation in patients with stress-related pain symptoms like tension headache and neck pain of muscular origin, and unload the jaw joints in patients with acute TMJ pain of intracapsular origin\textsuperscript{7-9}.

In spite of the present divergence in opinions about the value of splint treatment, it is reasonable to recommend it for the following purposes:

- to protect oral tissues in patients with oral parafunctions;
- to stabilize unstable occlusion;
- to eliminate the effect of occlusal interferences; and
- to test the effect of changes in occlusion on the TMJ and jaw muscle function before extensive restorative treatment.

**Splint material**

In the past several metal materials were used to fabricate bite splints including gold, silver, - even lead! Most splints today are made using heat- or light-cured acrylic\textsuperscript{10-11}.

Dentists who are frequently involved in treating TMD patients often like to be able to make and deliver a splint shortly (1 to 2 hours) after taking impressions rather than having them fabricated in a laboratory. This is especially important if patients have acute pain, but also if they have to travel a long way for treatment. Using light-cured composite, a splint can be made "in house" and delivered about 1 hour after the casts have been mounted in an articulator\textsuperscript{11}.

Some patients prefer the cushion effect created by the soft acrylic. A vacuum-formed soft vinyl "night guard" is easy to fabricate. However, it needs careful adjustment and supervision to avoid unwanted results\textsuperscript{12}.

**Location**

Without specific reasons for a mandibular placement, such as deep curve of Spee or substantial loss of mandibular teeth, some clinicians prefer the splint to be made for the upper jaw. Others prefer to place the splint in the lower jaw. If teeth are missing, the splint is usually made in the jaw where most teeth are lost. If molars and premolars are missing in both jaws, it may be advisable to make both an upper and a lower splint or to first restore occlusion in at least one jaw with prosthetic reconstruction.

**Usage**

There are no fixed rules for how long patients should continue to use splints. However, with few exceptions, non-conservative splints that often have to be worn 24 hours a day should not be used for more than 4 to 6 weeks to avoid the risk of irreversible occlusal changes.

Bite splints should be looked on as temporary solutions to be used only until a final diagnosis has been made and a curative treatment has been successfully performed. Unfortunately, it is sometimes not possible to reach those goals; in those occasions only should, a dentist can encourage a patient to use a splint indefinitely.

Patients who have conservative bite splints prescribed because of parafunctional motor activities like bruxing, clenching, and tongue pressure mainly use their splints only during sleep. However, those who can not control such habits when awake might need to use the splint during the day also.

**Main types of splints**
Conservative splints

**Michigan-type splint.** If properly designed and adjusted, this splint\(^1\) is effective as a diagnostic and treatment device. It reduces muscle hyperactivity, thereby helping the condyles to reposition in a way that promotes healing of internal TMJ structures. It is usually placed in the upper jaw covering all the maxillary teeth, giving the supporting cusps of the opposing mandibular teeth and the edges of the mandibular incisal teeth balanced, even contacts with the splint at habitual closure. Cuspid guidance is created to provide a rise in lateral and protrusive movements, so that all mandibular teeth, except the cuspids, are excluded at protrusive and lateral movements. This splint is not a flat occlusal splint and it does not have incisal guidance.

**Plane splints.** For esthetic reasons, some patients may prefer to have splints without cuspid guidance. Balanced contacts with all opposing supporting cusps are mandatory but some clinicians believe that better results are achieved if the contacts between the incisors and the splint are very light or even removed. Thin splints are often too fragile for heavy bruxers. Thicker splints may also be made to compensate for "reduced vertical". Finding the best vertical by adjusting a bite splint, before final large permanent restorations are made may significantly facilitate the dentist's work.

**Bite splint according to Shore.** This splint has a design similar to the conventional plane splint but does not extend onto the facial or buccal surfaces of the teeth and it covers the entire palatal area. For esthetic reasons, it may be preferred by some patients who need to use the splint during the day because it can be made less visible.

**Sved plate.** Only the opposing anterior teeth make contact with this splint\(^13\). It is recommended for patients with acute or chronic muscle pain if the plane splint is ineffective. The Sved plate is usually placed on the upper teeth. It is mostly used only at night and not more than 10 to 12 hours a day. There is a risk for intrusion of teeth, which has to be explained to the patient before delivery. As always, regular checkups are important.

