

**An unusual type of bad split pattern in bilateral sagittal split osteotomy: A case report**

<sup>1</sup>M. R. Haranadha Reddy, Professor, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

<sup>2</sup>D. Chandana Sowjanya, Post Graduate Student, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

<sup>3</sup>M. Bhargavi, Post Graduate Student, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

<sup>4</sup>G. Sai Sarath, Post Graduate Student, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

**Corresponding Author:** D. Chandana Sowjanya, Post Graduate Student, Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

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**Introduction**

Bilateral sagittal split osteotomy (BSSO) is one of the most popular techniques in orthognathic surgery performed to correct malocclusion in relatively young patients. Some of the complications associated with BSSO are neurosensory disturbances of the inferior alveolar nerve (IAN), resulting in altered sensation of the lower lip, infection at the surgical site and an unfavorable fracture pattern during osteotomy, termed ‘bad split’.<sup>1</sup> The average incidence rate of bad splits in BSSO is 2.3% per split site (range from 0.2 to 11.4%).<sup>5</sup> Frequently cited reasons for a bad split include incomplete osteotomies, using osteotomes that are too large<sup>2</sup>, attempting to split the segments too rapidly or

not rapidly enough, presence of impacted third molars<sup>3</sup>, misdirecting the medial osteotomy upward toward the condyle, and placement of the medial osteotomy too far superior to the lingula<sup>4</sup>. Mandibular anatomy is also an important factor in conjunction with other etiologies in the occurrence of a bad split.<sup>5,6</sup>

**Case Report**

A 22-year-old male patient presented to the department of oral and maxillofacial surgery with a chief complaint of forwardly placed lower teeth and jaw. Patient has undergone orthodontic treatment for the past 2 years. The patient did not give any relevant past medical or familial history. Clinical examination revealed an Angle’s Class III malocclusion, a concave profile,

brachycephalic head, mesoprosopic face, an average nasolabial angle and mento-labial sulcus, class III molar relationship, an anterior open bite of 5mm and a reverse overjet of 8mm. The Cephalometric analysis revealed a skeletal Class III due to retrognathic maxilla and prognathic mandible showing hyper divergent growth pattern, reduced lower anterior facial height, potentially competent lips, anterior cross bite, anterior position of chin. Considering the age and diagnosis of the patient orthognathic surgery was planned under General anaesthesia. After 3D virtual planning, a surgical splint was fabricated. Treatment planned was Lefort I osteotomy with Advancement of maxilla by 5mm, Anterior down grafting of maxilla by 4mm and Bilateral sagittal split osteotomy with setback of mandible by 7mm followed by post-surgical orthodontics.

### **Surgical procedure**

The operation was performed under general anaesthesia. Nasal endotracheal intubation done through right nostril under sterile aseptic conditions. Local infiltrations were given using 2% lignocaine HCL in 1: 80,000 dilution adrenalines injected in the maxillary and mandibular anterior and posterior vestibular region (total volume of 20 ml). Lefort I osteotomy with advancement of maxilla by 5mm and anterior down grafting by 4mm was done uneventfully. With the aid of 3D designed prefabricated splint, maxilla was guided into new position and intermaxillary fixation was done. The maxilla was fixed with 1.5 mm titanium miniplates and 2 mm diameter mono cortical screws. The alar base cinch suture was given with 2-0 prolene to avoid the unfavorable increase in nasal width. The mucosal layer was closed with 3-0 vicryl suture material.

BSSO setback of mandible by 7mm was performed, and osteotomy cuts were secured with 2mm 6-hole double 'Y' titanium plates. Intermaxillary fixation was carried

out under the guidance of 3D designed splint and the mandible was fixed into new position. After plating, the intermaxillary fixation removed and the mucosal layer was sutured with 3-0 vicryl. The day after surgery, class III intermaxillary elastics were applied for two weeks to protect the jaws in the new position against the muscle forces. Later intermaxillary wiring fixation was done for 4 weeks and regular follow up was done by giving proper postoperative instructions.

