

# การผ่าตัดกระดูกขากรรไกรร่วมกับการรักษาทางทันตกรรมจัดฟัน ในผู้ป่วยที่มีโครงสร้างกระดูกขากรรไกรประเภทที่ 2

ภณิดา ณ สงขลา \*

## บทคัดย่อ

รายงานผู้ป่วยแสดงผลการรักษาทางทันตกรรมจัดฟันร่วมกับการผ่าตัด ในผู้ป่วยที่มีความผิดปกติของโครงสร้างกระดูกขากรรไกร และการสบฟันประเภทที่ 2 ที่มีขากรรไกรบนยื่นและหมุดการเจริญเติบโต โดยผ่าตัดเพื่อแก้ไขความผิดปกติของโครงสร้างกระดูกในขากรรไกรบนผ่าตัดถอยกระดูกขากรรไกรบนไปด้านหลังและยกขึ้น ร่วมกับการผ่าตัดเลื่อนคางในขากรรไกรล่าง ซึ่งการจัดฟันก่อนการผ่าตัดเพื่อปรับระดับและเรียงฟัน แก้ไขโค้งสปีและการจัดฟันหลังการผ่าตัดเพื่อปิดช่องว่างที่เหลือ ปรับขนาดช่องว่างให้เหมาะสมสำหรับการใส่ฟันปลอม ใช้ระยะเวลาในการรักษาทั้งสิ้น 31 เดือน ภายหลังการรักษาผู้ป่วยรายนี้ พบว่ามีโครงสร้างกระดูกขากรรไกรและการสบฟันประเภทที่ 1 ยึดเห็นเหงือกและเนื้อเยื่ออ่อนถูกแก้ไขให้ดีขึ้น จากนั้นผู้ป่วยถูกส่งต่อเพื่อทำการใส่ฟันปลอม

**คำสำคัญ :** โครงสร้างกระดูกขากรรไกรประเภทที่ 2, การผ่าตัดขากรรไกร

\* ท.บ., วท.ม.(วิทยาศาสตร์สุขภาพช่องปาก), ว.ท. (ทันตกรรมจัดฟัน) กลุ่มงานทันตกรรม โรงพยาบาลมหาราชานครศรีธรรมราช  
อีเมลล์: pani\_dent@hotmail.com

## Orthognathic surgery in skeletal Class II patient

*Panida Na Songkhla\**

This case report showed the outcome of surgical orthodontic treatment in non- growing patient with skeletal Class II malocclusion and prognathic maxilla. Le Fort I maxillary superior reposition and setback, and chin genioplasty were planned to eliminate the etiology of jaw discrepancy and malocclusion. Presurgical orthodontic treatment was performed with non-extraction, aligned and leveled tooth malalignment and flatted curve of Spee. Postsurgical orthodontic treatment was to consolidate residual spaces and to create proper space for dental substitutes. A total treatment time was 31 months. At the end of treatment, skeletal Class I orthognathic maxilla and mandible, canine and molar Class I was accomplished. Gummy smile was corrected and soft tissue profile has improved dramatically. Moreover, the edentulous areas of both arches were placed by dental prostheses.

**Key words :** skeletal Class II, orthognathic surgery

---

\* D.D.S., Master of Science (Oral Science), Dip.(Orthodontics), Department of Dentistry, Maharaj Nakhon Si Thammarat Hospital, E-mail; pani\_dent@hotmail.com

## Introduction

Class II malocclusion is considered the most frequent problem presenting in the orthodontic practice. The dentoskeletal disharmony can be defined into maxillary - mandibular relationship ; prognathic maxilla, retrognathic mandible or both<sup>1, 2</sup>. This malocclusion is likely to produce significant problem of facial esthetic, function and psychosocial effects. Treatment alternatives are varied according to the skeletal maturity level, severity of malocclusion, facial appearance, patient's expectation and cooperation.

Growth modification would be considered in growing Class II patients to provide restrict growth of maxilla and grow mandible forward. The treatment has opportunity to improve a skeletal relationship.<sup>3,4,5</sup>

In non- growing Class II patient, orthognathic surgery is a treatment approach for patients with severe skeletal discrepancies beyond reach of conventional treatment. An important factor to be considered for surgical combined orthognathic treatment is the paradigm of soft tissue<sup>3,6</sup>. Orthognathic surgery can be done to enhance soft tissue esthetic in severe Class II skeletal discrepancy.