**Gelb splint.** The Gelb appliance is made in the lower jaw, covering only the premolar and molar teeth. It is used to correct mandibular displacement, reduce TMJ dysfunction and oral/facial pain, and to provide occlusal stability with the patient's natural dentition serving as the anterior guidance\(^14\). Some dentists fear that this splint can cause intrusion of the posterior teeth. The originator claims that what seems to be an intrusion is actually a postural change because of a corrected jaw imbalance\(^14\).

**Distraction splints.** The pivot splint was introduced by Krogh-Poulsen about 40 years ago and was supposed to be helpful in patients with disk displacement. The proposed effect is that the condyles are pulled downward upon clenching on the pivot, thereby relieving traumatic load and giving the disk freedom to reassume a normal position\(^15\). It is seldom used today because most patients find it uncomfortable. The distraction splint, used by Pedersen et al to achieve a similar effect, has been tried successfully to reduce the destructive effect of juvenile rheumatoid arthritis on internal TMJ structures\(^16\).

**Repositioning splints.** Repositioning splints guide the mandible into a position different from (mostly anterior to) the habitual one at closing. The purpose is to facilitate repositioning of the TMJ disks and to reduce the load on retrodisical pain-sensitive areas\(^17\). These splints may be indicated for short-term use to keep a recaptured disk in a normal superior position (e.g., when a displaced disk has been recaptured by manipulation).

A repositioning splint is most often removable but can be fixed. Such a splint, often called a cap splint, can be described as an intermediary between a splint and a bridge. It is useful for temporary reconstruction before final decision about design, vertical dimension, etc. It is often made in metal with the occlusal surface in hard acrylic\(^18\).
Splints for protection of oral tissues. The most common reason for making a splint is to protect the teeth from excessive abrasion in bruxers. Several variations of splints are designed to protect cheeks and the tongue in patients with oral parafunctions (such as cheek biting or tongue thrust). These patients may benefit from a splint with extensions or enlargements designed in a way that keeps the cheeks from being pinched or the tongue from pressing against the lingual surfaces of the teeth.

Combination splints. Missing teeth can easily be replaced by adding artificial teeth to the splint. A Shore splint can function as a temporary partial denture by adding artificial teeth. There are numerous combinations of splint and orthodontic appliances. A removable bionator appliance can act both as an orthodontic and as a repositioning appliance. An “invisible retainer” can simultaneously function as a soft acrylic splint.

Sources of Errors in Bite Splint Treatment

Careful adjustment of the stabilization splint is an important step as muscle activity changes and edema subsides. Regular supervision, therefore, is important, and a splint should never be delivered without securing that the patient can and will come back for regular check-ups. The dentist also has to ensure that he or she is able to see the patient any working day during the first weeks after delivery.

Acute pain can be caused by inflammation in intracapsular TMJ tissues. They may swell or shrink during different stages of the disease period. Repeated adjustments may have to be made for quite long periods.

Conservative splints have a minimal risk of causing permanent changes in occlusion. The risks increase when splints are made to guide the mandible into an advanced position. Those splints can cause irreversible, possibly harmful changes if used for longer than a few (4 to 6) weeks without adequate supervision. Examples of such splints are the repositioning splints, which have been used to keep a repositioned disk in a normal position during healing.

Splints designed to have contact with only some of the opposing teeth may eliminate or reduce acute TMJ-related pain. However, this is often only a short term effect; using such a splint for longer than 4 to 6 weeks may lead to extrusion of some teeth and/or intrusion of other teeth, depending on where the contacts are. Splints with contacts only in the molar regions may cause intrusion of the posterior teeth (Figures 9A through 10B). Splints in which the only contacts are with the incisors may cause an anterior open bite (Figures 11A through 11C). Long term use of such splints should not be prescribed without first trying other possible remedies. It may be the treatment of choice when everything else fails and the patient suffers from chronic pain.

