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10.5005/jp-journals-10015-1072

CASE REPORT

New Splint for Orthognathic Surgery

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ABSTRACT

A case of skeletal class III malocclusion treated by both orthodontics and orthognathic surgery is presented. In this case, body osteotomy has been done so as to maintain the natural integrity of the posterior part of stomatognathic system, including the TMJ. A new splint was designed to position and align the sectioned mandibular segments so as to assist in easy fixation and obtain proper occlusion. The postsurgical orthodontic treatment was minimal and no relapse was observed even after 1 year follow-up.

Keywords: Surgical splint, Orthognathic surgery, Body osteotomy.

INTRODUCTION

Proportion is a unique feature of any creation, natural or artificial for its beauty, functionality and stability, with the human body being no exception for this. The importance of this proportion is very much applicable in dentistry particularly so in the field of orthodontics.

When the malocclusion is dental or dentoalveolar in nature it is usually treated by orthodontic treatment procedures, but when there is considerable degree of dentoskeletal deformity along with orthodontics surgical intervention is also required for the correction of malocclusion and dentofacial deformity.

History of orthognathic surgery dates back to 1849 wherein mandibular anterior subapical osteotomy was done by Hullihen.[1] The development of vertical osteotomy of the ramus described by Caldwell and Letterman (1954) allowed for the repositioning of the ramus under direct vision but by an extraoral approach.[2,3] Since the early 1970s, different individuals have put forth various modifications of the surgical procedures, which can be attributed to the scientific understanding of the biologic basis of orthognathic surgery which aims at functional, esthetic, structural and psychological rehabilitation of the patient.

CASE REPORT

A male patient aged 30 years reported to the department of orthodontics, MS Ramaiah Dental College with a chief complaint of difficulty in chewing from the front teeth and altered speech. The medical history revealed that the patients father and paternal grandmother had a similar problem of protruded lower jaw. The facial examination showed a long face with a concave profile, prominent chin, steep mandibular plane and incompetent lips (Figs 1 and 2).

Intraoral examination revealed full complement of the teeth with the maxillary arch showing slight distraction of the right

