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Case report

Total subapical mandibular osteotomy to correct class 2 division 1 dento-facial deformity

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ABSTRACT

A severe Class 2 division 1 dento-facial deformity in an adult is normally treated by a combination of orthodontics and orthognathic surgery. The surgical procedure may involve either a single or double jaw osteotomy. The sagittal split osteotomy with forward mandibular slide has been the procedure of choice for many years for correcting the antero-posterior discrepancy between the dental arches. Although the total subapical mandibular osteotomy was described over 20 years ago, reports of its use in the literature are sparse. We report two cases to demonstrate that it can be the operation of choice for surgical correction of Class 2 dento-facial deformity in carefully selected cases. When performed correctly it can have very good aesthetic and functional results.

1. Introduction

Class 2 division 1 malocclusions are the most common dento-facial deformities seen in clinical practice, occurring in 13% of the population (Proffit et al., 1998). Mild to moderate Class 2 problems in young patients can almost always be treated by orthodontics alone. Severe cases however, or cases where growth has ceased, requiring full correction will need a combination of orthodontics and surgery (Cassidy et al., 1993).

Depending on the nature of the problem and its severity, surgical correction of Class 2 division 1 malocclusion can involve surgery to one or both jaws. Mandibular surgery is most frequently carried out using the bilateral sagittal split osteotomy technique, first described in 1957 by Trauner and Obwegeser (1957). A mandibular subapical osteotomy was first described by Hofer (1942) however this operation was initially limited to the anterior mandible alone. Hofer's original technique was modified and popularised by Kole (1959).

Total mandibular alveolar osteotomy was first described by MacIntosh (1974) mainly for correction of infantile apertognathia. He described use of the technique in two other situations, in addition to open bite cases. Dietz et al. (1977) and Murray (1980) reported further modifications of the total subapical mandibular osteotomy which included a horizontal medial ramus cut above the lingula. Eliades and Hegdvedt (1996) reported a single case where they combined bilateral sagittal ramus osteotomy with total subapical mandibular osteotomy to successfully treat a patient with a Class 2 division 2 malocclusion. Pangrazio-Kulbersh et al. (2001) in their paper comparing total mandibular subapical osteotomy and bilateral sagittal split osteotomy for correction of Class 2 subjects showed that both procedures, in their opinion, yielded stable long term results. They stated however that total mandibular subapical osteotomy was the procedure of choice in those cases that need a profound change in the labio-mental sulcus.

Possible disadvantages of total subapical osteotomy include the time required to complete this meticulous surgery as well as mental nerve damage, loss of tooth vitality, loss of a tooth or teeth, or indeed total loss of a dento-alveolar segment.

In the following report we describe two cases of Class 2 division 1 malocclusion, both of which had particularly well developed chins and deep labio-mental folds, treated using a total subapical mandibular osteotomy technique following a course of pre-surgical orthodontics.

2. Surgical technique used on these patients

A lower vestibular incision from right retromolar region to the left retromolar region is made, taking care to avoid damaging the mental nerve at the premolar region. A mucoperiosteal flap is reflected to expose the whole of the lateral mandible. The mental nerve is then identified and exposed. Space is then created around the mental nerve where it exits the mental foramen, by carefully removing a ring of cortical bone around the foramen (Fig. 1a). The inferior alveolar neurovascular bundle is then exposed and completely freed in its entire length from the mental foramen to

