



A STUDY OF HARD AND SOFT TISSUE RELAPSE RATE AFTER GENIOPLASTY

Dental Science

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ABSTRACT

Purpose: The present study was designed to evaluate the long term osseous and soft tissue changes twelve months after advancement genioplasty. **Materials and methods:** This study was done on patients who had been treated successfully at a teaching hospital in South India. This is a retrospective study of 10 patients who underwent advancement genioplasty in combination with maxillary anterior segmental osteotomy. The study included 8 female patients and 2 male patients in the age group ranging from 24-35 years. Lateral cephalometric radiographs were studied for immediate and twelve months post operative changes. The relapse rate for the pogonion (pg) and soft tissue pogonion (pg1) were evaluated. All patients were treated with rigid internal fixation and the relapse rate was correlated with the amount of advancement.

Results: In our study the mean advancement of the pogonion with the mean movement of the soft tissue pogonion shows a ratio of 1:1. The mean horizontal relapse of hard tissue pogonion was 0.55mm to the soft tissue horizontal relapse of 1.75mm which shows a ratio of 1:3. Hard tissue pogonion shows a relapse rate of 6% when compared to the soft tissue pogonion relapse rate of 18%. These changes were hard to detect clinically. Relapse was not significant to the amount of advancement.

Conclusion: The result of our study shows that the post operative relapse following advancement genioplasty was clinically insignificant. Advancement genioplasty is a stable surgical technique for the aesthetic enhancement of the lower facial skeleton when used in conjunction with rigid internal fixation.

KEYWORDS

Advancement; Genioplasty; Relapse;

INTRODUCTION

The chin is one of the most prominent facial features and often forms the basis for stereotyping of personality characteristics. The change in its position, proportion and/or contour can have a major impact on overall aesthetic facial balance.

The most favoured approach for correction of chin deformity is horizontal osteotomy of the inferior border of mandible termed as genioplasty. Genioplasty improves the profile of a patient by correcting vertical disharmony of lower third of the face or compensates for horizontal changes following mandibular set back.

In order to predict changes and study the results of surgery, a multitude of techniques are available. However, a very simple technique is based on the cephalometric landmarks in the frontal and lateral cephalograms.

The success of orthognathic surgery is dependent upon long term stability of the surgical correction. Failure to achieve stability; also called surgical relapse can result in a compromised final result. There are numerous reasons for relapse which include; stretching of the muscles of mastication and the suprahyoid musculature, condylar distraction during surgery, the use of wire versus rigid fixation, the mandibular plane angle, distal segment rotation etc.

The purpose of this study is to assess skeletal stability and soft tissue changes one year after advancement genioplasty.

AIM OF THE STUDY

To assess the hard and soft tissue relapse rate one year after advancement genioplasty

MATERIALS AND METHODS

This study was done on patients who had been treated successfully at a teaching hospital in South India. This is a retrospective study of 10 patients who underwent advancement genioplasty in combination with maxillary anterior segmental osteotomies. The study included 8 female patients and 2 male patients in the age group ranging from 24-35 years ($x=27$)

Criteria for selection of patients:

1. Patients were non growing adults.
2. They had a natural dentition supporting the lips.
3. Patients demonstrated a mandibular retrognathism for which surgical intervention was necessary.
4. Patients on whom genioplasty procedure (with adjunctive maxillary segmental osteotomies) performed were the subjects of the study.

5. Patients were treated with rigid internal fixation.
6. Records consisting of standardized lateral cephalograms that met the following criteria were available on all patients.
 - a. A pre operative radiograph taken within one week of surgery (T1)
 - b. A postoperative radiograph taken six to seven days after surgery (T2)
 - c. A postoperative radiograph taken twelve months after surgery (T3)
 - d. All radiographs were taken in centric relation with lips in repose

SURGICAL TECHNIQUE

All operations were performed under general anaesthesia in an operating room. A vestibular incision was made from canine to canine; the mental nerves were identified and the osteotomy was performed below the mental nerve. The genioplasty segment was moved anteriorly, as a pedicle graft, according to the preoperative plan and stabilized with rigid internal fixation. First the muscle layer and then the mucosa was closed with continuous suturing technique. A pressure dressing was placed by using elastoplasts and was left in place for 5 days.

