Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

Evaluation of new extraction protocol in the camouflage treatment of skeletal class III malocclusion – A retrospective study

1 Dr. Ratna Parameswaran, 2 Dr. Shahina Juneith,
3 Dr. Sumitra Balaguru, 4 Dr. Anantanarayanan Parameswaran
[1,2,3,4] Meenakshi Ammal Dental College,
Chennai
Tamil Nadu
* Drratna.Ortho@Madch.Edu.In

ABSTRACT

BACKGROUND: The present study aims to assess the skeletal, dental and soft tissue changes following the extraction of mandibular single premolar in adult borderline Skeletal Class III patients, by comparing pre- and post-treatment lateral cephalograms and study models. **METHODS:** Twelve patients (seven male and five female) with "borderline" skeletal Class III malocclusion were included in the study. The age of the patients ranged from 17 to 24 years with a mean age of 20 years All the patients were treated with extraction of a single mandibular premolar. Pre-treatment and post-treatment lateral cephalograms and study models were examined. Groups were compared for change using Mann-Whitney U tests. **RESULTS:** The change in overjet ($p < 0.01$) and the increase in chin thickness ($p < 0.05$) were statistically significant at the end of treatment. Model analysis revealed a statistically significant change of 9.4% in the Bolton's overall ratio ($p < 0.01$). The average increase in the upper arch perimeter and a minor decrease in the lower arch perimeter of 4.5mm and 1.7mm respectively showed statistical significance ($p < 0.01$) which attributed to the treatment changes following the specific extraction pattern. The anterior crossbite was corrected, and an ideal overjet and overbite were achieved. The Class III subdivision molar relationship was maintained with a bilateral Class I canine relationship. The upper and lower midlines matched with a stable occlusion. **CONCLUSION:** The goals of functional efficiency, structural stability, and esthetic harmony are imperative for all Orthodontic cases. In that aspect, the new extraction protocol suggesting extraction of single mandibular premolars can be widely incorporated as a successful treatment option for Skeletal Class III subdivision cases

Keywords: Skeletal Class III, Camouflage, Biomechanics, Extraction

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

Introduction

Class III malocclusion is characterized by a complex three-dimensional facial skeletal imbalance between maxillary and mandibular growth, as well as varied degrees of dentoalveolar and soft tissue compensations that can manifest themselves morphologically in various ways[1]. It frequently presents the practitioner with demanding challenges for effective treatment. According to studies, skeletal Class III disparity worsens with age. Profitt and Ackermann introduced the concept of the envelope of discrepancy to illustrate the limitations of camouflage treatment, Growth modification, and surgical treatment[2]. Borderline cases with mild to moderate skeletal discrepancies can be addressed either surgically or orthodontically. However, the right patient selection is essential for effective dental camouflage. Kerr et al. suggested some cephalometric yardsticks to identify measurable criteria for available treatment options in Class III borderline cases [3.] The criteria for surgical correction included an ANB angle of less than -4°, a maxillary/mandibular (M/M) ratio of 0.84, an inclination of the lower incisors to the mandibular of 83°, and a Holdaway angle of 3.5°. The criteria were similar to those suggested by Zeng et al., who suggested surgical correction when the ANB angle and L1-MP angle were both less than -4 degrees and 82 degrees respectively[4]. Hence in our study, the case selection was carried out accordingly for camouflage treatment. The most common choice of extraction pattern for Class III camouflage cases is either maxillary second premolars and mandibular first premolars to establish Class I canine and molar relationship or extraction of only the mandibular first premolars to achieve Class I canine relationship with ideal overjet and overbite while maintaining the molar class III relationship. In our study, the rationale behind the choice of mandibular single premolar extraction is the representation of unilateral Class III molar relationship with anterior crossbite and lower dental midline shift towards the

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

contralateral side. This study aims to assess the skeletal, dental, and soft tissue changes following the extraction of mandibular single premolars in adult borderline Class III cases.

MATERIAL AND METHODS

Cases Selection

Seven male and five female patients with “borderline” skeletal Class III malocclusion were included in this study. The age of the patients ranged from 17 to 24 years with a mean age of 20years. All the patients were treated with extraction of a single mandibular premolar in the Department of Orthodontics at our institute. The patients' first visit dates were all from 2017 to 2021. The study protocol was approved by the Ethics Committee and informed consent was obtained from patients.