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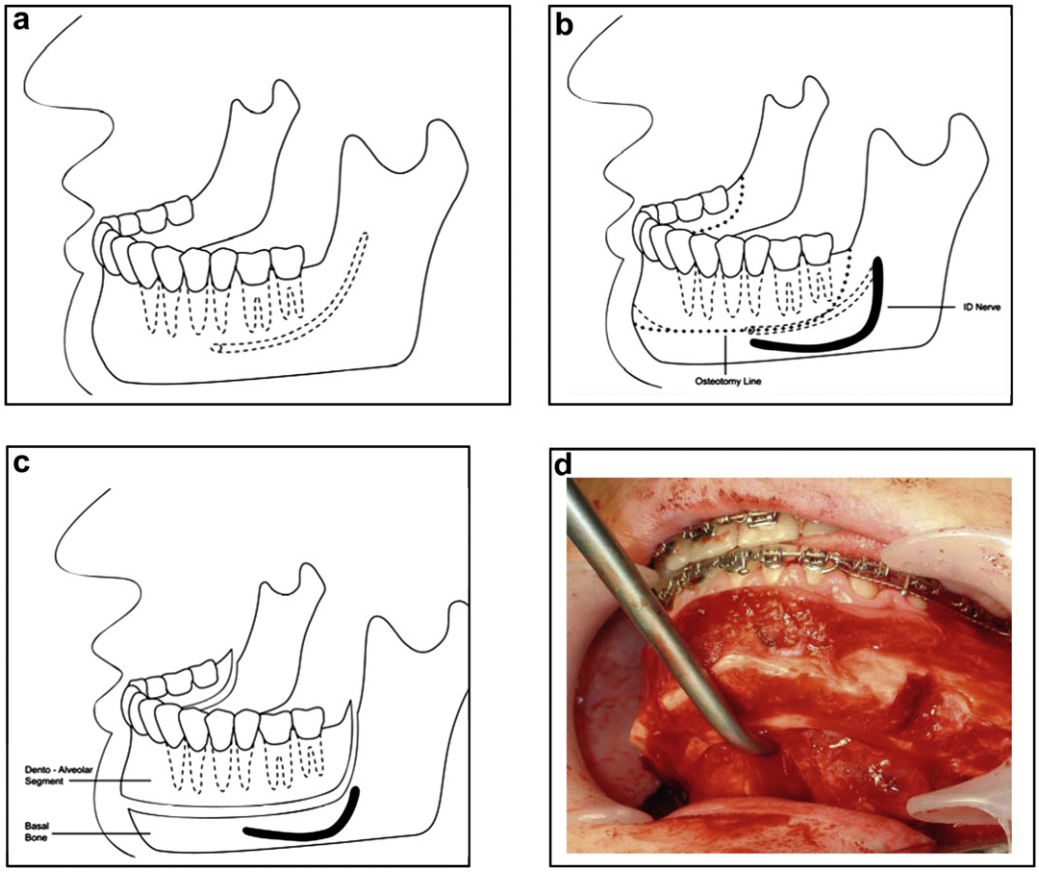

Fig. 1. (a) Line diagram showing freeing of mental nerve at the mental foramen and removal of buccal bone over inferior alveolar nerve, (b) inferior alveolar neurovascular bundle displaced from inferior alveolar canal, (c) complete separation of tooth-bearing segment from basal bone, (d) clinical photograph showing repositioning of the whole lower dento-alveolar segment.

the retromolar region by gradual and meticulous removal of a channel of buccal cortical bone with a bone removing bur. Copious amounts of saline irrigation are used throughout this entire procedure. Once the inferior alveolar neurovascular bundle can be viewed in its entirety, it is carefully removed from the inferior dental canal and displaced either inferiorly or superiorly to the canal (Fig 1b). This requires sectioning of the incisive nerve. The lingual plate from the mental foramen to the retromolar region can now easily be separated from the basal bone using an oscillating saw. An enormous amount of care is taken to avoid damaging the apices of the premolar and molar teeth. The osteotomy cut is then completed in the parasymphyseal region by cutting through both the buccal and lingual plates with an oscillating saw at least 5 mm below the apices of the anterior teeth. It is essential to avoid damage to the lingual mucosa at the time of cutting the lingual bone as this will be the main pedicle supplying nutrition to the dento-alveolar segment after the osteotomy. The dento-alveolar segment is then completely separated from basal bone (Fig. 1c). This mobilized alveolar bone segment, containing the entire lower dentition, can now be repositioned to the desired site with the aid of a surgical wafer (Fig 1d). The tooth-bearing fragment is now stabilized in the new position with mini bone plates. The mucosal incision is then closed with dissolvable sutures.

3. Case 1

A 23-year-old woman presented with a Class 2 division 1 incisor relationship on a Class 2 skeletal base largely due to retrusion of the lower dento-alveolar segment (Fig. 2). She had ANB of 4.5° on a normal SNA of 81°. Her lower vertical facial height was reduced at 50% although her maxillary mandibular planes angle was normal at 28.5°. Her upper labial segment was well aligned but proclined at 125° and her lower arch was also well aligned and normally inclined at 90°. In occlusion, her overjet was 14 mm and her overbite was 3.5 mm. Notably, she had a prominent bony pogonion with thick soft tissue cover therefore her chin appeared to be in a good position from an aesthetic perspective.

It was considered that correction of her sagittal discrepancy with the usual technique of a sagittal split mandibular advancement would lead to an abnormally protrusive chin point, which would then necessitate a reduction genioplasty for full correction. To maintain the chin position, which was considered to be aesthetic, but also to correct her sagittal dental discrepancy she underwent a total mandibular subapical osteotomy to move the whole dento-alveolar segment forward to a 2–3 mm overjet situation. The result of this approach was an excellent functional and aesthetic outcome (Fig. 3).