CEPHALOMETRIC ANALYSIS

Before tracing the radiograph three orientation crosses were drawn on the radiograph, two within the cranium and one over the area of the cervical vertebrae. Then the three orientation crosses were traced into the acetate paper. After this, the soft tissue and hard tissue outline were traced and the cephalometric landmarks were identified.

An x-y cranial base co-ordinate system was constructed on the radiograph through sella. The x-axis was determined as a line rotated 7° upwards from SN line through N. This line called "constructed horizontal plane" was used as a reference line (x-axis) for this study. A constructed vertical reference line was drawn perpendicular to this line at nasion, which formed the y-axis. (Fig.1) These reference lines were transcribed to each consecutive cephalogram after super imposition on a best fit of sella, nasion, anterior and posterior cranial base. Measurements were made either parallel or perpendicular to the reference lines.

The landmarks used in this cephalometric analysis were:

1. Sella (S) – The center of the pituitary fossa
2. Nasion (N) – the most anterior point of the naso frontal suture in the mid sagittal plane
3. Pogonion (Pg) – the most anterior point- in the mid sagittal plane of the contour of the chin
4. Soft tissue pogonion (Pg1) the most anterior point on the soft tissue chin

CEPHALOMETRIC PLANE OF REFERENCE

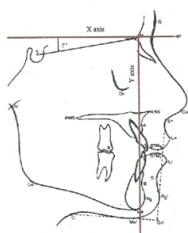


Fig: 1

STUDY I

POGONION HARD TISSUE RELAPSE:

The horizontal changes of the hard tissue pogonion were assessed by projecting the pre-operative, immediate post operative and twelve months follow up of pogonion perpendicular to the vertical reference line and measuring the difference between them.(Fig:3)

The amount of hard tissue pogonion advancement was assessed by measuring the difference between the pre-operative and immediate postoperative distance of the pogonion from the vertical reference line. The amount of relapse of hard tissue pogonion was assessed by measuring the difference between the immediate post operative and twelve months follow-up distance of the hard tissue pogonion from the vertical reference line.

STUDY II

SOFT TISSUE POGONION SOFT TISSUE RELAPSE:

The horizontal changes of the soft tissue pogonion was assessed by projecting the pre operative, immediate post operative and twelve months follow up of soft tissue pogonion perpendicular to the vertical reference line and measuring the difference between them.

The amount of soft tissue pogonion movement was assessed by measuring the difference between the pre-operative and immediate postoperative distance of the soft tissue pogonion from the vertical reference line. The amount of relapse of soft tissue pogonion was assessed by measuring the difference between the immediate post operative and twelve months follow-up distance of the soft tissue pogonion from the vertical reference line. (Fig:4)

STUDY III

HARD TISSUE POGONION VERSUS SOFT TISSUE POGONION RELAPSE COMPARISON

A comparative study of relapse, between hard and soft tissue pogonion was conducted.

DIAGRAMMATIC REPRESENTATION

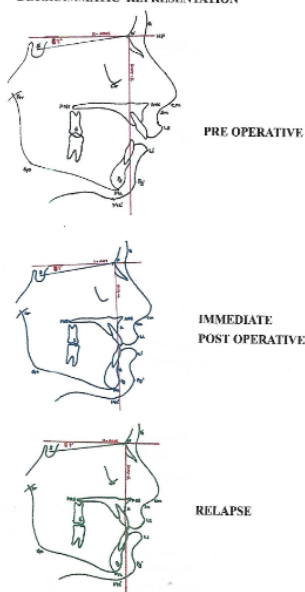
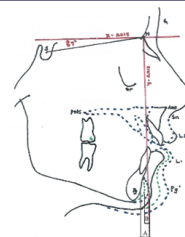