Fig. 1: Frontal view

Fig. 2: Profile

Fig. 3: Maxillary arch

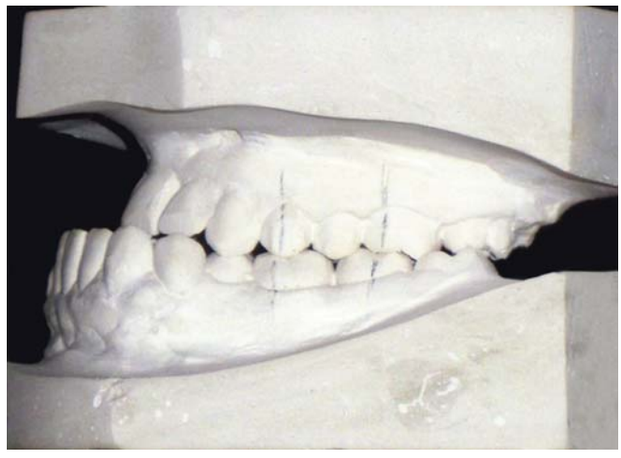


Fig. 6: In occlusion: Left

Fig. 4: Mandibular arch

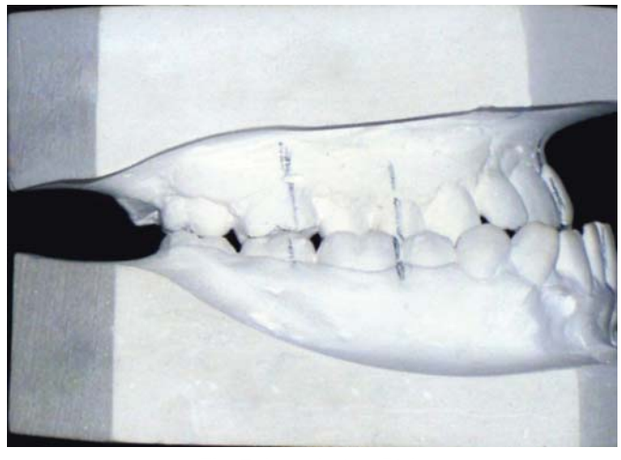


Fig. 7: In occlusion: Right

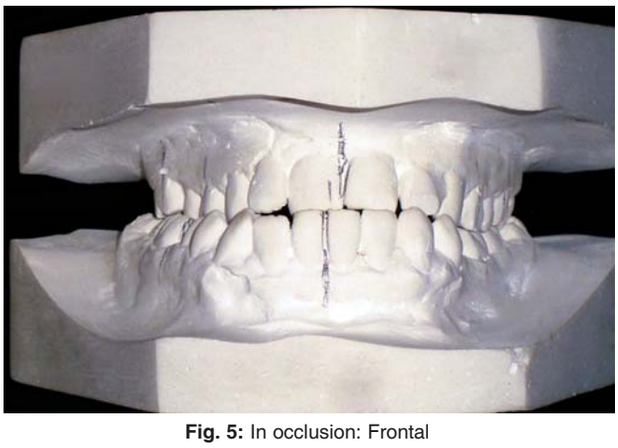


Fig. 5: In occlusion: Frontal

posterior segment and mild anterior crowding and proclination. The mandibular arch was wide with a U shape and a slight lingual contraction of the left posterior segment along with mild anterior crowding (Figs 3 and 4).

In occlusion 1st molars were in super class III relation bilaterally with an anterior crossbite having a reverse overjet of 8.5 mm and anterior openbite of 1 mm. Crossbite was present with respect to 13, 14, 15, 17; 44, 45, 46, 47, 48; and 22, 23 with 34 and 27 with 38. Mandibular midline was shifted to the right side by 4 mm (Figs 5 to 7).

The cephalometric analysis showed mild prognathism of the maxilla and a severe prognathic mandible and the effective length of the mandible was increased by 10 mm. The maxillary and mandibular incisors were proclined and the lower face height was increased by 4.4 mm (Fig. 8).

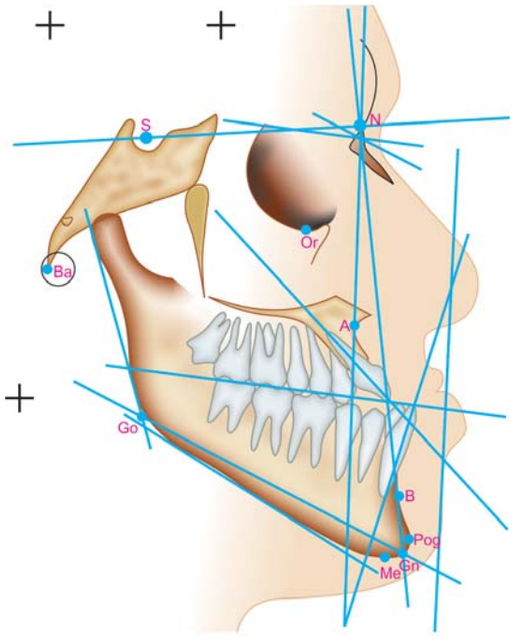
Burstone soft tissue analysis showed a concave profile with slight prognathic maxilla, severely prognathic mandible, acute nasolabial angle and severe lower lip protrusion. Mentolabial sulcus was shallow having a reduced lip length and increased chin height (Fig. 9).

The case was diagnosed as skeletal Class III malocclusion with proclination and crowding of upper anteriors, reverse overjet, anterior openbite and crossbite of 22, 23 with 34; 27 with 38; and 13,14,15,17 with 44, 45, 46, 48 and the mandibular midline was shifted to the right side by 4 mm.

TREATMENT PLAN

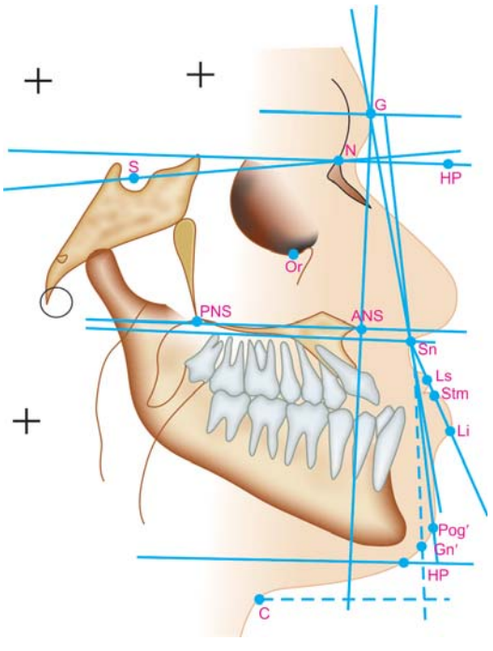
The treatment was carried out in three phases:

1. Presurgical orthodontics



S—Sella; N—Nasion; Or—Orbitale; A—Point A; B—Point B; Pog—Pogonion; Gn—Gnathion; Me—Menton; Go—Gonion; Ba—Basion

Fig. 8: Steiner's hard tissue cephalometric analysis



S—Sella; N—Nasion; G—Glabella; HP—Horizontal plane; C—Throat point; ANS—Anterior nasal spine; PNS—Posterior nasal spine; Or—Orbitale; Sn—Subnasale; Ls—Labrale superioris; Li—Labrale inferioris; Pog'—Soft tissue Pogonion; Gn'—Soft tissue Gnathion; Stm—Stomion

Fig. 9: Burstone soft tissue cephalometric analysis

2. Orthognathic surgery
3. Postsurgical orthodontics.

Presurgical Orthodontics

It was done to achieve individual dental arch alignment on the respective basal bone using MBT prescription of PEA technique. Mild expansion of the maxillary arch was done for the alignment of maxillary anteriors. In the lower arch 1st and 2nd molars were banded, proximal reduction was done to relieve the crowding and alignment of the teeth was done using the same technique. At the end of this phase overjet was 8.5 mm (Fig. 10).

Fig. 10: End of phase I

At the end of 1st phase lateral cephalogram was taken and two sets of models were made. Cephalogram was traced and a template was made with hard drawing paper as per the morphology of the mandible, including the dentition. This template was moved distally gliding over the tracings of the maxillary teeth till the normal overjet and overbite was obtained. According to this, mandibular setback of 11 mm was required and mesiodistal width of the mandibular first molar was 11 mm, hence it was decided to go for a body osteotomy in the region of the first permanent molar instead of premolar region. The same was done on the template by cutting the 1st molar segment. Mild anticlockwise rotation of the mandible was required to correct the anterior open bite. Measurements of these sectioning were recorded (Figs 11 and 12).

Model Surgery

The treatment plan was discussed with the oral surgeon and the surgical procedure was decided.

The maxillary and mandibular models were aligned in proper occlusion with the help of a thin wax bite registration. Occluded models were mounted on the semiadjustable articulator. During the mounting of the lower model, a flat modeling wax sheet was placed between the models and the plaster placed on the articulator for fixation. The models were placed in such a way that the occlusal planes were kept parallel to the floor. After the plaster base was set, the edges of the wax sheet were melted and fixed to the base. The position of the posterior segment of the lower model was permanently fixed to the base by a small amount of melted wax. After stabilizing the position of the lower model, the upper model was mounted on the articulator by keeping the models in the same occluded position. After mounting, vertical markings are made on the