Combined surgical-orthodontic treatment aims to obtain more harmonious facial, skeletal and soft tissue relationship as well as to improve occlusal function.<sup>4,5,6</sup> Thereby, adult patients who have severe skeletal discrepancies, maxillary prognathism, improper facial esthetic, orthognathic combined with orthodontic treatment is the best treatment alternative to gain ideal results regarding function, esthetic and stability.

## Case presentation

A 30- year-old woman with a complaint of upper front teeth protrusion was referred to our clinic. The motivation that she came for orthodontic consultation was internal motivation. Her expectation was normal inclination of upper incisor. She had no medical history and drug allergy.

Extraoral examination, from frontal photographic analysis, revealed a mesofacial type, symmetrical face, slightly short lower anterior facial height and incompetent lips. When she smiled, she had gummy smile. From lateral view, she had a convex soft tissue profile, chin retrusion, upper incisor and lip protrusion. (Fig 1). She has a family history of Class II growth malocclusion.

Intraoral examination showed fair oral hygiene, normal frenum attachment and mild gingivitis. Class II canine and molar relationship, overjet 10 mm, overbite 7 mm. and gingival impinging were presented. Upper teeth mild crowding, lower anterior teeth spacing and lack of several posterior teeth on both arches. Upper and lower midline coincided with facial midline. (Fig 2) She had no functional shifts, no sign and symptom of TMDs. and no abnormal oral habits.



FIGURE 1 PRETREATMENT FACIAL PHOTOGRAPHS



FIGURE 2 PRETREATMENT INTRAORAL PHOTOGRAPHS

**Intraoral analysis**

Frontal view

- Overbite 7 mm.
- Upper dental midline coincides with facial midline
- Lower dental midline coincides with facial midline

Maxillary arch

- Asymmetric paraboloid-shaped arch form
- Mild crowding
- 14, 24-26 edentulous area
- 37 mesial shifting

Mandibular arch

- Asymmetric paraboloid-shaped arch form
- Lower anterior teeth spacing

- 45 linguoversion

Lateral view

Angle's classification

- Right : Unclassified molar relationship  
Class II canine relationship (8mm.)
- Left: Class II molar relationship (8 mm.)  
Class II canine relationship (8 mm.)

- Overjet 10 mm
- Curve of Spee 5 mm.

Arch perimeter

- Upper: intercanine width 33 mm.
- Lower: intercanine width 30 mm.

TOOTH MEASUREMENT

17	16	15	14	13	12	11	21	22	23	24	25	26	27
10	-	7	-	7	7	8	8	7	7.5	-	7.5	-	10
-	12	8	8	6.5	6	5.5	5.5	6	7.5	8	8	-	11.5
47	46	45	44	43	42	41	31	32	33	34	35	36	37

### Space analysis

TYPE	SPACE LACK /EXCESS	
	UPPER	LOWER
FRONT	-2	2
LEFT	20	2
RIGHT	6	10
SUM	24	14

#### Bolton's analysis

Anterior ratio (normal; 77.2 + 1.65 %) = 80%

Conclusion: The size of upper anterior teeth is larger than normal.

- Permanent dentition stage
- 28, 38 and 48 were surgical removal
- Maxillary sinus and nasal septum are normal.
- Normal bone density and trabeculation
- Symmetrical condyles
- No sign of airway obstruction
- No visible pathology

#### Radiographic analysis

1. Panoramic radiograph (Fig 3)



Figure 3 Pretreatment panoramic radiograph

2. Lateral cephalometric radiograph (Fig 4)

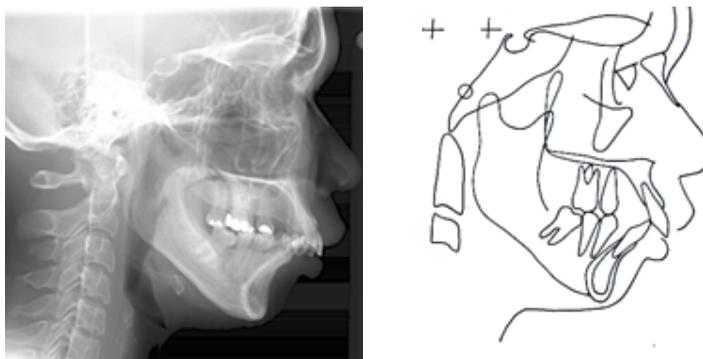


Figure 4 Pretreatment panoramic radiograph

Table 2 Pretreatment cephalometric analysis.

