

# THE EFFECTS OF SERIAL EXTRACTION ON THE SOFT-TISSUE PROFILE (Seri Çekimin Yumuşak Doku Profiline Etkisi)

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## Özet

Seri çekimin premolar çekimi etkisine bağlı olarak düz profillere yol açtığı belirtilmiştir. Buna karşılık premolar çekiminin fasial profilin istenmeyen düzleşmesine yol açmadığını belirten düşünceler de mevcuttur.

Bu araştırma, seri çekimin fasial profil üzerine etkilerini belirlemek amacıyla yapılmıştır.

Angle Sınıf I ve hafif Sınıf II, I malokluzyona sahip vakalardan, seri çekim grubu 20, kontrol grubu ise 21 vaka içerecek şekilde oluşturuldu. Bu gruplar, yaş ve vertikal ve sagittal iskeletsel sefalometrik özellikleri bakımından eşleştirildi.

Seri çekim işlemleri Dewel'e göre uygulanırken, kontrol grubu herhangi bir ortodontik tedavi uygulanmaksızın 3-5 yıl izlendi.

Bu araştırmanın sonuçları, seri çekimin yumuşak doku profiline olumsuz etkileri

olduğu görüşünü desteklememektedir. Yumuşak doku B noktası ve dolayısıyla labiomental açı üzerindeki etkiler dışında seri çekimin yumuşak doku profili üzerinde belirgin bir etkisine rastlanılmamıştır.

**Anahtar kelimeler:** Seri çekim, Yumuşak doku profili

## SUMMARY: THE EFFECTS OF SERIAL EXTRACTION ON THE SOFT-TISSUE PROFILE

Serial extraction has been said to lead to straight profiles due to the extraction of premolars. Contrary opinions declaring that premolar extraction does not cause undesirable flattening of the facial profile are also present. This study was done in order to determine the effects of serial extraction on the facial profile.

A serial extraction group consisting of 20 patients and a control group of 21 cases with Angle Class I and slight Class II, I malocclusions were constructed. These groups were matched according to their age and vertical and sagittal skeletal cephalometric characteristics.

The serial extraction procedure was carried out according to Dewel and the control group was followed for 3 to 5 years without any orthodontic treatment.

The results of this study do not support the claim that serial extraction has deleterious effects on the soft tissue profile. No other apparent effect of serial extraction on the

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*soft tissue profile were observed, other than those on the soft tissue B point and thereby on the labiomental angle.*

**Key Words:** *Serial extraction, Soft tissue profile*

## Introduction

It has been said that serial extraction has disadvantageous effects on the soft-tissue profile and that the straight profile must be viewed with great concern, since early removal of premolars is likely to cause a concave, recessive area in the lower half of the face in the permanent dentition(1). Recent studies do not support the opinion that premolar extraction causes undesirable flattening of the facial profile(2,3,4).

Drobocky and Smith(2), declared that extraction of four first premolars does not result in a "dished-in" profile. According to their results, the soft-tissue measurements suggested that the profile was improved.

Staggers(5), investigated the vertical changes following first premolar extraction compared with nonextraction cases. The results did not support the hypothesis that extractions in conjunction with orthodontic treatment result in a loss of vertical dimension. Staggers(5), interpreted this result partly to be due to growth and noted that alteration of growth with extractions had not been documented.

Bishara et al.(6), compared the changes in subjects treated with and without four first premolar extractions. They indicated that the extraction or nonextraction decision did not have detrimental effects on the facial profile.

Young and Smith(3), compared the changes on the facial profile in non-extraction and four premolar extraction cases and concluded that it was incorrect to blame undesirable facial

esthetics after orthodontic treatment on the extraction of premolars.

Johnson and Smith(7), pointed out that there is no predictable relationship between the extraction of premolars and the esthetics of the smile.

It is apparent that different opinions are present concerning the effects of premolar extraction on the soft tissue profile. However reports solely on the effects of serial extraction without any mechanics are infrequent. This study was therefore planned to assess the effects of only serial extraction on the soft tissue profile, that will also serve further to eliminate the effects of fixed orthodontic mechanics.

## Materials and Methods

Two groups were constructed; 1. Serial extraction group, 2. Control group. The cases treated with serial extraction had chronological ages between 7.08 years (7 years 1 month) and 11.08 years (11 years 1 month) at the beginning. This group contained 16 female and 4 male, a total of 20 patients. Fifteen of these cases had Angle Class I and 5 had only slight Angle Class II, I malocclusions. The control group was selected from the records of the Department of Orthodontics of the University of Ankara. Cases in both groups were matched according to their vertical craniofacial growth pattern, sagittal relationship of the maxilla and mandible and skeletal ages. The control group consisted of 16 female, 5 male, a total of 21 patients. These patients were followed 3 to 5 years without any orthodontic treatment. They had chronological ages between 8.42 years (8 years 5 months) and 11.08 years (11 years 1 month). Twelve of these patients had Angle Class I and 9 had only slight Angle Class II, 1 malocclusions.

