

Surgical Procedure for Orthognathic Correction of Class 2 Skeletal Dentofacial Deformities at Dental Office Setting

Suryakanta Narendra¹, Sanghamitra Jena², Anup Satpathy³

Contributors:

¹Professor and Head, Department of Periodontics, Sriram Candra Bhanja (SCB) Dental College, Cuttack, Odisha, India; ²Assistant Professor, Department of Orthodontics, Institute of Technology and Science Dental College, Muradnagar, Uttar Pradesh, India; ³Professor and Head, Department of Oral Surgery, Vira Surendra Sai Medical College, Burla, Odisha, India.

Correspondence:

Dr Suryakanta Narendra, Professor and Head, Department of Periodontology, Sriramchandrabhanja Dental College, Cuttack, Odisha, India. E-mail: suryakantanarendra@yahoo.com

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Abstract:

Background: The delivery of care for orthognathic correction of Class 2 skeletal dentofacial deformities is becoming more challenging because of escalating health care costs and limited reimbursement from insurance providers. The delivery of these surgical services performed in a hospital environment under general anesthesia now can be routinely achieved in an outpatient setting of any dental office by corticotomy assisted orthodontics, substituting conventional horizontal anterior maxillary osteotomy.

Materials and Methods: A total of 20 adult patients with severe skeletal Class 2 division 1 malocclusion with mean skeletal discrepancy around A-point-nasion-B point (ANB) angle 10° and with mean occlusal discrepancies around 10 mm advised for orthognathic surgery are selected for this study. Here, investigation is done to test the efficacy of alveolar reshaping surgery and corticotomy at extraction sites under local anesthesia followed by fixed orthodontic treatment at dental office setting.

Results: The results at 3 and 6 months interval, when compared to the baseline, indicated that this treatment modality resulted in significant change in cephalometric parameters like ANB angle and overjet values with this application of treatment protocol.

Conclusion: Corticotomy assisted orthodontics comparatively a less invasive procedure than orthognathic surgery, can be utilized to improve the skeletal facial profile completely at dental office setting instead of utilizing surgical services at hospital environment under general anesthesia.

Key Words: Alveolar bone, bone remodeling, orthognathic surgery

Introduction

The delivery of care for orthognathic correction of Class 2 skeletal dentofacial deformities is becoming more challenging because of escalating health care costs and limited reimbursement from insurance providers. The delivery of these

surgical services performed in a hospital environment is now routinely achieved in an outpatient setting of a dental office. Surgery for treatment of these conditions completed in the dental office without administration of general anesthesia can be considered to be safer, and aid in controlling the escalation of health care costs.¹

As the percentage of adult, orthodontic patients increased in orthodontic practices, the skills required of the orthodontist changed.² The treatment of adult orthodontic cases and the recognition of the effect of orthodontics and growth modification on the face have changed the focus of routine orthodontic treatment.³ The goals of orthognathic treatment for the improvement of facial appearance may be attained readily by orthodontic methods in children, but the tools are different for different ages, orthognathic surgery in the adult for skeletal modification and growth modification in the adolescence.⁴ When surgery assisting orthodontic treatment became a more refined and less traumatic procedure, it rapidly became a reasonable treatment option for orthodontists to incorporate into their treatment planning strategies.⁵ The facial changes created by improvement of skeletal malformations are truly remarkable, and they are important factors for patient's motivation and satisfaction.⁵

Different types of periodontal surgeries to facilitate orthodontic treatment are introduced from time to time.⁶ The surgical procedures such as corticotomy, alveolar corticotomy, and periodontally accelerated osteogenic orthodontics (PAOO) the decalcification-recalcification procedure consistent with regional acceleratory phenomena (RAP) are indicated to accelerate orthodontic treatment.⁷ One of the most important objectives for an interdisciplinary team for addressing dentofacial orthopedics problem should be optimization of the elaborated procedures to maximize long-term function, esthetics, and stability.⁸ Orthognathic surgical options are being selected less often even though they are the optimal choice for the treatment of skeletal discrepancies.⁸ At the same time, patients are demanding simplified minimal invasive surgical treatment protocols with less recovery times.⁹ These are just some of the reasons for the development of alternative techniques of classified surgical procedure to facilitate orthodontic treatment.⁹ These techniques, using corticotomies and single or multiple tooth osteotomy/osteoplasty to enhance orthodontic movements are gaining more popularity.⁹ This article reports the effectiveness of alveolar reshaping

surgery with complete corticotomy at extraction site of the 1st upper premolars for the treatment of severe skeletal Class 2 malocclusion substituting horizontal anterior maxillary osteotomy. On closer evaluation, this surgical technique provides some very promising concepts to get a grip for better overall treatment for patients with complex skeletal orthodontic problems on an outpatient basis.

