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ORIGINAL RESEARCH

An Esthetic Treatment Outcome of Orthognathic Surgery and Dentofacial Orthopedics in Class II Treatment: A Cephalometric Study

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ABSTRACT

Aim: The main objective of any orthodontic treatment is to achieve well-established stable occlusal relationship with a definite positive change in facial profile. The purpose of this study was to determine, if such a goal is achievable for patients who could be classified as borderline surgical cases without the invasive use of the actual surgery or, with the use of the recently developed and rapidly spreading fixed functional appliance system (Forsus) and a comparison of the esthetic treatment outcome with the two systems.

Materials and methods: Twelve postadolescent borderline skeletal class II patients with a deficient mandible. All the patients used in the study were treated by a preadjusted edgewise appliance for presurgical decompensation with or without extractions and for postsurgical finishing and detailing. Out of the 12 patients six were treated with bilateral saggital split osteotomy (BSSO) and six were treated with fixed functional appliance (Forsus).

Results: The results suggested that although surgical patients had a better mandibular advancement, profile reduction, and marked improvements in soft tissue structures, the patients who had undergone fixed functional therapy also had comparable improvement in the above aspects. In the maxilla there was no change in cases treated with surgery but in case of Forsus some retraction of anterior dental segment was evident.

Conclusion: In surgical group, class II malocclusion correction was more skeletal than dental, whereas in functional group class II malocclusion correction was more dental than skeletal.

Clinical significance: Looking at the common surgical risks, cost-effective and postsurgical problems and patients with borderline class II malocclusion, fixed functional therapy is a valuable adjunct in the management of class II malocclusion.

Keywords: Fixed functional appliance system, Bilateral sagittal split osteotomy, Esthetic treatment outcome.

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INTRODUCTION

The goal of modern orthodontics is to establish the best possible occlusal relationship between the maxillary and mandibular dentition while maintaining or enhancing facial esthetics.[1] Some patients have a unique constellation of skeletal and dental features that neither growth modification nor camouflage would be able to offer a possible solution. Combined surgical orthodontic procedures to correct major dentofacial deformities and malocclusion has been in practice for many years. These surgical procedures also produces changes in the shape and position of the overlying soft tissues.[2,3] Many investigations have been carried out to evaluate the possibilities of growth modification with orthopedic appliances.[4,5] Orthopedic appliances provide a new muscular and functional environment for the facial bones that encourage with changes of either mandible or maxilla.[5] The lack of success of functional appliances has in some circumstances been attributed to lack of patient compliance in appliance wear. Thus, the ideal appliance was needed for the correction of class II skeletal problems that would eliminate the need for patient cooperation, provide the ability to stimulate the overall amount of mandibular growth and direct this growth in the appropriate direction. An important break through in the treatment of class II malocclusion came through the use of fixed functional appliances in adolescent and adult cases, therefore opening a new vista in the clinical management of borderline skeletal discrepancies. So the aim of this study was:

1. To analyze the dentoskeletal and facial treatment effects in class II postadolescent patients using bilateral saggital split osteotomy (BSSO) and fixed functional therapy.

2. To analyze the esthetic treatment outcome of orthognathic surgery and dentofacial orthopedics in class II postadolescent patients (soft tissue analysis).
3. To assess fixed functional therapy as an alternative to orthognathic surgery.

MATERIALS AND METHODS

Data selection: Twelve adult patients were selected as subjects for the present study comprising of two groups of six patients each: The subjects were selected from the patients attending orthodontic clinic.

Group A: Treated with bilateral saggital split osteotomy.

Group B: Treated with fixed functional appliance (Forsus).

CRITERIA FOR SELECTION OF PATIENTS

- Postadolescent borderline skeletal class II patients with orthognathic maxilla and retrognathic mandible who have convex profile with mandibular deficiency.
- All the patients used in the study were treated by a pre adjusted edgewise appliance for presurgical decompensation with or without extractions and for postsurgical finishing and detailing.
- All patients had a positive clinical VTO.
- No history of trauma or injury to the face.

ANALYSIS OF LATERAL CEPHALOGRAMS

Standard lateral cephalograms were taken from the record section for analysis of certain angular and linear measurements for both hard and soft tissues that were selected from Arnetts, Steiners, McNamara, AM Schwarz and Jarabak analysis.[6-10] Cephalograms were traced using a 0.3 mm lead pencil and measurements were made using standard landmarks (Figs 1 to 3).