Lateral cephalometric and hand-wrist radiographs were taken at the beginning and at the end of the study from both of the groups. Serial extraction was applied according to Dewel(8), beginning with the

extractions of deciduous canines, followed by deciduous first molars and ending with the extractions of the first premolars. Records at the end of serial extraction were collected when at least one permanent canine had erupted in both of the jaws. The study period was approximately 3.15 years.

Landmarks and measurements used in the study are shown in Figure 1. A reference line (RL) was constructed at 7 degrees inferior to the original sella-nasion line (Fig 1)(9). Fifteen linear and angular measurements were assessed to 0.5mm and degrees sensibility. The hand-wrist radiographs were evaluated according to Greulich and Pyle(10).

Linear measurements:

1. Sn-Me'
2. Sn-St
3. St-Me'
4. Steiner soft tissue upper lip
5. Steiner soft tissue lower lip
6. RL  $\perp$  Pronasale
7. RL  $\perp$  Sn
8. RL  $\perp$  Ls
9. RL  $\perp$  Li
10. RL  $\perp$  A'
11. RL  $\perp$  B'
12. RL  $\perp$  Pg'

Angular measurements:

1. Nasolabial angle
2. Li-B-Pg
3. Labiomental angle

The mean changes within each group were analyzed statistically by the use of the paired t-test, the comparison of the changes between the groups was examined by student's t-test. Individual tracing and measuring errors were tested by the calculation of repeatability coefficients for each parameter with the assessment of each parameter twice in randomly selected 20 radiographs.

### Results

The repeatability coefficients of individual tracing and measuring errors were found to be very close to 1.00.

Although a significant difference was found between the mean chronological ages of the groups at the beginning of the study, no significant difference was found between the mean skeletal ages of the groups at the beginning and at the end of the study (Table I). The study period, the changes in skeletal age and the rates of growth used did not show a significant difference either (Table II).

*Nasolabial angle* decreased in both groups showing a statistical significance only in the control group, but no significant difference was present between the groups (Table II).

Fig. 1: Landmarks and measurements used, and the constructed reference line (RL).