AREA		MEASUREMENT	NORM MEAN±SD	PRE-TX 21/7/17	INTERPRETATION
SKELETAL	MAXILLA TO CRANIAL BASE	SNA (DEGREE)	84 + 4	88	PROGNATHIC MAXILLA
		A-NPERP (MM)	5 + 4	10	PROGNATHIC MAXILLA
	MANDIBLE TO CRANIAL BASE	SNB (DEGREE)	81 + 4	81	ORTHOGNATHIC
		PG- NPERP (MM)	0 + 6	15	MANDIBLE RETROGNATHIC MANDIBLE
	MAXILLO- MANDIBULAR	ANB (DEGREE)	3 + 2	6	SKELETAL CLASS II
		WITS (MM)	-3 + 2	1	SKELETAL CLASS II
	SKELETAL CONFIGURATION	FMA (DEGREE)	23 + 5	30	HYPERDIVERGENT
		SN-GOME (DEGREE)	29 + 6	35	NORMODIVERGENT
		NS-GN (DEGREE)	68 + 3	72	HYPERDIVERGENT
		OCCL-SN (DEGREE)	16 + 5	5	HYPODIVERGENT
OTHERS	SNO (DEGREE)	65 + 6	50	MIDFACE DEFICIENCY	
	O-NA (MM)	9 + 2	20	MIDFACE DEFICIENCY	
	MAX. DEPTH (DEGREE)	90 + 3 90 + 3	95 94	EXCESSIVE MAXILLARY LENGTH EXCESSIVE	
	CO-A (MM)	119 + 4	119	MAXILLARY LENGTH	
	CO-GN (MM)	6 + 3	4	NORMAL MANDIBULAR	
	FH-SN (DEGREE)	8 + 5	1	LENGTH NORMAL SN	
	OCC.PL. TO FH			PLANE HYPODIVERGENT	
DENTAL	MAXILLARY DENTITION	UI TO NA (DEGREE)	22 + 6	31	PROCLINED UI
		UI TO NA (MM)	5 + 2	13	PROTRUDED UI
		UIPP (DEGREE)	119 + 5	120	NORMAL INCLINED UI
	MANDIBULAR DENTITION	LI TO NB (DEGREE)	30 + 6	30	NORMAL INCLINED LI
		LI TO NB (MM)	7 + 2	9	PROTRUDED LI
		LIMP (DEGREE)	99 + 5	94	NORMAL INCLINED LI
	MAXILLO- MANDIBULAR	UI TO LI (DEGREE)	125 + 8	110	ACUTE INTERINCISAL ANGLE
	OTHER	ADH (MM)	29 + 3	36	INCREASED ADH
PDH (MM)		19 + 2	25	INCREASED PDH	

**Table 2** Pretreatment cephalometric analysis. ( Continue)

AREA		MEASUREMENT	NORM MEAN±SD	PRE-TX 21/7/17	INTERPRETATION
SOFT TISSUE	SOFT TISSUE	U LIP-E PLANE (MM)	1 + 2	10	PROTRUDED UPPER LIP
		L LIP-E PLANE (MM)	2 + 2	7	PROTRUDED LOWER LIP
		NLA (DEGREE)	91 + 8	78	ACUTE NLA
		H-ANGLE (DEGREE)	14 + 4	30	CHIN RETRUSION
		FCA (DEGREE)	9 + 5	20	CONVEX PROFILE
		UFH (MM)	48 + 3	50	NORMAL UFH
		LFH (MM)	69 + 4	65	NORMAL LFH
		ULL (MM)	23 + 2	25	NORMAL ULL
		LLL (MM)	46 + 2	40	DECREASED LLL
		TL (MM)	58 + 7	45	DECREASED TL
		LCTA (DEGREE)	115 + 7	135	INCREASED LCTA

**Diagnosis**

1. Skeletal

- Skeletal class II hyperdivergent pattern with vertical maxillary excess, prognathic maxilla and orthognathic mandible with chin retrusion

2. Dental

- Dental class II division 1 malocclusion, deepbite, mild crowded upper teeth

3. Facial

- Symmetric mesocephalic face
- Convex facial profile
- Gummy smile
- Protruded upper and lower lips
- Acute nasolabial angle
- Chin retrusion
- Short throat length

4. Intraoral soft tissue

- Generalized mild gingivitis and normal mucosa
- Normal frenum attachment and normal tongue size

6. Other

- Growth status: mature

Treatment objectives were the following :

1. Obtain skeletal and dental Class I relationship ;
2. Relieve gingival exposure ;
3. Establish normal overjet, over bite and normal alignment with maximum intercuspation and normal functional occlusion ;
4. Improve soft tissue facial profile. To achieve these objectives, an orthodontic combined orthognathic surgical treatment was planned.