4. Case 2

A 17-year-old man presented with Class 2 division 1 incisor relationship on a Class 2 skeletal base due to relative mandibular retrognathia. He had an ANB of 6° with SNA of 67°. His maxillary mandibular plane angle was reduced at 16°, with a normal lower facial height of 54%. His overjet was 11 mm with an extremely deep labio-mental fold. The upper arch was crowded and the

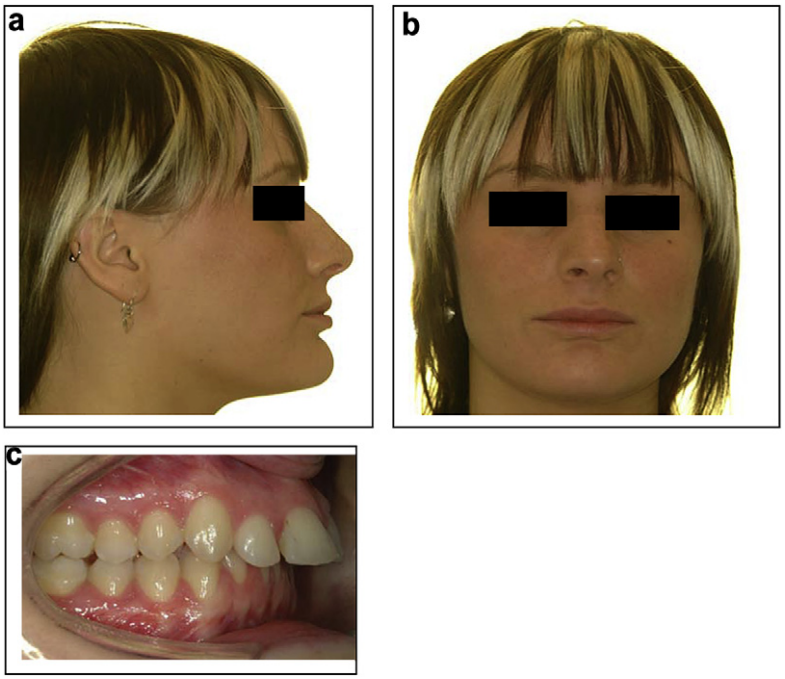

Fig. 2. Preoperative profile (a) and frontal (b) views depicting a deep labio-mental groove and prominent chin despite a Class 2 skeletal relationship. Intraoral view (c).

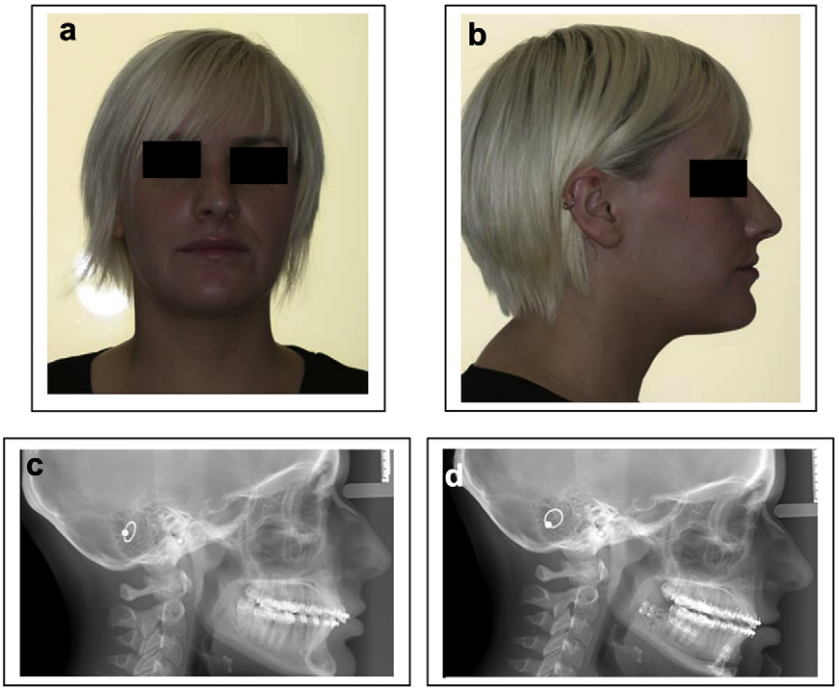

Fig. 3. Postoperative frontal (a) and profile (b) views. Preoperative (c) and postoperative (d) lateral cephalograms showing advancement of dento-alveolar segment and mini-plate fixation.