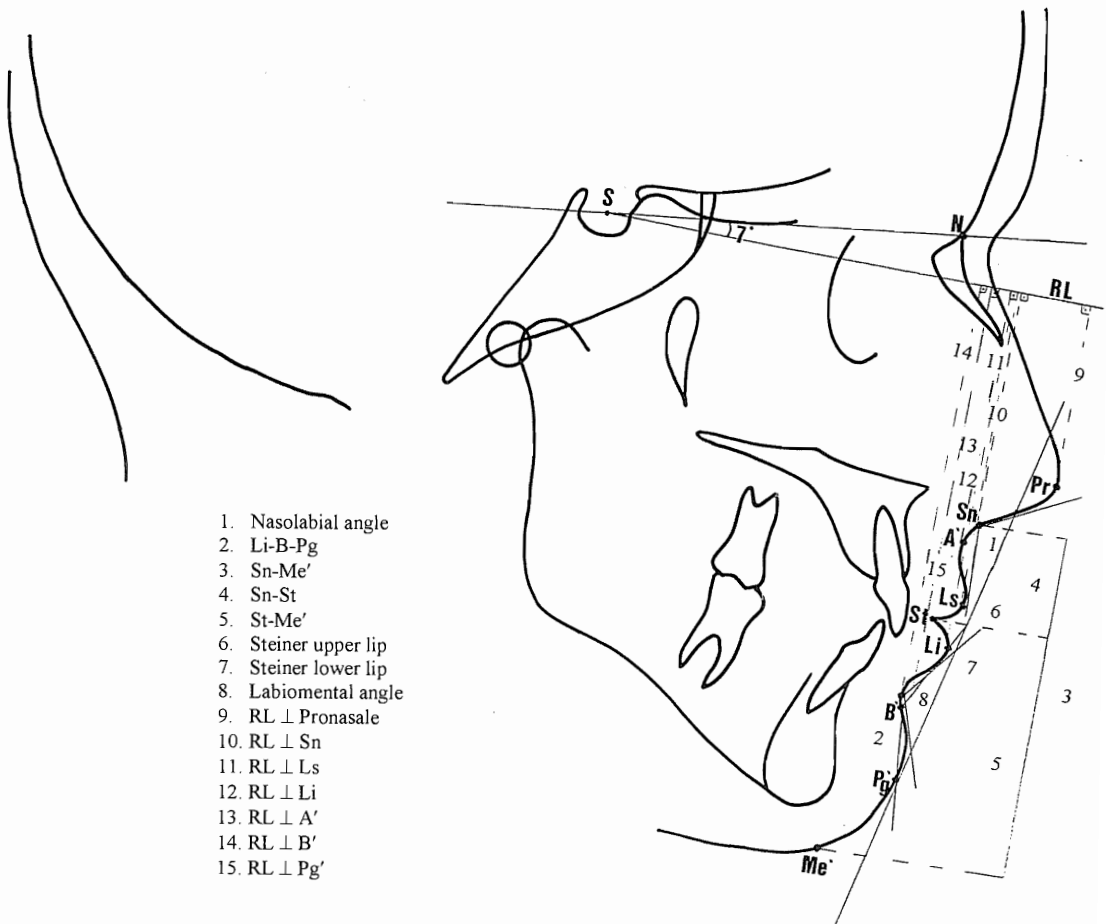


Table I. Comparison of the mean values of serial extraction (n=20) versus control (n=21) group before and after the study (\*p&lt;0.05, \*\*\*p&lt;0.001).

Measurements	Before Study						After Study						
	X	Sx	Sd	min	max	P	X	Sx	Sd	min	max	P	
1. Nasolabial angle	serial extraction control	113.5 107.9	2.41 1.76	10.80 8.08	89.5 94.5	128.5 125.5	0.065	109.4 102.5	2.23 1.91	9.96 8.76	94.0 87.0	129.5 120.0	0.022*
2. Li-B-Pg	serial extraction control	145.6 140.4	2.14 2.60	9.57 11.93	129.5 116.5	161.0 162.5	0.139	137.9 138.0	2.80 2.75	12.53 12.62	117.0 115.0	165.5 162.5	0.975
3. Sn-Me'	serial extraction control	61.6 62.4	1.18 0.85	5.29 3.91	54.0 57.0	72.0 70.0	0.514	66.8 66.8	1.28 1.04	5.73 4.77	58.0 58.5	79.0 76.5	0.996
4. Sn-St	serial extraction control	20.5 20.7	0.45 0.42	2.02 1.93	17.5 17.0	24.0 24.0	0.728	21.9 21.5	0.49 0.43	2.17 1.98	18.5 18.0	25.5 25.5	0.493
5. St-Me'	serial extraction control	41.0 41.7	0.85 0.68	3.79 3.10	33.5 35.5	49.0 46.5	0.497	44.9 45.4	0.93 0.84	4.15 3.83	38.0 38.0	54.0 52.0	0.716
6. Steiner soft tissue upper lip	serial extraction control	1.0 0.6	0.36 0.38	1.60 1.73	-2.5 -3.0	3.5 3.5	0.527	-0.5 -0.7	0.38 0.44	1.69 2.00	-4.0 -4.5	3.0 3.5	0.744
7. Steiner soft tissue lower lip	serial extraction control	1.5 1.43	0.46 0.48	2.05 2.21	-2.0 -2.5	5.0 5.5	0.975	0.4 0.5	0.59 0.58	2.65 2.65	-3.5 -5.0	7.5 7.5	0.836
8. Labiomental angle	serial extraction control	125.9 123.5	3.33 3.98	14.9 18.25	98.5 81.5	147.0 153.5	0.652	117.1 122.6	4.14 3.55	18.5 16.26	78.0 87.0	154.0 149.0	0.324
9. R.L.L. Pronasale	serial extraction control	35.6 36.4	0.73 0.70	3.24 3.22	28.0 31.0	40.5 44.0	0.443	38.6 40.7	0.86 0.89	3.84 4.07	31.0 32.5	47.0 48.5	0.092
10. R.L.L. Sn	serial extraction control	45.7 45.9	0.70 0.72	3.11 3.29	41.0 41.0	51.5 53.0	0.877	49.3 49.8	0.86 0.84	3.84 3.84	42.0 43.0	57.0 58.5	0.688
11. R.L.L. Ls	serial extraction control	62.4 63.1	0.68 0.71	3.05 3.24	57.0 56.5	67.5 69.0	0.530	67.3 67.6	0.94 0.91	4.21 4.18	61.0 61.5	77.0 75.5	0.837
12. R.L.L. Li	serial extraction control	73.5 73.9	0.82 0.71	3.65 3.23	68.0 68.0	81.0 80.0	0.692	78.1 79.2	1.10 0.88	4.94 4.02	71.0 74.0	91.0 87.0	0.432
13. R.L.L. A'	serial extraction control	51.7 51.1	0.89 0.72	3.96 3.31	43.0 47.0	58.0 58.5	0.614	55.0 54.7	0.89 0.87	4.00 3.99	49.5 46.5	63.0 62.0	0.866
14. R.L.L. B'	serial extraction control	83.9 84.0	0.97 0.90	4.31 4.12	77.0 77.0	93.0 92.0	0.938	88.0 90.8	1.18 0.90	5.27 4.12	79.0 84.0	101.0 98.0	0.058
15. R.L.L. Pg'	serial extraction control	94.9 95.0	0.87 0.90	3.88 4.14	88.0 87.0	103.0 105.0	0.952	102.1 103.9	1.18 0.85	5.27 3.88	95.5 96.0	115.0 111.0	0.224
16. Chronologic age	serial extraction control	9.1 9.9	0.26 0.20	1.16 0.91	7.1 8.4	11.1 11.1	0.019*	12.2 13.5	0.27 0.15	1.20 0.67	10.8 11.8	15.1 14.2	0.000***
17. Skeletal age	serial extraction control	8.5 8.8	0.25 0.24	1.10 1.09	6.8 6.5	10.2 10.0	0.312	11.7 12.7	0.36 0.36	1.61 1.66	9.5 10.0	14.7 15.0	0.063
18. Growth potential	serial extraction control	20.1 18.7	0.92 1.06	4.10 4.88	13.2 12.6	30.5 30.0	0.337	9.2 7.0	1.09 1.34	4.88 6.15	1.6 1.0	19.6 18.8	0.222

