RESEARCH PAPER

Satisfaction Audit of Patients Undergoing Mandibular Distraction Osteogenesis with Extra-Oral Distraction Appliances

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Abstract

Introduction The aim of this research was to evaluate the level of satisfaction of patients who were undergoing distraction osteogenesis of mandible with extraoral distraction appliance.

Material and Methods The prospective study was performed on 13 patients with facio-mandibular deformity reporting to the Oral Health Sciences Center, PGIMER, Chandigarh, India, who required surgical and orthodontic intervention for correction. A standardized multiple choice questionnaire was provided to all patients at 3 stages of

treatment i.e. during predistraction, distraction and post distraction period.

Results Predistraction evaluation showed that the main reason for patients to seek treatment was lack of facial esthetics and all of them were sure that there would be a change in their lives after they underwent this treatment procedure. During distraction phase the most common complaint was pain. None of the patients felt that they were suffering during active distraction phase and all felt that they made the right decision. In post distraction phase, all patients were satisfied with the treatment and felt that the treatment was worth it. Twelve out of 13 patients would recommend treatment to others without any hesitation.

Conclusion Our study concludes that distraction osteogenesis of the mandible with extra-oral appliances is acceptable to patients, and improved facial appearance is a positive influence. The appliance and results of the procedure are socially accepted and appreciated.

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Keywords Distraction osteogenesis · Patient satisfaction · Extraoral

Introduction

Facial deformity is a condition that leads to physical, functional and psychological problems for the patient. It may arise due to growth disorders, trauma or pathology [1–3]. Such patients usually require combined therapy with both orthognathic surgery and orthodontic treatment. One of the recent advances in the field of maxillofacial surgery and orthodontics is distraction osteogenesis of mandible and midfacial skeleton. Distraction osteogenesis of the mandible is still an emerging technique, and there are many areas associated with this procedure that require better

Table 1 Distribution of age, sex, etiology of retrognathia, side and distance of mandibular distraction osteogenesis of patients enrolled in this study

S. No	Age	Sex	Etiology of retrognathia	Distraction	Left (mm)	Right (mm)
1	16	Female	Condylar agenesis	Bilateral	32	41.5
2	22	Female	Trauma	Unilateral		29.5
3	10	Female	Hemifacial microsomia	Unilateral		19.5
4	19	Male	Trauma	Unilateral		21
5	26	Male	Trauma	Bilateral	28	32.5
6	23	Female	Trauma	Unilateral	18	
7	31	Male	Trauma	Bilateral	46.5	47
8	11	Male	Trauma	Unilateral	30	
9	19	Male	Trauma	Unilateral		32
10	12	Female	Trauma	Bilateral	16	19.5
11	22	Female	Trauma	Bilateral	24.5	6
12	15	Female	Trauma	Unilateral	24	
13	15	Female	Trauma	Bilateral	21	29

understanding [4, 5]. Distraction devices are available in wide range and variety [6–10]. The extra-oral appliances have a definite advantage in greater versatility in length of distraction appliance which relates to the length of bone distraction required. Other factors in their advantage include lower cost, flexibility of multi-directional distraction and ease of removal of distractor device under local anesthesia after the procedure is completed [11]. Scarring of overlying skin associated with extra oral distraction appliance devices does improve with time [12]. However, it cannot be denied that extra-oral mandibular distraction

devices require a certain level of acceptance, tolerance and perseverance from the patient related to personal comfort, functional problems, cosmetic and psycho-social factors. Ayoub et al. [13] investigated patient response to the use of extra-oral distracters, and another series of data has been presented by Primrose et al. [12], who studied patients' responses to both mandibular and midface distraction in a multicenter study.

Careful assessment of the surgico-orthodontic patients is necessary to find out motivation of patients seeking treatment, understanding of the treatment plan, expectation from the treatment and the impact of the treatment outcome. This can help to identify factors which can be the predictors of dissatisfaction. Such research can be helpful in understanding the areas of distress or disappointment to the patients and by addressing these we can make patients more comfortable and compliant during the treatment procedure.

Keeping all these features in mind, a prospective study was planned in order to evaluate the satisfaction of patients who were to undergo mandibular distraction osteogenesis with extra-oral appliances in all three phases of treatment i.e. pre-operative phase, distraction phase and the post-distraction phase.

Materials and Methods

The study protocol was reviewed and accepted by the ethics committee of the Oral Health Sciences Centre, PGIMER, Chandigarh, India.