Fig: 2



Cranial base superimpositioning illustrates skeletal and soft tissue relapse

A. Indicates horizontal surgical advancement (Hard tissue pogonion)

B. Indicates horizontal surgical relapse (Hard tissue pogonion)

Black line = pre-operative

Blue line = immediate post-operative

Green line = twelve months post-operative

Fig: 3



Cranial base superimpositioning illustrates skeletal and soft tissue relapse

A. Indicates horizontal surgical advancement (Soft tissue pogonion)

B. Indicates horizontal surgical relapse (Soft tissue pogonion)

Black line = pre-operative

Blue line = immediate post-operative

Green line = twelve months post-operative

Fig: 4

RESULTS

STUDY I

POGONION HARD TISSUE RELAPSE RESULT

The mean advancement at the pogonion was 7.25 mm with a standard deviation of 2.85mm. The mean relapse for the pogonion after twelve months was 0.50mm with a standard deviation of 0.527mm. The relapse was not significant statistically ($P=0.55$). The mean percentage of relapse for the pogonion was found to be 6.32%. No correlation was found between the amount of advancement and the amount of relapse.

STUDY II

SOFT TISSUE POGONION SOFT TISSUE RELAPSE RESULT

The mean movement of the soft tissue pogonion was 7.25mm with a standard deviation of 3.12mm. The mean soft tissue relapse at the pogonion was 1.75mm with a standard deviation of .677mm, which was not significant statistically ($P=0.59$). The mean percentage of relapse for soft tissue pogonion was found to be 18.4%. No correlation was found between the amount of advancement and the amount of relapse.

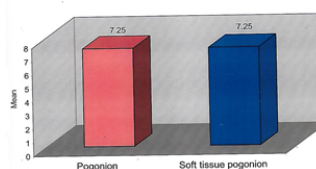
STUDY III

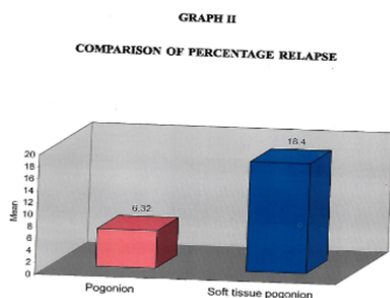
POGONION VERSUS SOFT TISSUE POGONION RELAPSE COMPARISON

The mean advancement of the pogonion was 7.25mm to the soft tissue pogonion movement of 7.25mm, which shows 1:1 ratio of hard to soft tissue pogonion.(Graph1) The mean relapse of the pogonion was 0.50mm versus 1.75 mm to the soft tissue pogonion, which shows a ratio of 1:3. The mean percentage of relapse for the pogonion was 6.32% to the soft tissue pogonion relapse of 18.44% (Graph 2). No significant difference in relapse at the pogonion and soft tissue pogonion was found for advancements greater than 7mm versus advancement less than 7mm.

GRAPH I

COMPARISON OF HARD AND SOFT TISSUE POGONION ADVANCEMENT





STUDY I: HARD TISSUE POGONION RELAPSE RESULT

TABLE I HORIZONTAL CHANGES OF HARD TISSUE POGONION

Patient	Pre operative	Immediate post operative	12 months post operative	Relapse
1.	19.5	10	10	0
2.	9	3	4	1
3.	20	15	15	0
4.	12	8	9	1
5.	17.5	10	11	1
6.	16	4	4	0
7.	11	3	4	1
8.	15	4	5	1
9.	11	7	7	0
10.	9.5	4	4	0

Mean relapse = 0.50mm

Descriptive statistics: Relapse

	N	Minimum	Maximum	Mean	Standard Deviation
Hard tissue pogonion	10	.00	1.00	.5000	.5270

(N=No.of Patients)

Group statistics: Relapse for advancement <or> 7mm:

Pogonion Advancement	N	Mean	Standard Deviation	Z
< 7mm	5	.4000	.5477	.6000
> 7mm	5	.6000	.5477	P= .549 ns

Z = Mann – Whitney U test

Correlations – Pogonion:

	Relapse
Pearson correlation	0.31
Sig (2- tailed)	.932
N	10

STUDY II: SOFT TISSUE POGONION RELAPSE RESULT

TABLE II HORIZONTAL CHANGES OF SOFT TISSUE POGONION

Patient	Pre operative	Immediate post operative	12 months post operative	Relapse
1	-2	5	3	2
2	1	10.5	9	1.5
3	-4	5	3	2
4	9	12	10	2
5	4	6	4.5	1.5
6	2	9	7	2
7	12	17	16	1
8	-5	7.0	5.5	1.5
9	5	14	13	1
10	9	18	15	3

Mean relapse = 1.75mm

Descriptive statistics: Relapse

	N	Minimum	Maximum	Mean	Standard Deviation
Soft tissue pogonion	10	1.00	3.00	1.7500	.6770

Group statistics: Relapse for advancement <or> 7mm:

Soft tissue advancement	N	Mean	Standard Deviation	Z
< 7mm	5	1.6000	.4813	.5370
> 7mm	5	1.9000	.8944	p= .591 ns

Correlations- Soft tissue:

	Soft tissue relapse
Pearson correlation	.256
P	.475
N	10

STUDY III: HARD AND SOFT TISSUE RELAPSE COMPARISON

TABLE III ADVANCEMENT GENIOPLASTY STABILITY DATA

Patient	Pogonion Advancement	Relapse	Soft tissue pogonion Advancement	Relapse
1	9.5	.00	7.00	2
2	6	1.00	9.5	1.5
3	5	0	9	2
4	4	1	3	2
5	7.5	1	2	1.5
6	4	0	9	1
7	8	1	5	1
8	11	1	12	1.5
9	12	0	7	2
10	5.5	0	9	3

Mean advancement of hard tissue pogonion = 7.25mm

Mean advancement of soft tissue pogonion = 7.25mm (1:1)

Mean relapse of hard tissue pogonion = 0.50mm

Mean relapse of soft tissue pogonion = 1.75mm (1:3)

Descriptive statistics: Comparison percentage relapse

Variable	N	Minimum	Maximum	Mean	Standard deviation
Pogonion	10	33.33	37.50	6.32	2.13
Soft tissue	10	11.11	35.71	18.44	7.03

Descriptive statistics: Comparison- Relapse

	N	Minimum	Maximum	Mean	Standard deviation
Hard tissue Pogonion	10	.00	1.00	.5000	.5270
Soft tissue Pogonion	10	1	3.00	1.7500	.6770

Mean difference in relapse- Advancement <or> 7mm:

Variable	<7mm (mean + SD)	>7mm (mean +SD)	P Value
Pogonion	0.40 ± 0.54	0.60 ± 0.54	0.549
Soft tissue Pogonion	1.60 ± 0.41	1.90 ± 0.89	0.591 Not significant

DISCUSSION

Relapse is a frequent but unpredictable complication of the surgical correction of mandibular retrognathism¹⁷. Relapse in this context refers to any posteriorly directed change of mandibular position in the horizontal plane measured at pogonion.

A retrospective study by Anthony Pogrel et al.⁵ on 20 patients to assess long term relapse concluded that mean relapse of the pogonion was - 0.38 mm versus - 1.5mm for the soft tissue pogonion.. In our study after twelve months the means relapse for the hard tissue pogonion was only .50mm when compared to the soft tissue pogonion relapse of 1.75mm., the mean percentage of horizontal relapse for the pogonion is 6.32% to the soft tissue percentage of 18.44%, which shows a ratio 1:3. The soft tissue seems to behave in manner similar to hard tissue. Consistent with findings of Anthony Pogrel et al the result of our study indicate that there is no significant relapse for advancement genioplasty after twelve months.