**Table II.** Statistical evaluation of the mean changes in both groups and the comparison of these changes between the serial extraction (n=20) and the control (n=21) group (\*p<0.05, \*\*p<0.01, \*\*\*p<0.001).

Measurements	D	S <sub>D</sub>	S <sub>A</sub>	P	Comparison serial extraction -- control p value	
1. Nasolabial angle	serial extraction control	-4.08 -5.41	2.20 1.99	9.82 9.10	0.079 0.013*	0.655
2. Li-B-Pg	serial extraction control	-7.65 -2.41	2.11 1.97	9.42 9.02	0.0018** 0.24	0.076
3. Sn-Me'	serial extraction control	5.38 4.43	1.17 0.84	5.23 3.86	0.0002*** 0.0000***	0.512
4. Sn-SI	serial extraction control	1.45 0.79	0.41 0.36	1.85 1.63	0.0024** 0.038*	0.228
5. St-Me'	serial extraction control	3.93 3.64	0.82 0.69	3.68 3.15	0.0001*** 0.0000***	0.793
6. Steiner soft tissue upper lip	serial extraction control	-1.48 -1.33	0.31 0.32	1.36 1.45	0.0001*** 0.0004***	0.749
7. Steiner soft tissue lower lip	serial extraction control	-1.08 -0.88	0.39 0.37	1.74 1.69	0.012* 0.027*	0.719
8. Labiomental angle	serial extraction control	-8.73 -0.93	2.45 2.52	10.95 11.55	0.0021** 0.72	0.033*
9. RLL Pronasale	serial extraction control	2.98 4.33	0.64 0.63	2.87 2.90	0.0002*** 0.0000***	0.140
10. RLL Sn	serial extraction control	3.58 3.91	0.56 0.61	2.49 2.79	0.0000*** 0.0000***	0.692
11. RLL Ls	serial extraction control	4.88 4.52	0.62 0.55	2.78 2.53	0.0000*** 0.0000***	0.674
12. RLL Li	serial extraction control	4.60 5.29	0.80 0.56	3.57 2.59	0.0000*** 0.0000***	0.484
13. RLL A'	serial extraction control	3.30 3.67	0.70 0.60	3.14 2.76	0.0002*** 0.0000***	0.693
14. RLL B'	serial extraction control	4.10 6.88	0.99 0.60	4.43 2.75	0.0006*** 0.0000***	0.020*
15. RLL Pg'	serial extraction control	7.20 8.91	0.92 0.59	4.12 2.70	0.0000*** 0.0000***	0.123
16. Chronologic age	serial extraction control	3.15 3.59	0.24 0.12	1.05 0.55	0.0000*** 0.0000***	0.106
17. Skeletal age	serial extraction control	3.25 3.88	0.31 0.19	1.40 0.87	0.0000*** 0.0000***	0.091
18. Growth potential	serial extraction control	-10.93 -11.72	0.82 0.53	3.68 2.45	0.0000*** 0.0000***	0.422

*Lower facial height changes* of the soft tissue showed significant increases in both groups where the differences were not found to be significant in comparison of the two groups (Table II).