The selection criteria were as follows:

1. Class III subdivision malocclusion
2. Lower dental midline shift towards the quadrant with Class I molar relationship.
3. Dental compensations reveal proclined maxillary incisors and retroclined mandibular incisors.
4. Concave facial profile
5. Patients who have completed adolescent growth spurt
6. Pleasing soft tissue profile

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

Treatment Approach

All patients were treated with MBT prescription (0.022”) to level, align, and close spaces. In all the cases, a single mandibular first premolar was extracted. The initial phase of the treatment included the insertion of a posterior bite plane to disocclude the dentition. The archwire sequence for leveling and aligning was 0.014’ NiTi, 0.016’ NiTi, and 17x25 NiTi. Lower incisor brackets were inverted for reversing the torque and ease of retraction. Additionally, Intermaxillary elastics were given for midline correction and bite opening. Space closure was carried out using loop mechanics with a teardrop loop made of 17x25’ SS.

Cephalometric Analysis

Standardized lateral cephalometric radiographs were taken at the beginning and end of each patient's course of treatment. Each radiograph applied in this study was traced on FACAD software and was taken in the same cephalostat. Seventeen cephalometric landmarks were identified. In the software, Steiner’s cephalometric analysis and Holdaway’s soft tissue chin thickness were calculated and documented.

Model Analysis

Permanent dentition analysis such as Bolton’s analysis, Arch perimeter, and Carey’s analysis was done. Inter-canine, Inter-premolar, and Inter-molar widths were measured and recorded.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

Statistical Analysis

The statistical analysis was processed with SPSS 10.0 for Windows. The arithmetic mean and standard deviation were calculated for each variable. Mann – WHITNEY U test was performed to assess the statistical significance of any dental, skeletal, and soft tissue change. The levels of significance were: $p \geq 0.05$ (NS), $*p < 0.05$; $\dagger p < 0.01$. (Table 1)

Table 1: Independent t test sample.

SNA	Mann-Whitney U	46	0.14
SNB	Mann-Whitney U	67	0.795
ANB	Mann-Whitney U	55.5	0.355
GoGnSn	Mann-Whitney U	64	0.665
PpSn	Mann-Whitney U	71	0.977
Na	Mann-Whitney U	59	0.468
llsNa	Mann-Whitney U	56	0.371
1Nb	Mann-Whitney U	70	0.931
IliNb	Mann-Whitney U	57	0.402
01-Chaitra	Mann-Whitney U	40.5	0.073
U1Sn	Mann-Whitney U	71	0.977
AnPog	Mann-Whitney U	57.5	0.419
Chin thickness	Mann-Whitney U	23	**0.005**
E Plane	Mann-Whitney U	57.5	0.419
Bolton	Mann-Whitney U	0	**<.001**
U arch peri	Mann-Whitney U	11.5	**<.001**
L arch peri	Mann-Whitney U	56	0.37
U Canine W	Mann-Whitney U	29.5	0.014
U pre mol w	Mann-Whitney U	53.5	0.292

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

U Mol w	Mann-Whitney U	70.5	0.954
L canine w	Mann-Whitney U	53.5	0.294
L pre mol w	Mann-Whitney U	42.5	0.093
L mol w	Mann-Whitney U	63.5	0.642
Overjet	Mann-Whitney U	0	**<.001**
Overbite	Mann-Whitney U	25	**0.006**

RESULTS

After using the standard pre-adjusted edgewise prescription and extraction of mandibular single premolar in all the cases, the smile aesthetics significantly improved. At the end of the treatment, the facial profile improved from a concave to a straight tendency. The treatment goals were met, as evidenced by lateral cephalogram, intraoral photos and dental casts. The anterior crossbite was corrected, and an ideal overjet and overbite were achieved. The Class III subdivision molar relationship was maintained with a bilateral Class I canine relationship. The upper and lower midlines matched with a stable occlusion. (Table 2)

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

Table 2: Comparison of pre-treatment and post-treatment cephalometric parameters.