During BSSO procedure, resistance was encountered to set back the mandible on right side intraoperatively and we observed unfavorable split pattern on the buccal cortical plate (proximal segment). Careful stripping of the pterygomasseteric sling, medial pterygoid, masseter muscles and stylo mandibular ligament was done on the medial side of the proximal segment. The fractured proximal segment was stabilized with slight manipulation and stripping of periosteum, finally repositioned without the need for plate osteosynthesis. After checking the position of condyle in the glenoid fossa and without damaging the inferior alveolar nerve bundle, the proximal and distal segments were carefully approximated and plating was done. After 6 weeks, post-surgical orthodontic treatment was initiated, finishing & detailing of occlusion was carried out.

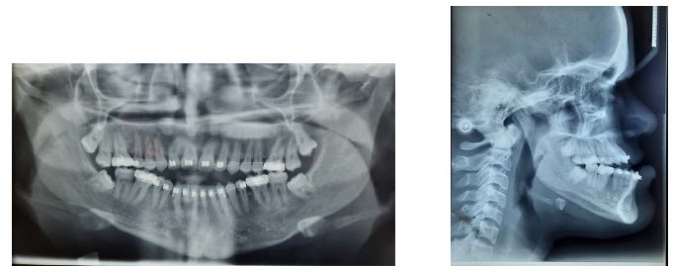


Figure 1: Pre-treatment Orthopantomogram and Lateral cephalogram



Figure 2: Post treatment orthopantomogram and lateral cephalogram.

### Discussion

Bilateral sagittal split osteotomy (BSSO), is the most commonly performed jaw surgery in the correction of dentofacial abnormalities along with other orthognathic surgeries, Lefort I Osteotomy and Genioplasty. Some of the complications associated with Bilateral sagittal split osteotomy are Post Operative Infection, neurosensory disturbances of the lower lip and tongue and bad split. Segmenting the mandible in an orthognathic procedure to reposition the tooth bearing part is generally known as a bilateral sagittal split osteotomy (BSSO). Historically, different ways of splitting the mandible have been advocated. The Trauner and Obwegeser technique (1955)<sup>7-9</sup>, the Dal Pont modification (1961)<sup>10</sup>, and the Hun suck modification (1968)<sup>11</sup> are the best documented. Various approaches, splitting techniques, and instruments have been advocated to reduce complications over the years since Hugo Obwegeser reported the operation in 1955. Despite these improvements, the procedure remains technically challenging in some cases. An unfavorable and unanticipated pattern of the mandibular sagittal split osteotomy is generally referred to as a 'bad split'. The average reported incidence of bad splits in BSSO is 2.3% range from 0.2 to 11.4%).<sup>5,6</sup>

Guernsey and De Champlain (1971) conducted a study among 22 patients using the classical Obwegeser technique for BSSO and reported two unanticipated proximal segment and three distal segment fractures.

Since then, several bad split patterns were reported while using the different surgical techniques.<sup>12</sup>

The bad split pattern was classified by Steenen et al. in 2016 into four types: Type 1, fracture of the buccal plate of the proximal segment (type 1A, small anterior; type 1B, vertical; type 1C, angle; type 1D, horizontal ramal; type 1E, oblique ramal; and type 1F, inferior border; Type 2, lingual fracture of the posterior aspect of the distal segment type 2A, vertical; type 2B, horizontal; Type 3, fracture of the coronoid process; and Type 4, fracture of the condylar process.

Patient factors predictive of a bad split are controversial. The exact cause is unknown whether the patient age, presence of third molar, surgical technique performed by the oral and maxillofacial surgeon, incomplete inferior border osteotomy, or mandibular anatomy influence the risk of a bad split in BSSO. If a bad split occurs, emphasis should first be placed on a careful inspection of the splitting pattern, followed by minimal stripping of the periosteum to assure vascularization of the fractured segment. Second, a salvage surgical procedure needs to be designed to produce the desired functional and aesthetic results. Lastly, great care must be taken not to increase the morbidity further, such as impairment of the neurovascular bundle.<sup>13</sup>

Bad splits may cause mechanical instability, a disturbance in bony union, and lead to bone sequestration with subsequent infection<sup>14</sup>. In addition, conditions like temporomandibular joint (TMJ) dysfunction and inferior alveolar nerve damage may arise due to excessive intraoperative manipulation in an attempt to reposition the fractured segments, and that subsequent difficulty in positioning the condyle in the glenoid fossa may increase the risk of relapse.<sup>15-19</sup> In order to reduce the risk of postoperative functional

deficits, fractured split segments are best fixated and reconsolidated.