centre-line was 2 mm to the right, the lower centre line was in the facial midline. He had a very prominent bony pogonion with thick soft tissue cover; as a result his chin was in a reasonably aesthetic position (Fig. 4). To correct his incisor relationship as well as the sagittal discrepancy in the buccal segments, but to simultaneously maintain the position of his chin, the preferred option would be to move the whole dento-alveolar segment forwards on the basal bone. As well as maintaining his chin in its reasonable position, this option would also reduce the deep labio-mental fold.

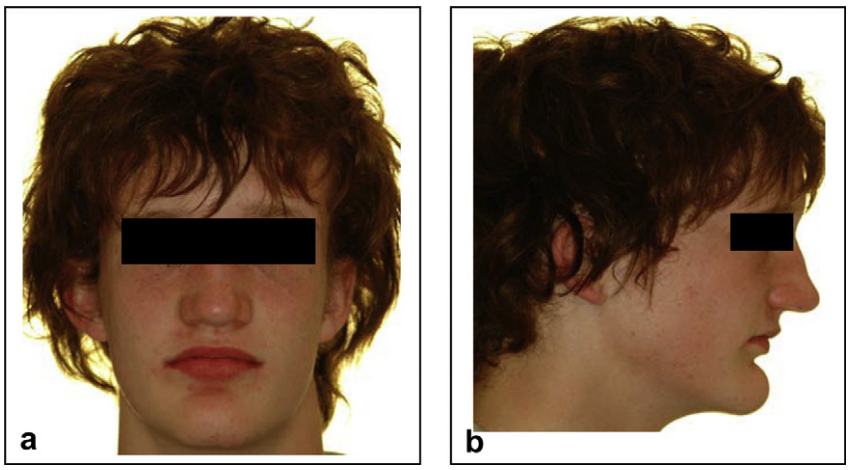

Fig. 4. Preoperative frontal (a) and profile (b) views depicting Class 2 skeletal relationship, prominent chin and deep labio-mental groove.

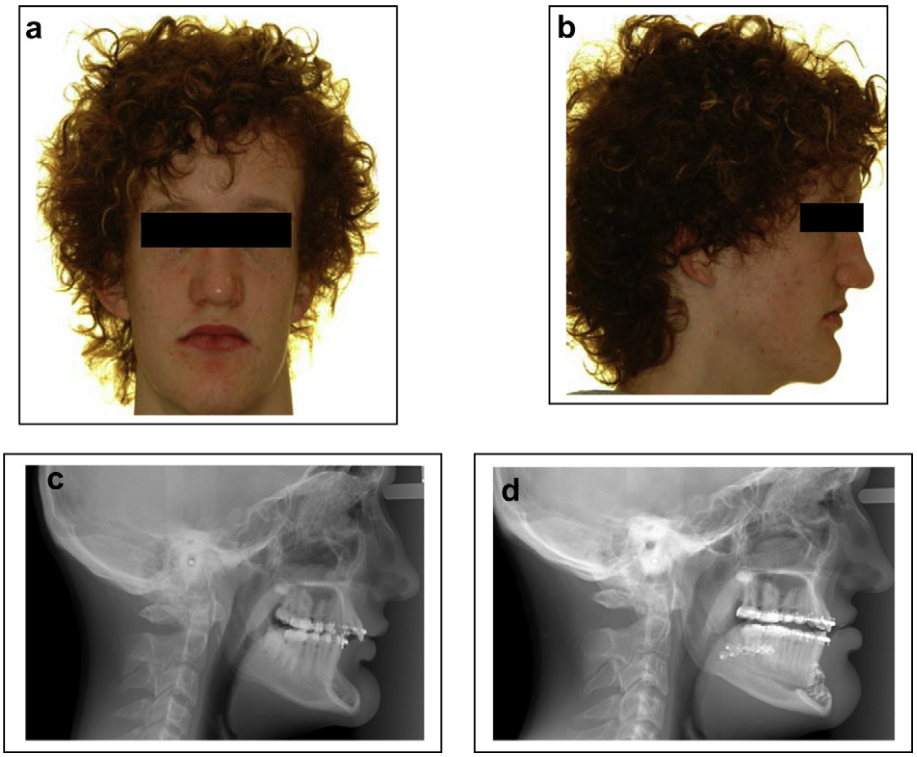

Fig. 5. Postoperative frontal (a) and profile (b) views. Preoperative (c) and postoperative (d) lateral cephalograms depicting advanced lower dento-alveolar segment.