Descriptives	N		Missing		Mean		Median		Standard deviation		Minimum		Maximum	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
Group	1	2	1	2	1	2	1	2	1	2	1	2	1	2
SNA	12	12	0	0	84.7	86.7	84.4	86.8	3.16	2.63	81	82.8	89.5	91.6
SNB	12	12	0	0	87.7	87.9	87.6	86.7	4.63	4.89	81	81	95.8	96.2
ANB	12	12	0	0	-2.15	-1.27	-3.75	-1.7	4.69	3.15	-8.7	-4.7	5.3	4
GoGnSn	12	12	0	0	23.1	23.9	23.5	24.5	6.42	6.84	15	15.3	34	34
PpSn	12	12	0	0	3.7	3.98	3.6	5.55	4.96	5.18	-3	-3.5	14	13
Na	12	12	0	0	6.03	6.94	6.4	6.5	2.59	2.3	2	3	10	9.9
IlsNa	12	12	0	0	34.7	37.9	41	37.7	11,1	10.1	19	23	50.3	50
1Nb	12	12	0	0	10.4	9.55	5.7	5.5	13.8	11.3	3	1.5	49	38
IliNb	12	12	0	0	29	27.2	27.4	25.9	3.32	7.06	25.1	17.2	35.1	36.5
01-Jan	12	12	0	0	115	113	115	110	4.27	7.67	110	106	123	127
U1Sn	12	12	0	0	123	124	126	122	9.91	11	105	106	132	138
AnPog	12	12	0	0	-2.84	-2.2	-5	-2.6	5.13	3.43	-8	-7	5.2	4.3
Chin thickness	12	12	0	0	**9.22**	**10.7**	9	10.3	1.73	0.935	7	10	12.8	13.1
E Plane	12	12	0	0	1.66	1.06	1.45	1	2.2	2.18	-0.8	-2.7	5.9	4.9
Bolton	12	12	0	0	**91.7**	**82.3**	91.2	82.1	1.48	1.17	90.1	79.8	94.6	84.3
U arch peri	12	12	0	0	**70.3**	**74.8**	70.5	75	2.57	1.99	67	71	74	78
L arch peri	12	12	0	0	59.2	57.5	59.5	59	4.65	5.25	53	50	65	66
U Canine W	12	12	0	0	33.3	35.8	34.5	37	2.61	2.3	28	31	35.7	38
U pre mol w	12	12	0	0	38.1	38.5	36	39	5.28	2.68	32	34	47	44
U Mol w	12	12	0	0	47.1	46.8	47	44.5	5.37	5.29	40	40	55	55
L canine w	12	12	0	0	27.7	28.7	27	28.5	2.81	1.92	23	25	32	33
L pre mol w	12	12	0	0	30	31.9	28	31.5	4.04	1.88	24.5	29	37	35
L mol w	12	12	0	0	40	40.2	40	41	4.24	2.92	34	36	47	44
Overjet	12	12	0	0	**-1.33**	**2.93**	-1.7	3	1.13	0.534	-3.16	2.28	1	3.78
Overbite	12	12	0	0	**1.78**	**0.986**	2.05	1.04	1.34	0.597	-1.76	-0.14	4	1.96

The following results were obtained after treatment:

CEPHALOMETRIC CHANGES:

At the end of treatment, the change in overjet ($p < 0.01$) and the increase in chin thickness ($p < 0.05$) were statistically significant.

MODEL ANALYSIS CHANGES:

Bolton's analysis showed a mean change of 9.4% in the overall ratio, which is statistically significant ($p < 0.01$). The average increase in the upper arch perimeter statistically significant($p < 0.01$) and a minor decrease in the lower arch perimeter of 4.5mm and 1.7mm respectively can be attributed to the treatment changes following the specific extraction pattern followed.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

DISCUSSION :

The Class III camouflage treatment mainly involves the proclination of maxillary incisors, retroclination of mandibular incisors along with a downward and backward rotation of the mandible. Similar changes are evident in our study. The mean ANB angle changed from -2.15^{o} to -1.27^{o} in the post-treatment group. Georgalis et al observed similar results and suggested that the results are unlikely to cause significant changes statistically in a camouflage case.[5] However, the minor change in the ANB can be attributed to the mean increase of 0.8^{o} in SnGoGn value, due to the downward and backward rotation of the mandible resulting in positive profile changes. An average of 1^{o} proclination of maxillary incisors was evident from U1-Sn values and 1.8^{o} retroclination of mandibular incisors further contributed to correcting the anterior crossbite and achieving ideal overjet and overbite due to the space obtained by extraction of single mandibular premolar. Battagel et al and Rabie et al reported similar findings suggesting that the retraction of the lower incisors and rotation of the mandible was crucial for crossbite correction. [6,7]