Treatment plan: once the objectives of treatment were established, a consultation was held with the Department of Oral and Maxillofacial Surgery. For this patient, in the field of the orthognathic surgery approach was two- jaw surgery with Le Fort I one - piece osteotomy and an advancement genioplasty.

Presurgical orthodontic phase: direct bonding of bidimensional technique, Roth appliances were placed. Alignment and leveling was done with the following archwire sequence: 0.012” nitinol to 0.017 x 0.025” stainless steel. Presurgical compensation was

seen in the dental and facial feature. (Fig 5 and 6)  
Lower anterior teeth spacing, crossbite at 15 to 45  
were corrected and curve of Spee was flattened before

surgery. Prior to surgery, radiographic records were  
taken for cephalomeric tracing and surgical prediction.  
(Fig7 and 8)



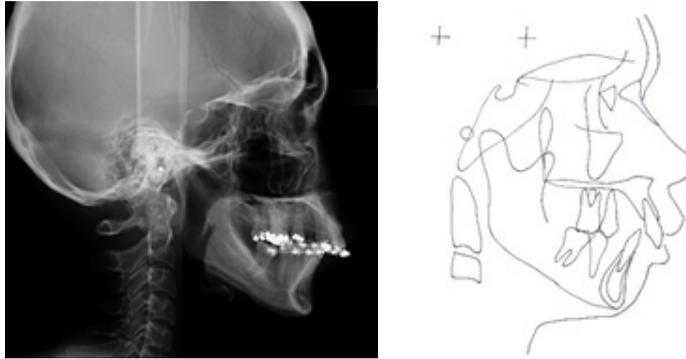
Figure 5 Presurgical facial photographs



Figure 6 Presurgical intraoral photographs



Figure 7 Presurgical panoramic radiograph



**Figure 8** Presurgical cephalometric radiograph

Surgical procedure: Le Fort I one - piece osteotomy was performed to maxillary setback 8 mm. The superior reposition was done 3 mm. at anterior part and 2 mm. at posterior part. The advancement genioplasty 5 mm. was also conduct. Right upper third molar was non occluded tooth and was surgical removed in operation. At the end of surgery, the surgical splint was placed and elastic chain was used as intermaxillary fixation.

Postsurgical orthodontic phase: orthodontic treatment was resumed three weeks after surgery. The objectives of this phase were to achieve normal occlusion in terms of Class I canine, normal overjet

and overbite and the coincidence of dental midline. 0.016”x 0.022” SS arch wires were placed for residual spaces closure and tooth adjustment. Total treatment duration was 31 months after the fixed appliances were removed, the wraparound retainer was indicated to use all time a day. At the end of treatment, patient has straight profile, normal smile line, Class I canine and molar relationship, normal inclination and position and maximum intercuspation. (Fig 9 and 10)

Radiographs were taken after treatment, (Fig 11 and 12) the changes were assessed by superimposition. (Fig13) In addition, cephalometric measurements were compared with the initial. (Table 2)