Initially wiring procedures were used to stabilize the osteotomized segments. However studies²¹ demonstrated significant change after operation. Post surgical changes that ranged from 10% to 80% were demonstrated²². Rigid fixation techniques were introduced in an attempt to decrease the post surgical relapse rate. Kirpatrick and

woods⁸ showed a mean horizontal relapse of 8% after mandibular advancement with rigid fixation. Relapse has been shown to be much less with rigid fixation from 8% to 18%²³. Reyneke et al⁹ compared the skeletal stability of wire and screw fixation after advancement genioplasty and demonstrated no difference between two groups. Ueki et al¹ in his study suggested that vertical relapse to the inferior site or resorption at the antero-superior edge of the segment could occur in the absorbable group. The present study were all the patients treated with rigid internal fixation showed a mean horizontal relapse of 6% for pogonion and 18% for soft tissue pogonion. This indicates that the relapse is minimal when genioplasty procedure was used in conjunction with rigid internal fixation.

Lines and Steinhäuser¹⁴ in their study concluded that soft tissue pogonion advanced at a simple 1:1 ratio to hard tissue pogonion. Mommart and Marxer¹³ showed pogonion to soft tissue pogonion ratio of 1:1.03, Hernandes-Orsini et al.²⁰ also showed a 1:1 immediate post operative changes. Iizuka et al⁴ opined that the main movement occurred in the horizontal plane. Soft tissue pogonion and mentolabial fold were found to follow the underlying skeletal structures in a nearly 1:1 ratio. Shaughnessy et al³ observed that the soft tissue of the chin was found to follow bony movement in a ratio of 0.9:1. Great individual variability was observed. Kim and Kim⁷ observed a good correlation between the amount of hard versus soft tissue change with surgery in the horizontal direction, but a poor correlation in the vertical plane. In our study we found that the mean post operative osseous tissue advancement was 7.25 at the pogonion with a mean soft tissue pogonion movement of 7.25, which shows 1:1 soft to hard tissue change.

The 7 mm and larger advancements were selected as a subgroup of patients to evaluate whether large advancements could lead to greater relapse after surgery. The value 7mm was selected arbitrarily as a cut-off to allow comparison with other studies¹⁵. Our data suggest that there is no significant greater relapse for pogonion advancements of greater than 7mm within the limits of the study in which the largest individual advancement was 12mm. Advancement greater than 7mm was not found to be significant. This is in contradiction to other studies¹⁷ that report greater relapse rate at greater than 7mm advancements.

There are warnings in the literature¹⁶ against the use of pogonion as a reference point, when studying the stability of genioplasty because bony remodeling would invalidate any conclusion about skeletal stability, since the differentiation between them is impossible. But several studies have shown that stability is retained in the horizontal position^{7,12}. DeFreitas et al¹⁰ describe the pogonion as an important point to be assessed in a genioplasty study as it is the bony landmark of the chin prominence.

The causes of skeletal relapse in advancement genioplasty has been the basis of much debate. The supra hyoid musculature and perimandibular connective tissue acting on the anterior mandible have received most of the attention. A study by Ellis and Carlson¹¹ on Rhesus monkeys supported the hypothesis that stretching the suprahyoid musculature as a result of mandibular advancement was a major contributor to skeletal relapse. Reyneke¹⁹ suggested that the influence of suprahyoid muscle stretch on long term stability needs further research.

CONCLUSION

Relapse appears to be a multifactorial biologic phenomenon with considerable individual variability. Long term skeletal stability is an important goal following orthognathic surgery. Studies have shown that the greatest amount of relapse occurs in the first 6 months following surgery⁶. The relapse values in our study were found to be statistically not significant. The changes were minimal and hard to detect clinically. There was no significant difference in relapse at the pogonion and soft tissue pogonion for advancements greater than 7mm and less than 7mm. These ratios can be used for treatment planning to obtain predictable results.

Advancement genioplasty is a valuable and reliable technique for the aesthetic enhancement of the lower facial skeleton by improving the soft tissue profile. It is a stable surgical procedure, if adequate muscular pedicle and rigid internal fixation were maintained. The observation of skeletal and soft tissue relapse that follows advancement genioplasty is of significance in treatment planning and patient management. Cephalometric and clinical monitoring of each patient and careful interpretation of observed changes must be used as

a means of minimizing the effect of relapse on the treatment result achieved.

The main drawback of this study is that it is a two dimensional analysis of a three dimensional picture. But still this is the most popularized and simplest method for the long term assessment and analysis of hard and soft tissue stability.

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