The statistically significant change in chin thickness increased from an average of 9.22mm in the pre-treatment group to an average of 10.7mm in the post-treatment group. This is due to the fact there is an anterior displacement and overclosure of the mandible in class III cases, as suggested by Kerr et al [8] The downward and backward rotation of the mandible in the post-treatment group resulted in a reduction in the stretch of the soft tissue chin, thus leading to an increase in the soft tissue chin thickness.

The findings of this study are consistent with other Class III camouflage studies[9,10,11] .Camouflage by extraction of four premolars in a case of extreme crowding in the upper and lower arches of a

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

skeletal class III was reported by Pellegrino G[9], and Fukui, and Tsuruta et al[10]. After treatment, ideal overjet and overbite and satisfactory occlusal relationship with straight profile were achieved.

In our study, the model analysis showed considerable change in the overall Bolton ratio ($p<0.01$) i.e, the ratio decreased from 91.7% to 81.3% due to the unilateral mandibular premolar extraction. The increase in the upper arch perimeter values was statistically significant ($p<0.01$) and can be attributed to the proclination of the maxillary incisors to achieve positive overjet. Sperry et al reported similar results in a study of adult Class III cases (average age, 26.7 years) treated by orthodontic camouflage[12]. The treatment changes of one of the patients is illustrated below with pre- and post-treatment records. (Figure 1, 2, 3). The new extraction protocol, therefore, showed remarkable results in terms of dental, skeletal, and soft tissue changes.

Figure 1:PRE-TREATMENT RECORDS

A. Extra Oral - Profile View Of The Patient.
B. Extra Oral – Frontal View Of The Patient.
C. Lateral Cephalogram.
D. Intra Oral – Frontal.
E. Intra Oral – Right Side.
F. Intra Oral – Left Side.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