**Figure 9** Posttreatment facial photographs



Figure 10 Posttreatment facial photographs



Figure 11 Posttreatment panoramic radiograph

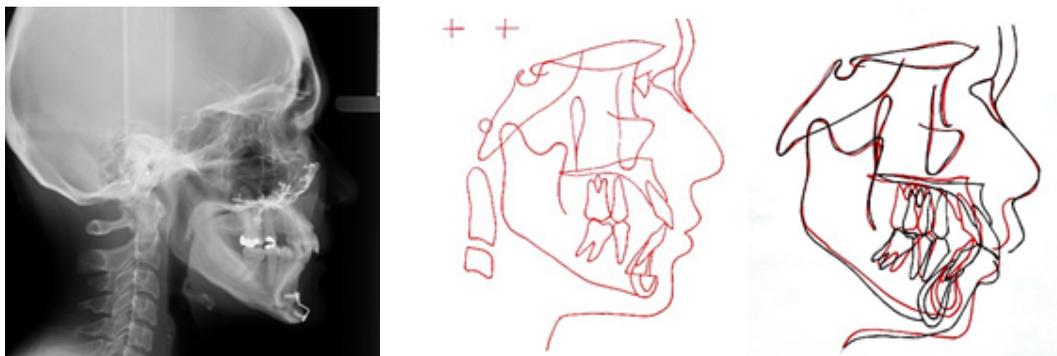


Figure 11 Posttreatment cephalometric radiograph and superimposition

— Initial treatment  
— Postsurgical treatment

Table 2 Posttreatment cephalometric analysis.

AREA		MEASUREMENT	NORM MEAN±SD	PRE-TX 21/7/17	POST-TX 27/11/20	INTERPRETATION
SKELETAL	MAXILLA TO CRANIAL BASE	SNA (DEGREE)	84 + 4	88	75	PROGNATHIC MAXILLA
		A-NPERP (MM)	5 + 4	10	10	PROGNATHIC MAXILLA
	MANDIBLE TO CRANIAL BASE	SNB (DEGREE)	81 + 4	81	81	ORTHOGNATHIC
		PG- NPERP (MM)	0 + 6	15	8	MANDIBLE RETROGNATHIC MANDIBLE
	MAXILLO- MANDIBULAR	ANB (DEGREE)	3 + 2	6	-6	SKELETAL CLASS II
		WITS (MM)	-3 + 2	1	1	SKELETAL CLASS II
	SKELETAL CONFIGURATION	FMA (DEGREE)	23 + 5	30	30	HYPERDIVERGENT
		SN-GOME (DEGREE)	29 + 6	35	35	NORMODIVERGENT
		NS-GN (DEGREE)	68 + 3	72	70	HYPERDIVERGENT
		OCCL-SN (DEGREE)	16 + 5	5	7	HYPODIVERGENT
OTHERS	SNO (DEGREE)	65 + 6	50	50	MIDFACE DEFICIENCY	
	O-NA (MM)	9 + 2	20	20	MIDFACE DEFICIENCY	
	MAX. DEPTH (DEGREE)	90 + 3	95	86	EXCESSIVE MAXILLARY	
		90 + 3	94	87	LENGTH EXCESSIVE	
	CO-A (MM)	119 + 4	119	122	MAXILLARY LENGTH	
	CO-GN (MM)	6 + 3	4	4	NORMAL MANDIBULAR	
	FH-SN (DEGREE)	8 + 5	1	5	LENGTH NORMAL SN	
	OCC.PL. TO FH				PLANE HYPODIVERGENT	
DENTAL	MAXILLARY DENTITION	UI TO NA (DEGREE)	22 + 6	31	30	PROCLINED UI
		UI TO NA (MM)	5 + 2	13	14	PROTRUDED UI
		UIPP (DEGREE)	119 + 5	120	115	NORMAL INCLINED UI
	MANDIBULAR DENTITION	LI TO NB (DEGREE)	30 + 6	30	30	NORMAL INCLINED LI
		LI TO NB (MM)	7 + 2	9	6	PROTRUDED LI
		LIMP (DEGREE)	99 + 5	94	93	NORMAL INCLINED LI
	MAXILLO- MANDIBULAR	UI TO LI (DEGREE)	125 + 8	110	120	ACUTE INTERINCISAL ANGLE
	OTHER	ADH (MM)	29 + 3	36	33	INCREASED ADH
		PDH (MM)	19 + 2	25	23	INCREASED PDH

**Table 2** Posttreatment cephalometric analysis. ( Continue)

AREA		MEASUREMENT	NORM MEAN±SD	PRE-TX 21/7/17	POST-TX 27/11/20	INTERPRETATION
SOFT TISSUE	SOFT TISSUE	U LIP-E PLANE(MM)	-1 + 2	10	0	-10
		L LIP-E PLANE(MM)	2 + 2	7	0	-7
		NLA (DEGREE)	91 + 8	75	95	+20
		H-ANGLE (DEGREE)	14 + 4	30	15	-15
		FCA (DEGREE)	9 + 5	20	10	-10
		UFH (MM)	48 + 3	50	50	0
		LFH (MM)	69 + 4	65	70	+5
		ULL (MM)	23 + 2	25	25	0
		LLL (MM)	46 + 2	40	45	+5
		TL (MM)	58 + 7	45	55	+10
	LCTA (DEGREE)	115 + 7	135	112	-23	