Materials and Methods

A total of 20 adult orthodontic patients including both sexes were selected for this study. The criteria for selection of the patients were as follows.

Inclusion criteria

Subjects are having severe Class 2 variety skeletal discrepancy with mean A-point-nasion-B point (ANB) angle 10° (Figure 1).

- Subjects are having occlusal discrepancy with mean overjet 10 mm
- Subjects are otherwise healthy
- Subjects are having no habits of using tobacco in any form
- Subjects are in the age group 20-35 years.

Exclusion criteria

Subjects with history of smoking subjects with medically compromised condition.

On examination, it was found that these patients were having a severe skeletal discrepancy. All these patients are advised for orthognathic surgery but not willing to accept that surgical protocol. These 20 patients were divided into 2 groups designated as A1 and A2, each having 10 patients in each group.

Group A1 included patients giving consent for this surgical intervention as mentioned in study design.

Group A2 prepared to continue orthodontic treatment without surgical intervention.

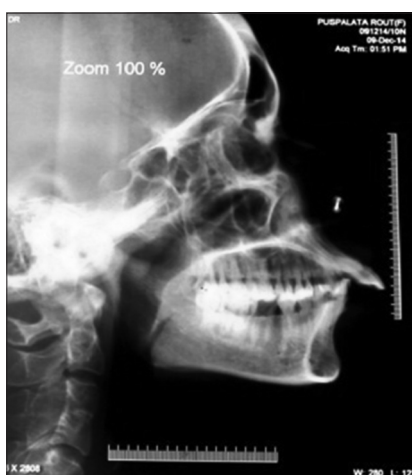


Figure 1: ANB angle 10° and overjet 12 mm.

Clinical parameters

(1) ANB angle, (2) Overjet, and (3) Clinical attachment level.

Surgical procedure

In Group A1 for all the 10 patients, alveolar reshaping surgery on labial aspect (Figure 2), alveolar reshaping surgery on palatal aspect (Figure 3), with complete corticotomy at extraction site (Figure 4), is done followed by fixed orthodontic



Figure 2: Alveolar reshaping surgery on labial aspect.



Figure 3: Alveolar reshaping surgery on palatal aspect.



Figure 4: Corticotomy at the extraction site.

treatment (Figure 5). From canine to canine the thickness of alveolar housing only in interproximal areas is compromised without removing tooth-supporting bone. The osteoplasty procedure is similar to vertical grooving on labial and palatal aspect. Corticotomy was done at the extraction site of both first premolars. This procedure of surgical periodontics is followed by fixed orthodontics treatment. All the 10 patients in Group A2 giving consent for continuing orthodontic treatment alone without any surgical intervention are called at regular intervals as per the fixed orthodontic treatment protocol.

Results

The two main cephalometrics parameters ANB angle, for determination of skeletal discrepancy and over jet, for determination of occlusal discrepancy are recorded. The cephalometrics parameters of patients continuing orthodontic treatment with surgical intervention and patients without periodontal surgical intervention are analyzed and displayed in the tables given in Tables 1 and 2, for Group A1 and A2, respectively.

From statistical analysis of results of cephalometric analysis, the following observations are made:

In Group A1, the differences (D1) between the base values of ANB angle, overjet and the values at 3 months interval following alveolar reshaping surgery and orthodontic treatment is highly significant, found in Table 1. In Group A1, in the 1st 3 months, following periodontal surgical intervention, the improvement of the skeletal profile can also be observed from (Figure 6). The evidence of change in cephalometrics parameter also can be seen from (Figures 1 and 6). This explains the significance of changes in values of parameters between base value and the values at 3 months.

Again the differences of changes in ANB angle and overjet between the base value and at 3 months (D1) are compared



Figure 5: Postsurgical orthodontic treatment.



Figure 6: Lateral cephalogram 3 months after treatment.

Table 1: Comparison of ANB angle and over jet from baseline to different time intervals in patients with combined treatment.