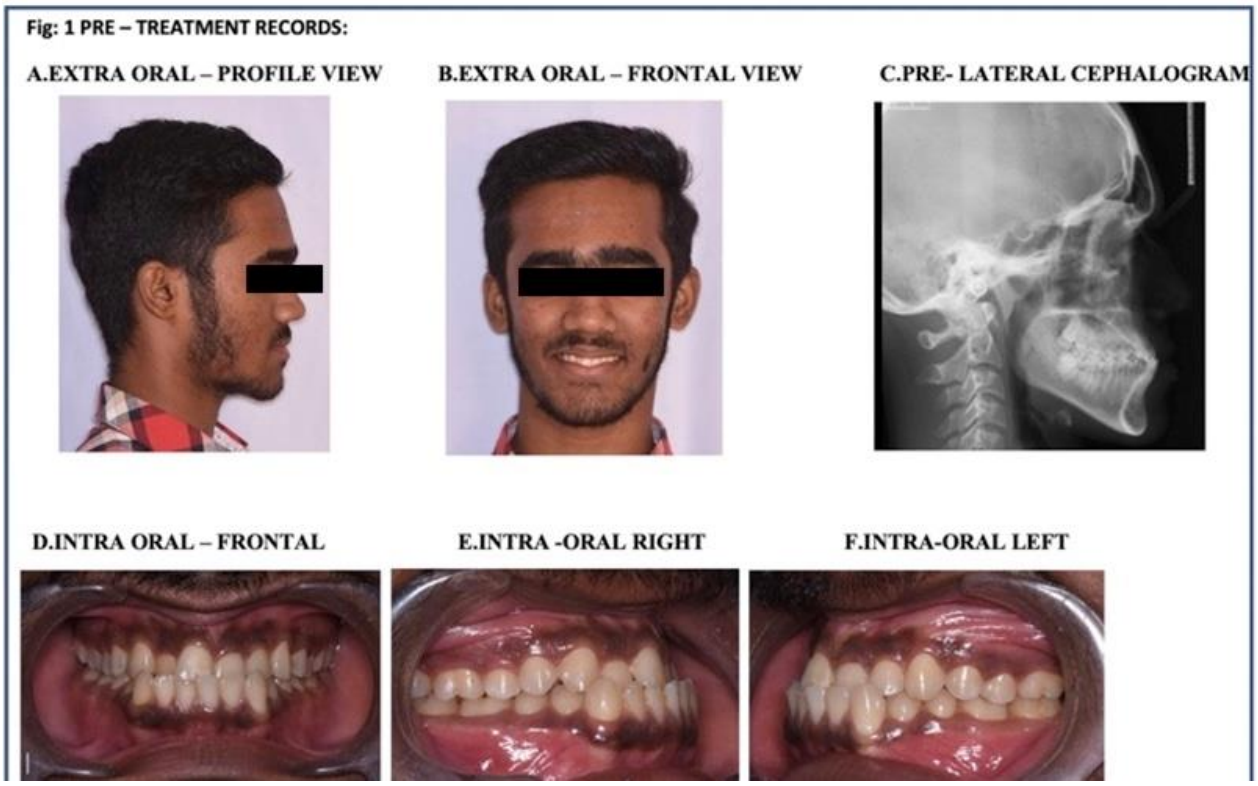


Figure 2 :POST- TREATMENT RECORDS

A. Extra Oral - Profile View Of The Patient.
B. Extra Oral – Frontal View Of The Patient.
C. Lateral Cephalogram.
D. Intra Oral – Frontal.
E. Intra Oral – Right Side.
F. Intra Oral – Left Side.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 27, Issue 1, 2023, Pages. 384 - 396
Received 10 August 2023; Accepted 25 August 2023.

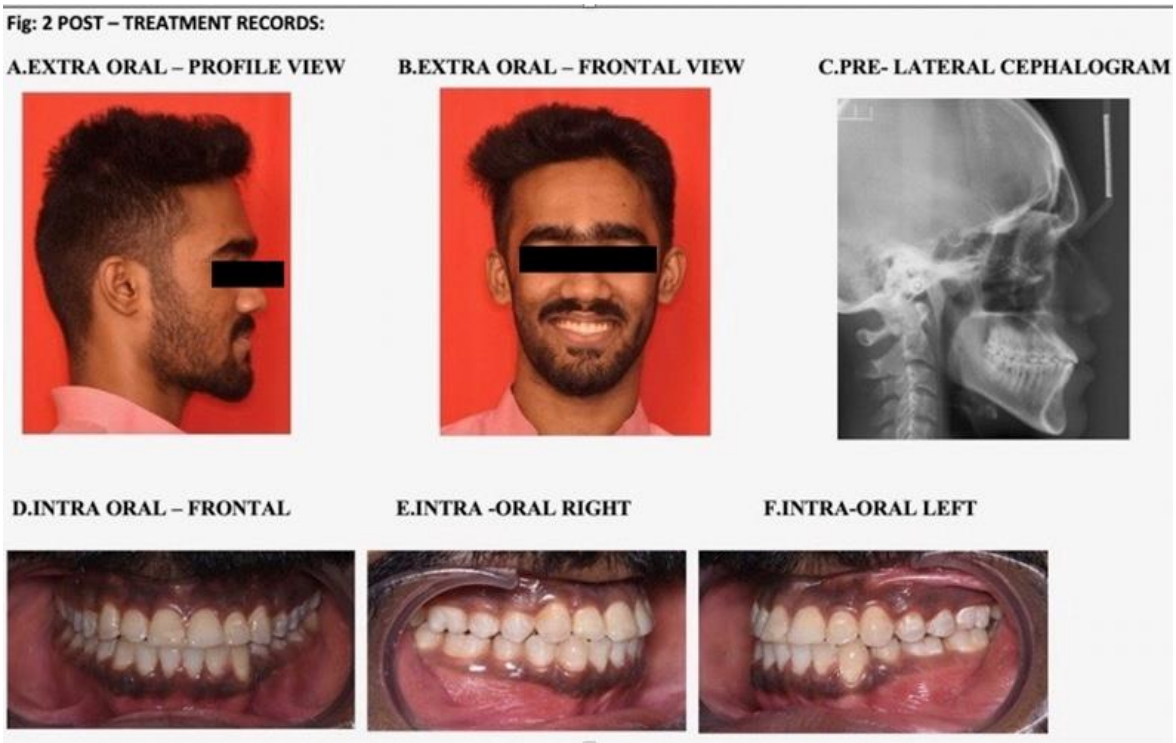
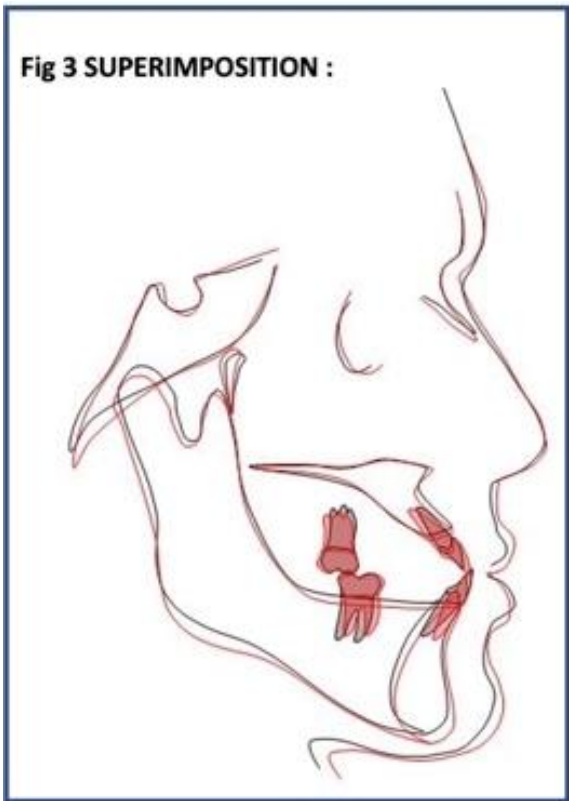