*Upper lip changes* in both groups were similar showing statistically significant retractions according to the Steiner's soft tissue line. Subnasale, the upper lip and the soft tissue maxillary base as measured vertically from the horizontal reference line, showed similar increases in both groups (Table II).

*Lower lip and labiomental sulcus changes* were observed to decrease in both groups during the study showing a significant difference between the groups in the change in the labiomental angle (Table II). The lower lip, the soft tissue mandibular base, and the soft tissue pogonion as measured vertically from the horizontal reference line, all showed increases in both groups. The soft tissue mandibular base was the only measurement where a significant difference was observed between the groups (Table II).

## Discussion

Drobicky and Smith(2), examined the soft tissue profiles of patients treated with removal of four first premolars and fixed appliances in three groups and with enucleation of premolars at an early age as another group. They concluded that extraction of four first premolars did not result in a "dished-in" profile. They declared that the profile was improved by treatment or remained satisfactory. The results included an increase in the nasolabial angle and retraction of the upper and lower lips.

Looi and Mills(11), evaluated extraction of four premolars in Class II, I cases treated with Begg technique. They also found an increase in the nasolabial angle similar to Drobicky and Smith(2).

Finnoy et al.(12), evaluated profile changes in Class II, I cases treated with Edgewise fixed appliances after extraction of the first premolars. They also reported an increase in the nasolabial angle. Bravo(13), also found similar results in a similar study.

The difference of these results from our study is probably due to the effects of treatment with fixed appliances (Table II).

According to Drobicky and Smith(2), the normal range for the nasolabial angle is between 90°-120°, with a desirable value of approximately 100°-105°. In our study, the pre and posttreatment mean values of the nasolabial angle for the serial extraction and control groups can be seen in Table I. It is clear that the posttreatment mean value is closer to the ideal range, and therefore we can point out that serial extraction has a positive effect on the facial profile.

Prahl-Anderson et al.(14), declare that the nasolabial angle decreases with age. This is in harmony with our finding in the control group. This also shows that serial extraction does not affect the normal growth pattern of the midface.

Similar to the results of our study (Table II), Talass et al.(15), determined a slightly more increase in the soft tissue lower facial height in the extraction group than the nonextraction group.

Young and Smith(3), found that the fewest differences between extraction and nonextraction treatment were in the measurements of soft tissue lower facial heights (Sn-Mé, Sn-St, and St-Mé).

Staggers(5), reported that the average posttreatment values for the soft tissue facial height ratio (G-Sn/Sn-Mé) were found to be less than the average pretreatment values in premolar extraction cases when compared with nonextraction cases. This shows that the lower face height increased during treatment.

Bishara et al.(6), compared the subjects treated with and without premolar extractions followed by treatment with Edgewise mechanics. After treatment the upper and lower lips were found to be more retrusive and the soft tissue profile was straighter in the extraction group. The retrusion in the upper and the lower lips in relation to Steiner's soft tissue line was also observed in our study, but the findings were not significantly different from the control group (Table II).

Cummins et al.(16), found that the upper and lower lips were retracted significantly more in the extraction group compared with the nonextraction group.

Young and Smith(3), found that the percentage of undesirable facial changes was similar in the extraction and nonextraction samples. This is true also for our study (Table II).

Bravo(13), showed that lip protrusion decreased in cases treated with Edgewise mechanics after four premolar extractions. Bravo(13), pointed out that only 12 % of patients in the study finished treatment with a clearly more flattened facial profile.

Luecke and Johnston(17), declared that their results did not support the claim that premolar extraction and incisor retraction must lead to unsightly profiles.

McLaughlin and Bennett(4), showed that there was no evidence that maxillary premolar extraction caused undesirable flattening of the facial profile. They pointed out that a patient with a significantly retruded dentition relative to the chin and the nose may exhibit some facial flattening, even when treated on a nonextraction basis. They declared that there was no basis that indicate that premolar extraction treatment lead to undesirable flattening of the facial profile when proper diagnosis and treatment planning procedures are followed.

Luppanapornlarp and Johnston(18), also agree with these opinions.

The vertical changes of different soft tissue profile landmarks except the soft tissue B point are very close between the two groups in our study (Table II).

### Conclusion

The results of this study do not support the claim that serial extraction has detrimental effects on the soft tissue profile. No other apparent effect of serial extraction on the soft tissue profile was observed, other than the effect on the soft tissue B point and thereby on the labiomental angle.

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