Bite splint fabrication is best learnt in hands-on courses, only a few details about the clinical and laboratory procedures will be discussed here. Keeping these details in mind can save a lot of chair time and help avoid frustrating remakes.

If using alginate, the impressions should be poured immediately, never waiting more than 1 to 2 minutes, to avoid dimensional changes. A high quality stone must be used and mixed with the right proportions of powder and water. A common mistake is to neglect the manufacturer's instructions and mix wrong proportions of plaster and water. Often, the mix is too thin (too much water) which lowers the quality of the stone and increases the risk of getting a splint that will not fit. Some practitioners might be surprised at how thick the mix is when using a balance to get the right proportions.
When making a bite registration, the wax should not extend onto the facial surfaces of the anterior teeth because it is important to compare how the teeth are aligned with and without the check bite in place (Figure 12).

Unless there is a specific reason based on the diagnosis, the dentist should make only minimal changes of vertical. Extensions onto the facial surfaces of the incisors should be avoided the risk of preventing lip seal, which may induce mouth breathing during sleep. There is no basis for the assumption that facial coverage is needed to prevent movement of the anterior teeth. If needed, improved retention can be achieved by adding simple ball clasps in the molar or premolar areas or by adding acrylic or composite in the molar interproximal areas on the lingual of the appliance.

It is a common mistake to let bite splint treatment drag on for years without making appropriate referrals. If the patient's acute problems are not resolved within a few months or his or her conditions are at least improving, the dentist should acknowledge that something is missing in the diagnosis or treatment plan. If the patient has persistent oral parafunctions or if the splint changes the occlusion in a desirable way, the dentist should discuss a permanent restoration. If the patient can not afford this or if it is impossible for other reasons, then the patient can be encouraged to use the splint indefinitely if coming back for controls at least 1-2 times/year.

Some patients function well with a splint but report that symptoms return if they stop using the splint. Unfortunately, some practitioners therefore encourage most or all of their patients to retain their splints for years, maybe even for the rest of their lives. A patient may be used to and even dependent on the splint, which then functions as a psychological "crutch". The dentist has the obligation to try to resolve the patient's problems with alternative treatments and by appropriate referrals.

Dentists should protect themselves and the patients by doing the following:
1. making study-casts and taking photos of the dentitions before treatment starts;
2. making careful recordings of jaw movement range, clinical signs of TMD, and oral/facial pain before and during treatment;
3. providing the patient with oral and printed information relevant to the case; and
4. obtaining a signed consent form and giving the patient a copy to keep.

Many problems might be avoided if the dentist keeps all patient records indefinitely, especially in cases where non-conservative procedures were used.

**Consent Form**

A consent form is not enough to protect a dentist from litigation if there is a treatment failure. The patient can not sign away the right to sue for a problem that may occur later. However, the consent form serves as a written proof that the patient was informed of possible dangers and consented to the treatment.

The consent forms should include statements in which the patient confirms that he or she:
1. was well informed;
2. understands that some TMD symptoms may actually get worse during treatment;
3. has no additional questions;
4. understands that he or she is obligated to come back for regular follow-up visits;
5. should not use the splint unsupervised;
6. should contact the dentist immediately if problems occur; and
7. should not use the splint if problems occur and he or she can not see the dentist immediately (i.e., the splint should be left out until the dentist can check it).
Conclusion

A bite splint can be a valuable diagnostic and treatment aid in carefully selected cases if properly made, adjusted and maintained. However, they are deceptively easy to fabricate and deliver, and can be mass-produced by health professionals with only superficial knowledge of occlusion, TMJ, and jaw muscle physiology. Such practice may be a threat to the welfare of the patients, especially if they are given non-conservative splints. The negative effects of conservative splints may be subtle, but these splints are not beneficial to patients if they are poorly adjusted at delivery and left without arranging for regular maintenance visits.

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Figures

Figure 1

Figure 2.
Figure 3.

Figure 4,
Figure 7.

Figure 8.
Figure 9A.

Figure 9B.
Figure 9C.

Figure 9D.
Figure 10A.

Figure 10B.
Figure 11A.

Figure 11B.
Figure 11C.

Figure 12.