A hassle free method of model surgery

Abstract
Model surgery for orthognathic surgeries has been reported as early as 1935 by Wassmund and improvements made to them through these past years have strengthened the success of jaw surgeries as a viable treatment modality. Here we are presenting a newer method of preoperative model surgery which is less time consuming, reduced laboratory procedures, and is reliable in all three planes.

Key Words: Model Surgery; Impression Compound; Orthognathic Surgery; Articulator

Introduction
Surgical repositioning of the maxilla and mandible, or simultaneous repositioning of both the jaws together requires complex three dimensional movements based on presurgical assessment of the skeletal malocclusion on different diagnostic tools. Although cephalometric evaluation is one of the primary tools, a 3-d evaluation of the malocclusion is essential to plan for orthognathic surgery. Model surgeries allow the planned osteotomies to be carried out on a three dimensional model, allowing for the fabrication of splints which are used to maintain occlusal relationship and the integrity of skeletal segments during the surgical procedures. Hohl (1) in 1978 and Bamber and Harris (2) in 1995 have proven that to achieve accuracy of the maxillary position in space and its relationship to the optimal functional centric occlusion, a preoperative model surgery is essential using an anatomical articulator with a face bow transfer.

According to Bamber et al (3) the lockwood keyspace system and the Eastman anatomically oriented technique are the two most widely used model surgery techniques. They concluded that neither of the techniques could carry out the treatment plans with absolute accuracy although the Eastman technique was relatively more accurate in the vertical and the anterior-posterior plane. The errors of the preoperative model surgery and the following surgical splint preparation can result in post-operative malocclusion. The aim of this paper is to introduce a newer method of surgical splint preparation through changes in the model surgery technique which is less time consuming and would help in the fabrication of a splint which will lead to a predictable post-surgical result.

Technique
Pre-surgical casts of a patient showing a skeletal class III malocclusion with a retrognathic maxilla and a hypo divergent mandible with a dental class III malocclusion and a reverse overjet are mounted on a semi-adjustable articulator (Hanau). Face bow registration was done and transferred to semi adjustable articulator (fig 1). A layer of Plaster of Paris (POP) is poured onto the base of the maxillary cast and a sheet of impression compound (Y- Dent, India) adapted onto the POP over the base of the cast (fig 2). A layer of POP is then poured over the impression compound and is articulated to the upper member of the articulator (fig 3). Ventilation windows are made in the upper layer of POP to facilitate uniform conduction of heat and softening of the compound (fig 4). The mandibular cast is then occluded with the set maxillary cast on the articulator using the bite registration wafer taken in centric relation. Mandibular cast is then articulated to the lower membrane of articulator (fig 5).

Fig 1: maxillary cast transferred to a articulator, Fig 2: impression compound adapted to the POP, Fig 3: POP poured till the upper member

Fig 4: ventilation windows, Fig 5: articulated upper and lower casts, Fig 6: reference lines marked and pre-surgical overjet measured

The POP is allowed to set totally before the horizontal and vertical grid lines are drawn on the casts for reference. The vertical, anterior-posterior and medio-lateral positions of the teeth and the jaws are recorded prior to the movement of the mounted casts (fig 6). The distance between the marked labial surfaces of the maxillary central incisor to the point marked on the incisal rod of the articulator is recorded. The upper jig is then removed from the articulator and immersed in warm water (fig 7). The impression compound is checked for uniform softening at regular intervals through the ventilation windows and is removed from the water once it is achieved. Using tactile sensation, a light force is applied on to the maxillary cast sagittally till the required advancement is achieved. If the compound...
hardens before the advancement, it is reimmersed in warm water and allowed to soften before advancing the cast again. In patients requiring advancement of more than 4mm, the maxillary cast can be easily displaced from the impression compound and repositioned at the required post-surgical position. Refixing of the maxillary cast to the impression compound is easily accomplished using sticky wax (fig 7). The amount of sagittal advancement can be measured by measuring the distance developed between the vertical lines drawn at the molar and canine region or also by measuring the overjet after sagittal advancement (fig 9). Vertical repositioning can also be achieved in this manner and the amount of vertical displacement can be calculated by measuring the distance between the two horizontal reference lines drawn on both sides of the compound.

Discussion
Orthognathic surgeries for the correction of skeletal malocclusion require an interdisciplinary approach involving the orthodontist, prosthodontist and maxillofacial surgeon. Treatment planning for the correction of skeletal malocclusions is as vital for the success of treatment as the procedure itself. Mock surgery is one of the main components of treatment planning for surgical cases as it provides a 3-d view of the malocclusion in all spatial planes.(5)

The early pioneers like kostecka used unarticulated models to evaluate the pre and postsurgical occlusion and later wax was used to hold the sectioned models together and a splint was fabricated for fixation.(3)

But Hohl et al have stated that the use of an anatomical articulator with a face bow transfer is essential to achieve accuracy of the maxillary position and its relationship to the optimum functional centric occlusion. Pre-surgical clinical and radiographic assessment and model analysis are utilised to arrive at a treatment plan which is then expressed in the model surgery. The simulated pre and post-surgical model relationships are used to fabricate occlusal splints which are then used to express the treatment plan into an accurate surgical procedure. The accuracy of the model surgery procedure has been debated and a serious concern expressed. The most commonly used model surgery techniques are the Lockwood keyspace system 4 and the Eastman technique.(3)

It has been reported that these two techniques also are not absolutely accurate even though the Eastman technique is relatively more accurate in the vertical and the anterior-posterior plane. In most of the model surgery techniques the casts are sawed at the bases from the articulator and repositioned. This procedure is not only time consuming, it is also laborious and may lead to respiratory disorders over a period. The sawing of the plaster bases is also not accurate which might lead to the development of malocclusion post surgically.(3)

Conclusion
In conclusion the procedure of model surgery discussed in this paper was devised to overcome the shortcomings of the previous techniques.

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