

# Splints in Orthognathic Surgery: A Brief Overview

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### Abstract

Correcting dentoskeletal abnormalities while enhancing facial profile and occlusal function are the goals of orthognathic surgery. The normal course of treatment is the three-stage technique, which includes 15–24 months of presurgical orthodontics, orthognathic surgery, and seven–12 months of postsurgical orthodontics. Following the symbiosis of orthodontics and surgery, surgical splints are applicable in orthognathic surgery. These splints are used to track intraoperative three-dimensional movements and the maxillomandibular area. Currently, the usage of these splints is determined by the results of a clinical and radiological investigation and with the help of dental technician's preparation with instruments like articulators and waxes for the maxillomandibular occlusion. Surgical splints (SS) are necessary during orthognathic procedures to stabilise the occlusion. The capacity to create three-dimensional (3D) photographs because to technological advancements in the computing industry has opened up new opportunities for SS, increasing surgical plans predictability and customisation.

**Keywords:** Orthognathic surgery, surgical splints, 3D photography, Maxillo-mandibular occlusion, radiological investigations.

### Introduction

Orthognathic surgery termed as a single or double jaw procedure used to treat a variety of minor and significant skeletal or dental abnormalities that lead to functional as well as aesthetically unpleasant issues. The surgical splints are originated at the university hospital in Lyon which is crucial instrument in since it serves as a 3D guide.<sup>1</sup> It is employed in the preoperative phase and is the product of cooperation between maxillofacial surgeon and the dental prosthetist is necessary to prepare which provides crucial information regarding the required bone-based. These are necessary during orthognathic surgery procedures involving the jaws in order to more reliably stabilise the motions made in the operated bone segments. Use of SS is a suitable technique to direct the location of the bone bases and their associated fixations.<sup>2</sup>

### 1. Uses

- i. Provide stabilisation in operated bone segments.
- ii. These splints are used to track intraoperative three-dimensional movements and the maxillo-mandibular area.
- iii. Prior to internal fixation devices, the anticipated ultimate occlusion had to be stabilised during the post-operative period by maintaining the maxillo-mandibular block. Maintaining the splint in its place began to recommended solely as auxiliary technique in elastic therapy or in situations of maxillary segmental surgery with the development of these fixation devices.

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## 2. Material

### i. Acrylic

It is most commonly used splint made by acrylic. In orthognathic surgery, occlusal wafer splints are frequently used following jaw osteotomies to ensure proper intraoperative jaw placement prior to osteosynthesis. The creation of good quality solid, long-lasting occlusal profile and adequate flexibility typically involves a lot of effort and money.<sup>3</sup>

### ii. Polymethylmethacrylate

It is also used to create splints. These materials dimensions changed after autoclaving.<sup>3</sup>

### iii. Splints by CAD-CAM

The diagnostic data from preoperative clinical and radiographic examinations, along with the model analysis, are all incorporated into traditional bimaxillary surgical planning in order to set a treatment aim and plan a surgery with the actions required to reach that objective. The postoperative relationships that come from simulating the surgical plan in a model will be used to create the intermediate as well as final splints. The bite registration and facebow to articulator translation issues, therefore, continue to exist. As computer technology has advanced, computer aided surgical planning has become more frequently used in this field and to help create more exact surgical treatment plans, shorten the time needed for preoperative preparation, and ultimately produce better surgical results.<sup>4-8</sup>

## 3. Types

The occlusal splint is used in both "surgery first" and elective surgery. Through precise measurements, reference points, and a specially constructed surgical splint, the analytic surgery transfers the intended 3D movements to the patient.

### i. Repositioning splint

When a patient has TMD prior to surgery and receives therapy to ascertain the analgesic and appropriate positioning of condyle in relation to the other joint components, the splint is useful. Its function is to retain the condyle positions after surgical osteotomies and dental arch repositioning while also recording the positions as determined by gnathological therapy.<sup>18</sup>

### ii. Intermediate splint

In orthognathic surgery, an osteotomy wafer is frequently being used as an intermediate guide to reposition the mobilised jaw in relation to the jaw. In bimaxillary surgery, and it is utilised to direct the mobility of one jaw in relation to the other. The mandible is not a fixed bone, thus there is some room for error. As a result, the condyle might not stay in its exact location within the glenoid fossa.<sup>21</sup>

### iii. Final splint

The parts of the jawbone must be moved precisely during traditional orthognathic surgical planning. The last occlusion connection between both the jaws is recorded and stabilised by an interocclusal final wafer. However, when using the "surgery first" strategy, the final splint sets goals for a postsurgical malocclusion. The final splint was worn for 20 days in our initial experience with the "surgical first" strategy before being used with elastics to provide occlusal stability. Today, we only occasionally utilise a splint to check the occlusion while surgery.<sup>21</sup>

### iv. Dynamic splint

The regional acceleratory phenomenon (RAP), which starts after surgery and remain for three months, can be fully utilised by starting orthodontic therapy with the dynamic splint. This stimulate the RAP during the stabilisation even with a segmental osteotomy, which requires splint stabilisation for a few days following surgery. This shortens the entire treatment period.<sup>19-20</sup>