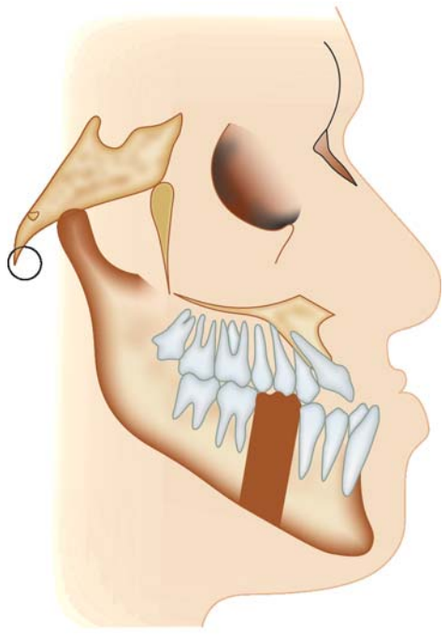


Fig. 11: Template marking

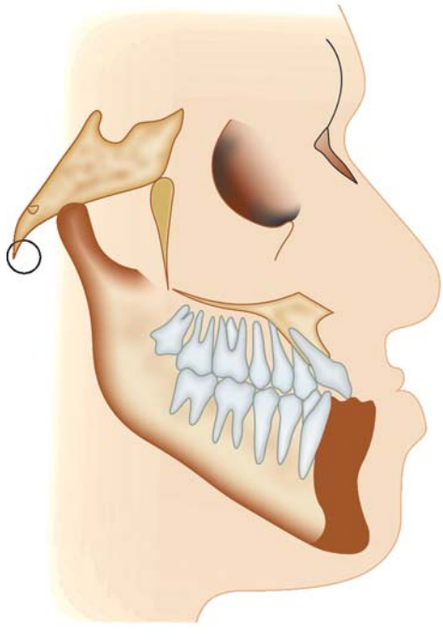


Fig. 12: Distal alignment of template

Fig. 13: Model marking

Figs 14A and B: (A) Sectioning 1, (B) sectioning 2

buccal aspect passing through mesiobuccal cusp of the maxillary 1st molar and the mandibular 1st molar to register their position. Two more vertical markings were made on the lower model, one on the mesial and one on the distal aspect of the 1st molars, as it was made on cephalometric template representing the line of sectioning of the model (Fig. 13). In the anterior region one more vertical marking was done which represents sectioning of the mandible in the median plane. Sectioning of the lower model was done as per markings using a fine saw. After separating the 1st molar segments, the remaining parts were aligned in relation to the maxillary arch so as to achieve proper overjet and overbite, and maximum intercuspation of maxillary and mandibular premolars. Mandibular segments were stabilized in this new position using sticky wax and modeling wax (Figs 14A to 15).

Fig. 15: Alignment of sectioned segments

Fig. 18: Osteotomy cut

Fig. 16: Splint in occlusion

Fig. 17: Dr Shekar's Surgical Splint

The splint was prepared using self cure acrylic. During the dough stage of setting, material of 2 to 3 mm thickness was placed over the arch and the maxillary model was brought down and held in position with light pressure. The acrylic was adapted on to the buccal and lingual aspect of the teeth using finger pressure and excess acrylic beyond the level of brackets and buccal tubes was removed. Small pieces of wire were placed in the acrylic before it sets on the buccal aspect in the region of molars, premolars and distal to canines to aid in intermaxillary fixation later. After polymerization, the acrylic splint was separated from the models and trimmed to remove proximal undercuts. Some amount of undercuts were retained to obtain proper positioning and alignment of the sectioned mandibular segments to the splint so as to achieve proper occlusion (Fig. 16).

Trial fitting: The splint was tried for its fitting on the maxillary arch whereas in lower arch one more working model was sectioned similar to that of model surgery and each segment was tried for its fitting to the splint. Splint was immersed in disinfectant solution until it was used (Fig. 17).

Surgical Procedure

The patient was taken up under general anesthesia with nasotracheal intubation. The splint was fixed to the maxillary arch using ligature wires. A standard bilateral mandibular osteotomy with extraction of the 1st permanent molars and an additional mid-symphyseal osteotomy between the central incisors was performed via an intraoral approach (Fig. 18). The continuity of the neurovascular bundle was maintained throughout the procedure. The osteotomized segments were reduced to the desired position with the help of a prefabricated acrylic splint and stabilized by intermaxillary fixation. The final fixation of the osteotomized segments was accomplished with 2.5 mm titanium miniplates.

The postoperative period was uneventful except for mild paresthesia of the inferior alveolar nerve which recovered over a period of 3 months.

Postsurgical Orthodontic

Treatment was required to close mild spacing between 35, 37 and 45, 47. Four months after the surgery, fixed orthodontic appliance was removed and Hawleys retainers were delivered (Figs 19 and 20).

Fig. 19: Postoperative occlusion

Fig. 20: Post-treatment occlusion

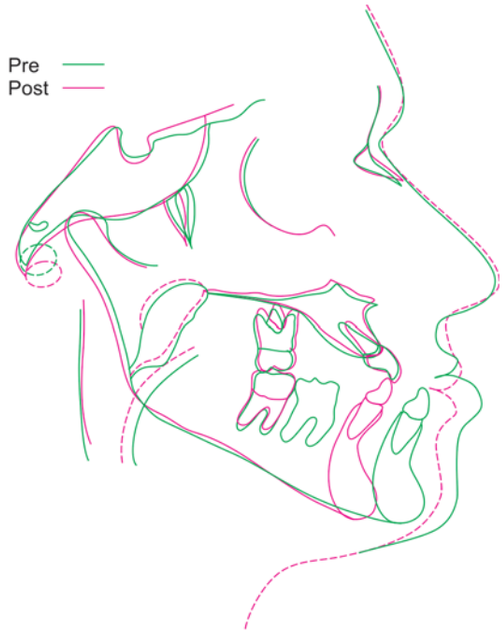


Fig. 21: Composite analysis

Measurements	*Pre*	*Post*
SNA	86°	87°
SNB	94°	86°
ANB	–8°	1°
UI to NA	44°	40°
UI to NA	10 mm	9 mm
LI to NB	26°	26°
LI to NB	4 mm	5 mm
S LINE to UL	–3 mm	–1 mm
S LINE to LL	4 mm	–1.5 mm