Pre-surgical orthodontics was carried out to expand his upper arch and to align the upper and lower dentition. After this he underwent a total mandibular subapical osteotomy to move the dento-alveolar segment forwards and to fully correct his malocclusion. This resulted in a satisfactory incisal relationship and aesthetic outcome (Fig. 5).

5. Alternative treatment options

An alternative treatment option in both of these cases would have been orthodontic decompensation, coordination and alignment of the arches, followed by a sagittal split mandibular advancement osteotomy to three-point contact which would produce clockwise rotation of the mandible. This would correct the deep bite and increase the lower facial height. Full correction of the lower curve of Spee can then be carried out post-surgery by extrusion of the buccal segment teeth.

The patient's appearance can improve because of this clockwise rotation of the mandible particularly in cases where the reduced lower facial heights were a major aesthetic consideration. In our two cases the problem was that the patients' soft and hard tissue pogonions were in the correct position anteroposteriorly and a mandibular advancement osteotomy would lead to an excessive protrusion of the soft tissue pogonion. This could be dealt with by a horizontal reduction genioplasty, perhaps with vertical augmentation if this was considered necessary. The results of genioplasty procedures however are variable and can lead to a 'floppy chin'. By correcting the Class 2

sagittal discrepancy by total mandibular subapical osteotomy instead of bilateral sagittal split osteotomy, risks associated with condylar distraction leading to relapse and condylar resorption are therefore avoided.

A second alternative treatment option could have been distraction osteogenesis of the anterior segment perhaps from first bicuspid to first bicuspid. This would however leave the patient with space for a third bicuspid in the lower arch thus committing them to a lifetime of dental treatment with requirements for single tooth implants or fixed/fixed bridges in the newly created premolar space. The results of distraction osteogenesis are also unpredictable, therefore the result is not guaranteed.

We feel that the total subapical osteotomy was indicated in these cases because it preserved the integrity of the complete lower dental arch and also allowed antero-posterior and vertical correction of the malocclusion resulting in an excellent aesthetic and functional result in both cases.

6. Discussion

Although mandibular subapical surgery has been reported in the literature, most surgical procedures have been limited to the anterior mandible. While total mandibular subapical osteotomy is a reasonable alternative surgical procedure that should be considered for some Class 2 cases, there have been very few reported cases, since it was first described by MacIntosh (1974).

One reason for the lack of popularity of this approach could be the amount of intricate surgery that is required to free up the inferior alveolar nerves on both sides of the mandible. Whilst this technique was reasonably time consuming for both of the patients described above (taking 1.5–2 times as long as a standard sagittal split osteotomy) it is felt that with practice, familiarity with the technique will follow and the time needed to complete the technique safely, will significantly reduce to levels little more than a traditional sagittal split osteotomy.

From the patients perspective the technique had a number of major advantages. The pain and swelling associated with a bilateral sagittal split osteotomy was significantly less in total mandibular subapical osteotomy. Because there was no through and through mandibular 'fracture', the basal bone was completely intact at all times which meant the patient postoperative discomfort was minimal. The patients were able to open and close their mouths with very little discomfort from the first postoperative day and in both cases the swelling was less than seen with a traditional approach. There could also be a concern on the surgeons' part about the possibility of devitalizing the teeth in the lower arch. Following an initial period of hypo-aesthesia, full sensory perception was restored to the lower lip in both of these cases and in neither case was the vitality of the teeth compromised when they were reviewed 2 years after de-bond of orthodontic appliances.

We are not advocating however, that this technique be undertaken by either junior staff or inexperienced surgeons, as the success of this approach is totally dependent upon a meticulous surgical technique and a full appreciation of all the anatomical structures in the surgical area including the teeth. Because of the potential complications that could be associated with the technique, we recommend that it should only be undertaken in very carefully selected cases, by experienced surgeons, who can handle the soft and hard tissues with a high degree of precision.

7. Conclusion

We have demonstrated in these two cases that, with careful patient selection and surgery performed by a skilled surgeon, total mandibular subapical osteotomy approach can produce an excellent aesthetic and functional result. It should be considered as a possible approach when treatment planning surgical patients with a Class 2 division 1 incisor relationship, especially in those with acceptable chin position at the start of treatment.

Conflict of interest

None to declare.

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