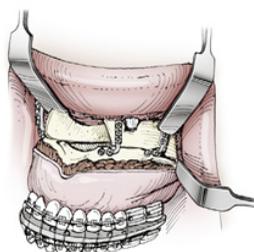
**Discussion**

Adult skeletal Class II patients can be treated with camouflage or combined orthodontic-orthognathic surgery. Because the effectiveness of camouflage treatment are limited by tooth movement, that will not be pronounced improvement of soft tissue profile and it may worsen in some cases.<sup>7, 8, 9</sup> In severe skeletal Class II malocclusion cases, orthognathic surgery should be done to correct skeletal discrepancies and enhance soft tissue esthetic.

LeFort I osteotomy is a procedure used by maxillofacial surgeon to correct a wide range of dentofacial deformities. Because of this versatile

procedure allows horizontal advancement of maxilla, vertically impaction or shortening of the maxilla, or vertical lengthening of the maxilla with down grafting.<sup>10</sup> (Fig 12)

A genioplasty is commonly required in orthognathic surgery to optimized chin position after the jaws have been moved into the desired location. Sliding genioplasty is performed as single cut through the chin at least 5 mm. inferior to the apices of the mandibular teeth.<sup>11</sup>(Fig 13) It allows the chin segment to be moved anteriorly or posteriorly while maintaining contact between the bone segments. Osseous genioplasty not only corrects cosmetic deformities and vertical height of the chin, but it also ameliorates hyperactivity of the mentalist muscle complex and improves obstructive sleep apnea.



**Figure 12** LeFort I osteotomy



**Figure 13** Sliding Genioplasty

Patient with severe Class II deformities due to mandibular retrognathism will often undergo LeFort I osteotomy and repositioning, in addition to mandibular advancement and osseous genioplasty, to achieve more stable and aesthetic appearance.

In this patient, Class II skeletal deformity is characterized by maxillary prognathism and retruded chin. Two jaw surgical procedures, Le Fort I maxillary osteotomy for setback and superior repositioned, and allow anterior rotation of mandible. However, procedure of maxillary impaction is affected to broadening of the alar base, V-Y closure surgery would be performed to prevent this effect. An alar cinch suture combined with V-Y closure should improve not only the nasal alar width, but would also improve the dynamics of some of orofacial muscle.<sup>11</sup>

Genioplasty advancement is proper treatment for this patient who has orthognathic mandible with retruded chin.<sup>10</sup> Lower anterior facial height was decreased (UFH: LFH > 2 : 3 and ULL: LLL > 1 : 2), the final position of the chin is not ideal and 5 mm. advancement was created improving facial height and esthetic facial profile. These anticipated postoperative facial changes and the new desired position of the chin are based on the postoperative cephalometric tracings that are performed as part of treatment planning phase of procedure.

Superior repositioning of maxilla in a combination with genioplasty advancement are the effective methods for Class II correction and also are the most stable and high predictability surgical outcomes.<sup>9, 13-16</sup>

Although orthognathic surgery could be an efficient treatment modality in severe Class II patients, the cost of surgery and fear undergoing surgery prevent patients from choosing this option. Before starting of surgical combined orthodontic treatment, patient was informed about the treatment plan, results and side effects for making decision.

Assessing and comparing the initial and final cephalometric analysis and superimposition of the patient, it was noted that there was orthognathic maxilla, decrease gummy smile, increased lower anterior facial height. The performed surgical movements have demonstrated to have a harmonized facial aesthetic and good postsurgical stability.

During orthodontic treatment there was 2 mm. increasing the upper intercanine width because rotation of upper canine and 1 mm. decreasing of intercanine width in the lower arch from lower incisor retraction. The expansion or constriction of intercanine width was less related to post retention alignment. Although the original intercanine width was maintain, the stability of retention period is controversy.<sup>17, 18</sup> However, using the continuous arch wires to harmonize arch form and to maintain shape of arch form will be provided the tooth position stability.<sup>19, 20</sup>

The prognosis of treatment is good, postsurgical orthodontic treatment achieve Class I malocclusion, normal inclination, overjet and overbite. Flatted curve of Spee, maximum intercuspation and no occlusal interferences were presented. Patient has good attitude and compliances, wraparound retainers for upper and lower teeth were applied after arch debonding. Upper and lower dental prostheses were planned for edentulous area.