RESULTS

Statistics

Comparisons between pretreatment and post-treatment values were done using paired t-test. p-value of less than 0.05 was statistically significant (s), p-value less than 0.01 highly significant (HS) and p-value more than 0.05 to be statistically nonsignificant (NS).

The results are summarized in tabular form (Tables 1 to 6).

SKELETAL CHANGES

In group I with regards to the sagittal relationship of the maxilla to the cranial base, the mean difference of SNA angle was 1.00 (Table 1). So no significant change was observed in sagittal relationship of maxilla, sagittal relationship of mandible to cranial base, there was optimum increase in the advancement of mandible in sagittal dimension which is shown by the mean value of SNB (2.50).

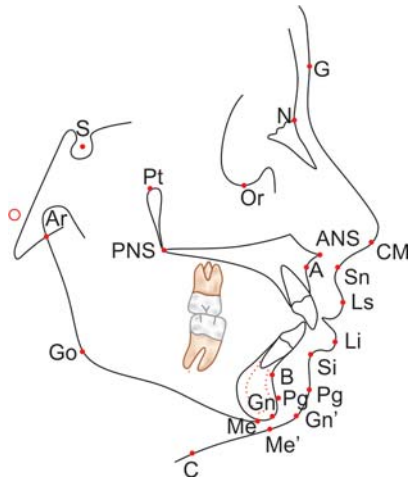

Fig. 1: Landmarks used for measurement

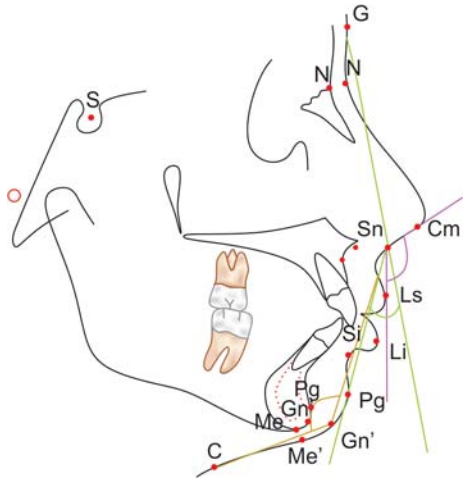

Fig. 2: Soft tissue analysis (angular parameters)

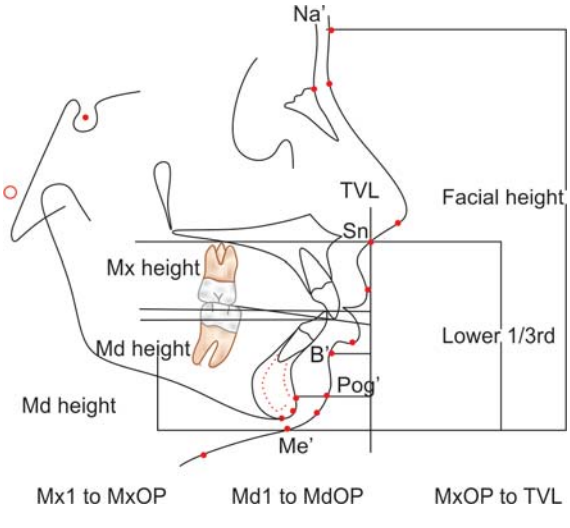

Fig. 3: Soft tissue (linear parameters) measured

In group II, the mean value of SNB (1.83) and N perp-Pog value (5.00) shows that there was significant advancement of mandible.

DENTAL CHANGES

There was significant amount of changes observed in dental structures which suggests that the incisors were proclined. The values lower 1-APog, L1-NB, L1-Mand plane angle, MD1-Mand occlusal plane, MD1-TVL suggesting proclination (Table 2).

SOFT TISSUE STRUCTURES

In relation to lower lip thickness there was marked improvement observed in group II (0.50) than compared to group I (0.17) (Table 3). In relation to Pog-Pog' it was slightly increased in group I (1.00) than in group II (0.83). And in relation to Me-Me' it was minimal increase in group I (0.50) than in group II (0.17). And in relation to interlabial gap it was found to be slightly more improved in group I (3.50) than in group II (3.17). And in relation to soft tissue B point there was marked improvement in group II (4.17) than in group I (3.83).