Figure 3: SUPERIMPOSITION OF PRE AND POST LATERAL CEPHALOGRAM



CONCLUSION :

The goals of functional efficiency, structural stability, and aesthetic harmony are imperative for all Orthodontic cases. In that aspect, the new extraction protocol suggesting extraction of single mandibular premolars can be widely incorporated as a successful treatment option for Class III subdivision cases.

References

1. Sanborn RT. Differences between the facial skeletal patterns of Class III malocclusion and normal occlusion. *Angle Orthod.* 1955;25(4):208–222.
2. Proffit, W.R. and Ackerman, J.L. (1982) Diagnosis and Treatment Planning. In: Graber, T.M. and Swain, B.F., Eds., *Current Orthodontic Concepts and Techniques*, Chapter 1, Mosby, St. Louis, 3-100.
3. Kerr WJ, Miller S, Dawber JE. Class III malocclusion: surgery or orthodontics? Br J Orthod 1992;19:21-4.
4. Zeng XL, Lin JX, Huang JF. Skeletal crossbite: surgery or orthodontics? West China J Stomatol 1985;3:233-7.
5. Georgalis, K., & Woods, M. G. (2015). A study of Class III treatment: Orthodontic camouflage vs orthognathic surgery. Australian Orthodontic Journal, 31(2), 138–148.
6. Joanna M. Battagel, Harry S. Orton, Class III malocclusion: a comparison of extraction and non-extraction techniques, *European Journal of Orthodontics*, Volume 13, Issue 3, June 1991, Pages 212–222

7. Rabie AB, Wong RW, Min GU. Treatment in Borderline Class III Malocclusion: Orthodontic Camouflage (Extraction) Versus Orthognathic Surgery. Open Dent J. 2008;2:38-48
8. Kerr, W. J. S. and TenHave, T. R. (1987) Changes in soft tissue profile during the treatment of Class Ill malocclusion,*British Journal of Orthodontics,* 14, 243-249.
9. Ning F, Phd , , Duan Y, Phd . Camouflage treatment in adult skeletal Class III cases by extraction of two lower premolars. Korean J Orthod 2010;40:349-357
10. Pellegrino G. Italian board of orthodontics: case N. 2 adult malocclusion. Prog Orthod. 2005. 6:102–112.
11. Fukui T, Tsuruta M. Invisible treatment of a Class III female adult patient with severe crowding and cross-bite. J Orthod. 2002. 29:267–275
12. Sperry TP, Speidel TM, Isaacson RJ, Worms FW. The role of dental compensati ons in the orthodontic treatment of mandibular prognathism. Angle Orthod 1977 ;47:293-9.