In our present case report, we recognised undesired fracture of the buccal cortical plate (proximal segment) intraoperatively and carefully repositioned the proximal segments without the need of fixation by carefully stripping the muscles and ligaments from the medial side of the proximal segment.

The post operative 3D image revealed an unfavorable fracture pattern on the right side buccal cortical plate of the proximal segment, where the fracture line runs obliquely starting from the buccal cortical plate of the body of mandible without involving the lower border and passing above the angle towards the ramus of mandible. This type of bad split fracture pattern was different from the bad split patterns reported in the literature review (1971-2015)<sup>15</sup>.

In our present case, we recommended intermaxillary fixation for 6 weeks to ensure correct bone healing and to prevent postoperative infection. Apart from transient paraesthesia, we didn't encounter any other postoperative complications.

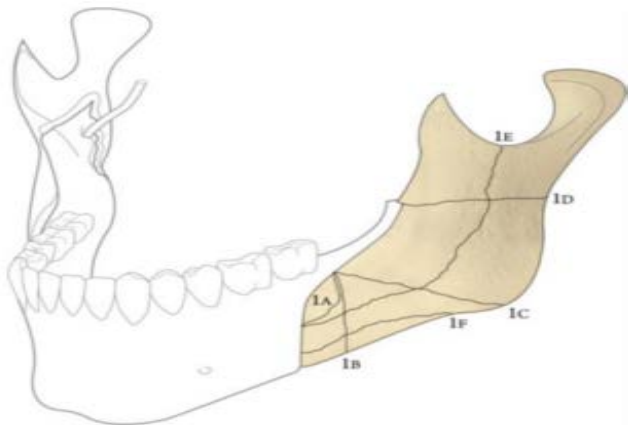


Figure 3

Bad split patterns reported in the literature (1971–2015).<sup>13</sup> Type1: Proximal segment (buccal) fractures (type 1A, small anterior; 1B, vertical; 1C, angle; 1D, horizontal ramal; 1E, oblique ramal; 1F, inferior border).

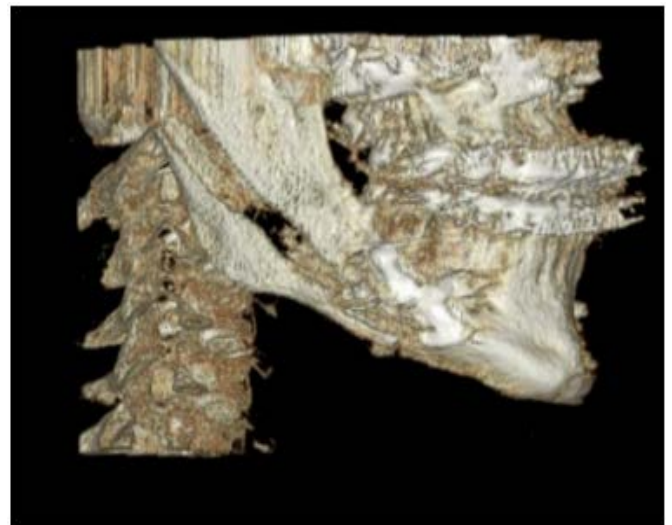


Figure 4

Bad split pattern observed in our case report. Proximal segment (buccal) fracture, note the fracture line runs obliquely on the buccal cortical plate passing from above inferior border of mandible towards the ramus of mandible.

### Conclusion

Various factors like the patients age, presence of third molar, surgical technique performed by the oral and maxillofacial surgeon, incomplete inferior border osteotomy, or mandibular anatomy may influence the risk of a bad split in Bilateral Sagittal split osteotomy. So appropriate salvage procedures must be followed to manage the different types of undesired fracture without excessive intraoperative manipulation in an attempt to reposition the fractured segments to avoid Temporomandibular joint (TMJ) dysfunction and inferior alveolar nerve damage post operatively.



Figure 5: Pre -treatment right profile view



Figure 6: Post treatment right profile view

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