Clinical parameters	Base value	6 weeks	3 months	Difference between B value and 3 months (D1)	T value at df 9 P=0.001	6 months	1 year	Difference between 3 months and 1 year (D2)	Comparison between D1 and D2
ANB angle	10.8'±2.8'	4.8'±0.4'	3.5'±1.5'	7.3'±1.3'	t>4.78 at df9 P=0.001, HS	2.5'±0.5'	2.2'±0.7'	1.3'±0.8'	t>3.92 at P=0.001, NS
Over jet (mm)	10.5±1.5	6.6±0.6	4.4±0.4	6.1±1.1	t>4.78 at df9 P=0.001 HS	3.6±0.6	2.8±0.5	1.6±1	t>3.92 at P=0.001, NS

ANB: A-point-nasion-B, NS: Non-significant

Table 2: Comparison of ANB angle and over jet from base line to different time intervals in patients with orthodontic treatment alone.

Clinical parameters	Base value	6 weeks	3 months	Difference between B value and 3 months (D3)	T value at df 9 P=0.01	6 months	1 year	Difference between 3 months and 1 year (D4)	Comparison between D3 and D4
ANB angle	10.6'±2.7'	10.5'±0.2.6'	10.5'±2.6'	0.1±0.05	t<3.25 at df9 P=0.01, ns	10.4'±2.3'	10.4'±2.2'	0.1±0.05	t<2.88 at P=0.01, ns
Over jet (mm)	10.3±2.1	10±2.3	9.8±2.2	0.5±0.1	t<3.25 at df9 P=0.01, ns	9.5±1.5	9.2±2.1	0.6±0.1	t<2.88 at P=0.01,ns

ANB: A-point-nasion-B, NS: Non-significant

with the differences between 3 months and 1 year (D2) in Table 1. D1 is found to be having more significant value than D2.

In Group A2, the differences between the base values of ANB angle overjet and at 3 months interval (D3) is not significant, shown in Table 2. Again the differences of changes in ANB angle and overjet between the base value and at 3 months interval (D3) are compared with the differences between 3 months and 1 year (D4). The differences are also found to be having no significance, shown in Table 2. In both the groups, the periodontium is finally found to be intact as the mean sulcus depth was within the normal limit as shown in Table 3.

Discussion

The difficulties associated with orthognathic correction have turned the interest of clinicians away from convincing the patients for these procedures.² One of the most important objectives for an interdisciplinary team for addressing dentofacial orthopedics is to employ alternative methods for providing quality surgical services at a reasonable cost exploring less invasive procedure on outpatient mode of surgical care.²

Corticotomy facilitated orthodontics has been employed in various forms over the past few decades to accelerate orthodontic treatments.⁶ Dental distraction technique for distraction of periodontal ligament was introduced by Liou and Huang in 1998. This surgical procedure is having the objective to weaken the bone resistance and grow new bone by mechanical stretching of the reparative bone tissue as in distraction osteogenesis.¹⁰ In 1959, Kole introduced corticotomy for rapid tooth movement during orthodontic therapy.¹¹ It was believed that the main resistance to tooth movement was the cortical plates of bone and by disrupting its continuity, orthodontic treatment could be completed in much less time than normally expected.¹² Kole’s procedure involves the reflection of full thickness flaps to expose buccal and lingual alveolar bone, followed by interdental cuts through the cortical bone. The blocks of bone were outlined using vertical inter-radicular corticotomy cuts. These cuts extend both facially and lingually and were joined subapically through the entire thickness of the alveolus.¹³ Accelerating orthodontic tooth movement can significantly reduce treatment duration and risk of side effects.¹⁴ Suya (1991) reported corticotomy-

assisted orthodontic treatment of 395 adult Japanese patients.¹⁵ Following the surgery, fixed orthodontic appliances were used for the said purpose. Some cases were completed in 6 months; other cases were completed in <12 months.¹⁵ Outstanding results and extreme patient satisfaction with corticotomy procedures were reported.¹⁵ He believed that the tooth movements were made by moving blocks of bone using the crowns of the teeth as handles. He recommended for completion of tooth movement within 3-4 months because, after that time the edges of the blocks of bone would begin to fuse together.¹⁵