Fig. 22: Composite analysis values

COMPOSITE ANALYSIS

Super imposition of the pre- and post-treatment cephalograms showed that, significant decrease in the angles SNB from 94^{o} to 86^{o} was observed; Angle ANB improved from –8^{o} to +1^{o}. Other dentoalveolar values measurements remained almost the same (Figs 21 and 22).

Significant improvement in the esthetics was achieved (Figs 23 and 24).

DISCUSSION

A case of mandibular prognathism (skeletal class III) treated by orthodontics and orthognathic surgery has been presented. The diagnosis and treatment planning was done in two stages. In the 1st stage the individual arches were aligned on the respective dental bases. The diagnostic records were made once again to plan the surgical treatment in the 2nd stage. A similar approach has been advocated by Epkar and Fish.[4]

In the present case, body osteotomy of the mandible was considered since the defect was mainly in the body of the mandible and with this procedure the natural, anatomical, physiological and functional integrity of the posterior part of the stomatognathic system is not affected in anyway. Hence, the probability of patients developing any occlusal or TMJ abnormalities are greatly reduced.

Fig. 23: Post-treatment frontal

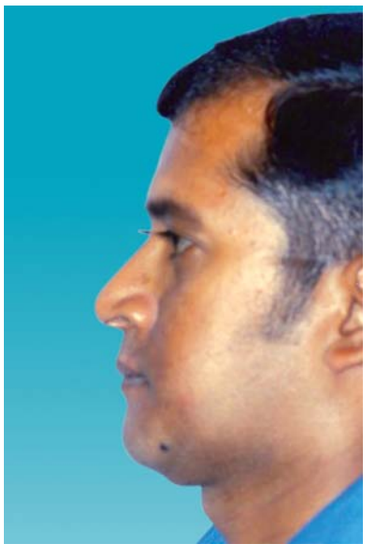


Fig. 24: Post-treatment profile

As reported by Liukkonen et al[5] and many other authors the reduction in the posterior airway size is related to the amount of mandibular setback. They have concluded that mandibular setback surgery with posterior rotation may cause narrowing of the posterior airway and may be a causative factor in the gradual development of breathing disorder. As reported by K Degerliyurt[6] et al, mandibular setback resulted in the significant reduction in the pharyngeal airway both in men and women.

As stated by James V Marko[7] model surgery, which is an integral part of the planning of orthognathic surgery, can be done in some cases using a simple hinge articulator or semi adjustable articulator. In the present case semiadjustable articulator has been used.

The splint was fabricated after establishing proper jaw relation and occlusion of the teeth; and the same occlusion was established even after the removal of the splint. The posterior part of the occlusion was maintained in the same preoperative normal position, and hence the integrity of the TMJ and the posterior aspect of the stomatognathic system was maintained without any change. Since the splint was extended not only to the occlusal (incisal) surface but also onto the lingual and facial aspect of the teeth, up to the bracket and buccal tube level, it acted as a holding splint to fix the segments after the surgical procedure in proper alignment, position and occlusion.

The splint used in this case has the following advantages:

1. Easy to fabricate
2. Maintains proper occlusion
3. Allows easy fixation of the jaw segments during surgery
4. Helps in simple and safe intermaxillary fixation
5. Chances of relapse are reduced to great extent as proper occlusion is established and maintained during healing
6. The postsurgical retention period is minimal.

CONCLUSION

A case of skeletal class III malocclusion, which was treated by both orthodontics and orthognathic surgery, has been presented. Body osteotomy of the mandible was done so as to maintain the natural integrity of the posterior aspect of the stomatognathic system including the temporomandibular joint and also not to reduce the pharyngeal (posterior) airway size. Excellent occlusion was established with the help of specially designed indigenous splint, which was used not only to obtain good occlusion but also to hold the segments of the mandible in proper position during surgery and the initial healing period. Post-treatment follow-up of one year was uneventful.

ACKNOWLEDGMENT

Thanks to Dr HN Shyla, Professor and Head, Department of OMFS, KLE's Institute of Dental Sciences, Bengaluru, Karnataka, India, for her kind help.

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