DISCUSSION

In the present study, the surgical group (Group I), with regards to the sagittal relationship of the maxilla to the cranial base, the mean difference of SNA angle was 1.00. So no significant change was observed in sagittal relationship of maxilla. Whereas in dental relation for upper incisor to NA angle no changes were observed. There was increase in maxillary height when compared to the pre-treatment values, these values were statistically significant but clinically not significant. With regards to sagittal relationship of mandible to cranial base, there was optimum increase in the advancement of mandible in sagittal dimension which is shown by the mean value of SNB (2.50) and N perp-Pog (– 6.33). The mean value of GoGn-SN (3.17) suggests that along with sagittal direction there was advancement of mandible in vertical direction as well (Table 1). And there was an increase in the mandibular length in horizontal and vertical direction. And also there was gradual increase in mandibular height (Table 5). In the maxillomandibular relation, the ANB angle showed significant decrease following surgery. And there was significant improvement in overjet and overbite after mandibular advancement surgery (Table 3). All these values suggests that there was optimum advancement of mandible after surgery.

In this present study the dental structures the mandibular incisors, were proclined in relation to mandibular plane, true vertical line, and mandibular occlusal plane and A-Pog line, more in group II than in group I suggesting there was significant dental corrections observed in group II than in group I (Table 2). These values suggests that class II malocclusion in group II was corrected by dental more than by skeletal, whereas in group I, class II malocclusion was corrected by skeletal more than dental.

In the present study, there was considerable amount of changes found in soft tissue structures following surgery. There was an increase in lower lip thickness (Table 4) and length (Table 5). And interlabial gap was found significantly decreased (Table 5). And when related to true vertical line the linear measurements to the soft tissue pogonion and soft tissue B point significantly reduced following surgery (Table 6).

So from all these above details it shows remarkable improvements in soft tissue corrections in group II compared with group I.

Shell and Woods[11] found that regardless of whether class II patients were treated with growth modification during adolescence or orthognathic surgery during adulthood, facial esthetics improved to a similar extent.[12] And it was concluded that although patients who had undergone surgery had a better mandibular advancement, profile reduction and marked improvements in soft tissue structures, the patients who had undergone fixed functional therapy also showed a good improvement in profile reduction and soft tissue profile comparable to the surgical cases.

Table 1: Post-treatment changes between surgery and functional (skeletal)

Skeletal	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
SNA angle (degrees)	1.00	0.63	3.87, p = 0.01	1.00	1.67	1.44, p = 0.20	0.0	0.0	1.00 (NS)
SNB angle (degrees)	–2.50	0.84	7.32, p = 0.01	–1.83	1.17	3.84, p = 0.01	–0.67	1.14	0.28 (NS)
ANB angle (degrees)	3.50	1.05	8.17, p = 0.001	2.83	1.17	5.94, p = 0.002	0.67	1.04	0.32 (NS)
N Perp. to Pog (mm)	–6.33	2.16	7.18, p = 0.01	–5.00	0.89	13.7, p < 0.001	–1.33	1.39	0.19 (NS)
GoGn to SN (degrees)	–3.17	4.26	1.82, p = 0.13	–2.17	1.72	3.08, p = 0.03	–1.00	0.53	0.61 (NS)
Eff.mand. length (mm)	–3.67	1.21	7.42, p = 0.001	–2.5	1.38	4.44, p = 0.007	1.17	1.56	0.15 (NS)
Y-axis angle (degrees)	1.00	2.36	1.04, p = 0.35	–1.50	0.84	4.39, p = 0.007	2.50	2.44	0.04 (S)
Facial axis angle (degrees)	–2.33	1.03	5.53, p = 0.003	–1.33	3.83	0.85, p = 0.43	–1.00	0.62	0.55 (NS)

NS: Nonsignificant; S: Significant

Table 2: Post-treatment changes between surgery and functional (dental)

Dental	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
U1 to NA angle (degrees)	4.00	5.73	1.71, p = 0.15	6.16	1.60	9.43, p = 0.001	2.16	0.89	0.39 (NS)
L1 to NB angle (degrees)	–4.67	3.78	3.03, p = 0.03	–5.67	3.20	4.33, p = 0.01	1.00	0.49	0.64 (NS)
L1 to A Pog (mm)	0.92	1.74	1.29, p = 0.25	–1.92	2.20	2.13, p = 0.09	2.84	2.48	0.03 (S)
L1 to mand plane angle (degrees)	–6.50	5.28	3.01, p = 0.03	7.00	7.16	2.40, p = 0.06	13.72	3.72	0.004 (S)

NS: Nonsignificant; S: Significant

Table 3: Post-treatment changes between surgery and functional (dentoskeletal structures)