## Conclusion

In this case report herein, showed the outcome of orthognathic treatment in non-growing Class II patient. This case illustrated the importance of proper diagnosis and treatment planning. A team approach with the orthodontist, surgeon and restorative dentist all having input before the initiation of treatment is the best way to achieve stable, functional and esthetic results. According to surgical orthodontic treatment, the patient had a dramatic

skeletal, dental and occlusal improvement. As a favorite benefit, the patient has reported the better self-esteem and the greater degree of pleasure related to her facial appearance.

## References

1. Shaughnessy T, Shire LH. Special Report- Etiology of Class II Discrepancies. *Pediatric Dentistry*. 1988; 10(4):336-7.
2. McNamara JA, Jr. Components of class II malocclusion in children 8-10 years of age. *Angle Orthod*. 1981; 51(3):177-202.
3. Proffit WR, Ackerman JL. Diagnosis and treatment planning, in Graber M, Varnasdall RL Jr(eds): *Orthodontics: Current Principles and Treatment*. St Louis, MO, Mosby, 1994.
4. Proffit WR, Phillips C. A comparison of outcomes of orthodontic and surgical-orthodontic treatment of class II malocclusion in adults. *Am J Orthod Dentofacial Orthop*. 1992; 101(6): 556-65.
5. Myron RT. Orthognathic surgery versus orthodontic camouflage in treatment of mandibular deficiency. *J Oral Maxillofac Surg*. 1995; 53: 572-8.
6. Pancherz H. Dentofacial orthopedics or orthognathic surgery: Is it matter of age? *Am J Orthod Dentofacial Orthop*. 2004; 126(3): 273-7.
7. Larsen MK. Indication for orthognathic Surgery- A review. *J Contemp Dent Pract*. 2012; 16(1) : 1-13.
8. Raposo R, Peleteiro B. Orthodontic camouflage versus orthodontic-orthognathic surgical treatment in class II malocclusion: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg*. 2018; 47 : 445-55.
9. Proffit WR. *Combine Surgical and orthodontic treatment: Contemporary Orthodontics*. 4th ed. St. Louis: Mosby; 2019.
10. Raymon J. Fonseca. *Orthognathic surgery Esthetic surgery Cleft and craniofacial surgery: Oral and maxillofacial surgery*. 3rd ed. St. Louis: Elsevier ; 2018.
11. Muradin MSM, Rosenber A, Bilt A, Stolen PJW, The effect of alar cinch sutures and V-Y closure of soft tissue dynamics after Le Fort I intrusion osteotomies. *J Craniomaxillofac Surg*. 2009; 37(6) : 334-40.
12. Bailey JL, Cevidanes SL. Stability and predictability of orthognathic surgery. *Am J Orthod Dentofacial Orthop*. 2000; 117(3) : 571-4.
13. Torgersbraten N, Stenvik A. Bimaxillary surgery to correct high-angle class II malocclusion : does a simultaneous genioplasty affect long-term stability? *Eur J Orthod*. 2020; 42(3) : 426-433.
14. Ewing M, Ross RB. Soft tissue response to mandibular advancement and genioplasty. *Am J Orthod Dentofacial Orthop*. 1992; 101(6) : 550-5.
15. Brammer J, Finn R. Stability after bimaxillary surgery to correct vertical maxillary excess and mandibular deficiency. *J Oral Surg*. 1980; 38(9) : 664-70
16. Proffit WR, Turvey TA. Orthognathic surgery : a hierarchy of stability. *Int J Adult Orthod Orthognath Surg*. 1996 ; 11:191-204.
17. Bishara SE. *Textbook of Orthodontics*. 1st ed. Philadelphia: W.B. Saunders; 2001.
18. Little RM. Stability and Relapse of Dental Arch Alignment. *Br J Orthod*. 1990; 17(3) : 235-41.
19. Graber TM, Vanarsdall RL. *Orthodontics Current Principles and Technique*. 3rd ed. Missouri : Mosby; 2000.
20. Bishara SE, Treder JE, Damon P, Olsen M. Changes in the dental arches and dentition between 25 and 45 years of age. *Angle Orthod*. 1996; 66(6) : 417-22.