## 4. Advantages

- 1) Individualized splints cut down on costs, anaesthetic time, and surgical time.<sup>9</sup>
- 2) Direct connection with the prosthetist is therefore feasible, enabling quick modifications as needed.<sup>10</sup>
- 3) In contrast to the documented modifications in traditional clinical protocols, which involve model surgery, face transfer to a semi-adjustable articulator, and cephalometric examination.<sup>12</sup>
- 5) To create intermediate splints, many approaches that combine optical or laser scanning.<sup>13</sup>

## 5. Method

The week before a surgical procedure is spent preparing for it. Then the surgeon records the information to manufacture the prosthesis when the orthodontic preparation has been effectively finished. This preparation entails a clinical assessment, a cephalometric analysis, and a fresh record of cast provided by the orthodontist who is in charge of preparing orthodontic appliances. Both methods of getting various splints are practical for use in surgery.<sup>14-15</sup> A lot of undesirable results are caused by bad planning. Now, the surgery planning and splints formation is done entirely in a computational environment by recent advancements in surgical planning technology that use 3D systems, making it easier for the surgeon. Additionally, the outcome will be easier to predict. A 3D computer-assisted surgical simulation system (CASS) was created in order to better the surgical planning of craniomaxillofacial abnormalities. With the help of this system, it is able to practically carry out the operation and forecast the patient's fate.<sup>16</sup>

**i. Impression study**

The surgeon makes sure that the standard preparation should be done by using the cast that the orthodontist has just prepared. The transverse dimensions can be seen more clearly on these casts. The construction of the surgical splints is also based on these study models. No more orthodontic shifts should occur after this visit. To avoid any medical difficulties during the surgery, a last consultation is held a few days before to the scheduled surgery day.<sup>1</sup>

**ii. Wax pattern fabrication on occlusion**

Throughout this phase articulated cast of patient is used. At this time, the wax's entire coverage of all the triturated dental surfaces serves as the standard for quality. The plaster models arches stability is ensured by the wax occlusion. By the completion of this step, the surgical processes are clearly defined, and the surgeon identifies the surgical procedures that will be performed.<sup>17</sup>

**iii. Face measurement with articulator**

By applying the initial occlusal splint in a centric relationship, casts can be positioned. Splints must be mounted and centred on an articulator during construction [fig1]. Predicting how the cusps will move during closure motions after the splint is removed.<sup>1</sup>

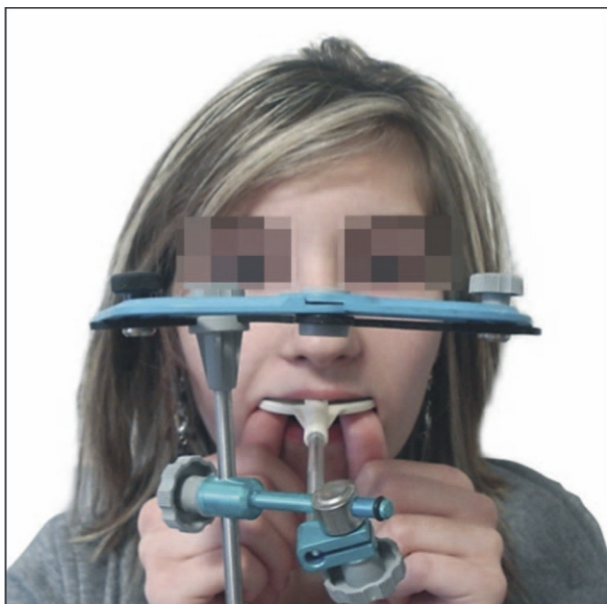


Figure 1: Facial arc placed to wax occlusion on the Frankfort plane

**iv. Lab work**

If bimaxillary work needs to be done, the prosthetist will construct intermediate and final biting planes using casts in this step [fig2]. The models for these surgical splints are built in reference to the occlusion plane, which is placed over the articulator via a face-bow, and are produced by simulating movement[fig3].<sup>1</sup>



Figure 2: In the sagittal sense measurements are taken for work to be done.



Figure 3: Splints

**Conclusion**

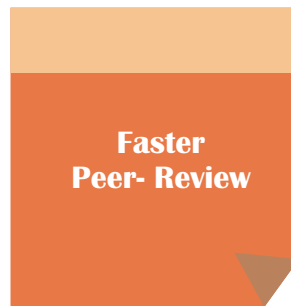
Orthognathic surgery advancements have made it possible for surgical planning to be more patient-centered and individualised. The study that is being presented shows that the intermediate splint made using this technique achieves a level of precision suitable for use in clinical surgery. It mimics the standard articulator procedure. The emergence of splint made using the CAD/CAM system, by surgeons due to its higher accuracy, improved chances of results, and quick processing, is another modern study that is primarily focused on technology. The 3D technique, on the other hand, is the one that takes the most time for general planning since the stages are time-consuming and require a sophisticated cephalometric system, and a segmentation procedure. For all types of patients examined, it was less expensive and time taking than in the traditional approach. Correcting dentoskeletal abnormalities while enhancing facial aesthetics and occlusal function are the goals of orthognathic surgery.

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