Wilcko *et al.*, patented selective alveolar decortications with augmentation grafting combined with orthodontic treatment as PAOO.⁶ Full-thickness labial and lingual alveolar flaps were reflected from the teeth intended for movement, and selective decortications surgery was performed. The surgery was done only in the areas of teeth desired for movement. It was the thickness of cortical bone that dictated where and how the cortical bone was injured. The depth of the decortication cuts barely penetrated into medullary bone and bleeding was promoted. Utmost care was taken not to injure any tooth or encroach on the periodontal ligament. An allograft of resorbable grafting material plus antibiotic was applied directly over the bleeding bone, and the surgical site was closed.⁶ Wilcko *et al.*, observed rapid orthodontics following PAOO and active treatment times of 6-8 months were common.⁷ They questioned Kole’s and suya’s precept of “bony block” movement and offered an alternative hypothesis that rapid tooth movement resulted from marked but transient decalcification-recalcification of the alveolus.⁶ In 1983 Frost, an orthopedic surgeon, had described a direct correlation between degree and proximity of bone trauma and intensity of physiological healing response, which he coined RAP.¹⁶ The alternate hypothesis of decalcification-recalcification described by Wilcko *et al.*, (2001, 2003) was consistent with RAP. Canine retraction was shown to be accelerated by corticotomy assisted orthodontics in animal studies.¹⁷ Post-orthodontic treatment stability was reported to be enhanced in corticotomy assisted orthodontic treatment.¹⁸ Corticotomy assisted traction was shown to facilitate eruption of palatally impacted canines.¹⁹ Corticotomy assisted expansion after surgical closure of palatal fistula in a patient with cleft palate was reported by Yen *et al.*²⁰ Corticotomy assisted orthodontic treatment was used as adjunctive treatment for manipulation of skeletal anchorage during the treatment of bimaxillary protrusion.²¹ In 2014, Finn MD mentioned that in surgically-assisted orthodontics multiple modalities are combined to shorten treatment time and to accomplish results that cannot be achieved with orthodontics alone. Surgeons are able to work in the comfortable environment with less cost and treatment time ultimately increasing the patient acceptance.²²

With this background of history of literatures on surgery to accelerate orthodontic treatment, alveolar reshaping

Table 3: Changes of mean sulcus depth.

MSD	Group A1 (mm)		Group A2 (mm)	
	<2	≥2 to ≤3	<2	≥2 to ≤3
No of patients: Before treatment	10	0	10	0
No of patients: After treatment	0	10	0	10

MSD: Mean sulcus depth

surgery with a combination of complete corticotomy at extraction site is investigated to resolve the skeletal Class 2 orthodontic problems. The patients are selected within the age group of 20-35 years. These cases were having average occlusal discrepancies around 10 mm and average skeletal discrepancy with ANB angle around 10°. Complete removal of cortical bone at the extraction sites and osteoplasty (vertical grooving) at inter-proximal areas is done to accelerate orthodontic tooth movement in these cases. This procedure of osteoplasty (vertical grooving) is also adapted during periodontal osseous resective surgery. This surgery with minimal invasion of bone is better accepted by patients. Here, the orthodontic tooth movement to the major extent could be completed by orthodontic activation of fixed appliances in much less time i.e., within 3 months. The ANB angle improves by more than 7° within the first 3 months. The occlusal discrepancy also improved by 6 mm during the same period. The alveolar bone is found to have taken a new shape along with the movement of teeth evident from the cephalogram (Figures 1 and 5). For this reason, this surgical procedure could be designated as surgical periodontics for accelerated orthodontics. The remarkable changes in facial profile within the span of the first 3 months are the reason, for better patient's acceptance of this treatment module. In the next 3 months, minor changes in positions and alignments of the teeth were corrected. The treatment was completed within 1 year. This entire surgical procedure involved in these dentofacial orthopedic corrections was done in dental office setting.

Conclusions

Alveolar reshaping surgery with corticotomy at extraction site, followed by fixed orthodontic treatment, can be done to resolve the problems of severe skeletal Class 2 division 1 malocclusion. This surgery, done on the outpatient basis can substantially reduce the cost and be an effective way of providing quality and affordable treatment to patients. Minimal invasion of bone is the cause of better patient's acceptance for this treatment protocol. The skeletal discrepancy with the ANB angle more than 10° and occlusal discrepancy ranging around 10 mm of over jet, which requires orthognathic surgery (horizontal anterior bi-maxillary osteotomy) can be also managed by this treatment protocol to accelerate orthodontic treatment. This surgical practice can change the health care landscape for orthognathic correction of skeletal Class 2 dentofacial orthopedics, to be more flexible and adaptive.

Instead of being performed in a hospital environment can now be performed in an outpatient setting.

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