Dental skeletal	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
Mx. occlusal plane	–1.17	6.18	0.46, p = 0.66	–2.33	10.37	0.55, p = 0.61	1.16	0.24	0.81 (NS)
Md1 to Md occlusal plane	–4.50	1.87	5.89, p = 0.002	–2.50	5.82	1.05, p = 0.34	2.00	0.80	0.44 (NS)
Overjet	8.33	1.75	11.7, p = 0.001	7.67	1.03	18.2, p < 0.001	0.66	0.80	0.44 (NS)
Overbite	6.50	1.38	11.5, p = 0.001	6.00	2.83	5.20, p = 0.003	–0.50	0.39	0.71 (NS)

NS: Nonsignificant

Table 4: Post-treatment changes between surgery and functional (soft tissue structures)

Soft tissue	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
Lower lip thickness	0.17	1.60	0.25, p = 0.81	–0.50	1.76	0.70, p = 0.52	0.67	0.69	0.51 (NS)
Pogonion	1.00	0.63	3.87, p = 0.012	0.83	1.33	1.54, p = 0.19	–0.17	0.28	0.78 (NS)
Nasion-menton	–0.50	0.55	2.24, p = 0.08	0.17	0.98	0.42, p = 0.69	–0.67	1.46	0.17 (NS)

NS: Nonsignificant

Table 5: Post-treatment changes between surgery and functional (facial length)

Soft tissue	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
Nasion'-menton	–2.17	4.58	1.16, p = 0.30	–3.83	3.13	–3.00, p = 0.030	1.66	0.73	0.48 (NS)
Interlabial gap	3.00	1.92	4.34, p = 0.007	3.17	3.66	2.12, p = 0.09	–0.33	0.19	0.85 (NS)
Lower lip length	–1.33	1.97	1.66, p = 0.16	–3.00	3.22	2.28, p = 0.07	1.67	1.08	0.31 (NS)
Lower 1/3rd of face	–3.17	3.66	2.12, p = 0.08	–4.50	3.08	3.58, p = 0.02	1.33	0.68	0.51 (NS)
Maxillary height	–3.33	1.21	6.74, p = 0.01	–2.83	0.98	7.06, p = 0.001	–0.50	0.79	0.45 (NS)
Mandibular height	2.17	4.02	1.32, p = 0.24	1.83	3.87	1.16, p = 0.30	0.34	0.15	0.88 (NS)

NS: Nonsignificant

Table 6: Post-treatment changes between surgery and functional (projections to TVL)

Projections to TVL	*Surgery*		*t*	*Functional*		*t*	*Surgery vs functional*		*p*
	Mean	*SD*		*Mean*	*SD*		*Mean*	*t*	
Md1	–4.33	2.25	4.72, p = 0.01	–4.83	1.17	10.1, p = 0.001	–0.50	0.48	0.64 (NS)
Lower lip anterior	–1.50	2.88	1.28, p = 0.26	–2.92	2.94	2.43, p = 0.05	1.42	0.85	0.41 (NS)
B point	–3.83	2.48	3.78, p = 0.01	–4.17	0.75	13.6, p = 0.001	0.34	0.32	0.75 (NS)
Pogonion	–3.17	2.04	3.80, p = 0.01	–4.50	3.73	2.96, p = 0.03	–1.33	0.77	0.46 (NS)

NS: Nonsignificant

But in surgical group, class II malocclusion was corrected more skeletal than dental, whereas in functional group class II malocclusion was corrected more by dental than skeletal. Thus, the question arises which is the best treatment modality for borderline class II adult. The most common surgical risk of mandibular advancement in neurosurgery is disturbances of the lower lip that affect about 50% of the subjects.[13] Additionally, nonunion or malunion of the body fragments, bad splits[14] and condylar resorption[15] are frequent complications. For that several factors must be considered in the treatment decision process:

- The reason the patient is seeking treatment.
- The effects that can be provided by fixed functional appliance and orthognathic surgery respectively.
- The costs and risks of two treatment approaches.

CONCLUSION AND CLINICAL SIGNIFICANCE

The present study was done to assess whether fixed functional appliance (Forsus) can be used as an alternative to mandibular advancement surgery (BSSO) in borderline adult class II patients. It was concluded from the study that the fixed functional appliance are a clinical alternative to advancement surgery (BSSO). Although patients who had undergone surgery had a better mandibular advancement, profile reduction, and marked improvements in soft tissue structures, the patients who had undergone fixed functional therapy also showed a good improvement in profile reduction and soft tissue profile comparable to the surgical cases.

In surgical group, class II malocclusion was corrected more skeletal than dental, whereas in functional group class II malocclusion correction was more dental than skeletal.

Looking at the common surgical risks, cost-effective and postsurgical problems and patients with borderline class II malocclusion, fixed functional therapy is a valuable adjunct in the management of class II malocclusion.

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