After ethics committee approval and informed consent had been obtained, the present study was conducted on 13 patients with facio-mandibular deformity reporting to the

Table 2 Results of questionnaire for pre-distraction phase

S.No.	Group	Understood procedure	Reasons for seeking surgery			Motivating factor	Impact on life	Understood all modalities	Reaction to device
			Esthetics	Function	Most Imp				
1	B	Yes	Esthetics	None	Esthetics	Self	Yes	Yes	Not Sure
2	U	Yes	Esthetics	Chewing	Esthetics	Self	Yes	Yes	Acceptable
3	U	Yes	Esthetics	Chewing	Esthetics	Family	Yes	Yes	Acceptable
4	U	Yes	Esthetics	None	Esthetics	Self	Yes	Yes	Acceptable
5	B	Yes	Esthetics	Breathing	Breathing	Self	Yes	Yes	Not Sure
6	U	Yes	Esthetics	None	Esthetics	Self, family	Yes	Yes	Bulky
7	B	Yes	Esthetics	Chewing, breathing	Breathing	self, dentist	Yes	Yes	Acceptable
8	U	Yes	Esthetics	None	Esthetics	Dentist	Yes	Yes	Acceptable
9	U	Yes	Esthetics	None	Esthetics	Self, dentist, family	Yes	Not sure	Acceptable
10	B	Yes	Esthetics	None	Esthetics	Dentist	Yes	Yes	Bulky
11	B	Yes	Esthetics	None	Esthetics	Self	Yes	Yes	Not Sure
12	U	Yes	Esthetics	None	Esthetics	Self	Yes	Yes	Acceptable
13	B	Yes	Esthetics	None	Esthetics	Self, dentist	Yes	Yes	Unesthetic

U unilateral distraction, B bilateral distraction

Table 3 Results of questionnaire for Distraction Phase

S.No.	Group	Appliance and expectations	Complaints	People's comments	Type of comments	Response to comments	Suffering?	Right decision
1	B	Yes	Pain, transient numbness	Sometimes	Encouraging	Ignore	No	Yes
2	U	Yes	Pain, transient numbness, chewing difficulty	Always	Encouraging	Ignore	No	Yes
3	U	Yes	Pain, chewing difficulty	Sometimes	Neutral	Ignore	Not sure	Yes
4	U	Yes	Pain, transient numbness, reduced mouth opening	Always	Encouraging	–	Yes	Yes
5	B	Yes	Pain, transient numbness	Always	Encouraging	Ignore	No	Yes
6	U	Yes	Pain, transient numbness, altered speech	Never	–	–	No	Yes
7	B	Yes	Pain, chewing difficulty	Sometimes	Encouraging	–	No	Yes
8	U	Yes	Pain, transient numbness	Sometimes	Encouraging	Irritated	No	Yes
9	U	Yes	Pain, transient numbness, discharge at site	Sometimes	Encouraging	Ashamed	Yes	Yes
10	B	Yes	Pain, Transient Numbness, Chewing Difficulty	Sometimes	Encouraging	–	No	Yes
11	B	Yes	Pain, transient Numbness, Reduced Mouth Opening	Never	–	–	No	Yes
12	U	Yes	Pain, transient numbness, chewing difficulty	Sometimes	Discouraging	Ignore	Not sure	Yes
13	B	Yes	Pain, abnormal sensation, chewing difficulty	Sometimes	Neutral	–	No	Yes

U unilateral distraction, *B* bilateral distraction

Table 4 Results of questionnaire for post-distraction phase

S.No.	Group	Level of Satisfaction	Change in any of the following					Treatment worth it	Treatment worth problems faced	Would you undergo again?	Would you recommend?
			Facial app	Speech	Breathing	Chewing	Most important				
1	B	Satisfied	Better	Worse	Better	Can't Say	Appearance	Yes	Yes	Don't know	Yes, no hesitation
2	U	Totally Satisfied	Better	No	No	Can't Say	Appearance	Yes	No	Yes, no hesitation	Yes, no hesitation
3	U	Satisfied	Better	No	No	Worse	Appearance	Yes	Yes	Yes, no hesitation	Yes, no hesitation
4	U	Satisfied	Better	No	No	No	Appearance	Yes	Yes	Don't know	Yes, some hesitation
5	B	Satisfied	Better	No	Better	Worse	Breathing	Yes	Yes	Yes, some hesitation	Yes, no hesitation
6	U	Satisfied	Better	No	No	No	Appearance	Yes	No	Yes, some hesitation	Yes, No hesitation
7	B	Totally Satisfied	Better	No	Better	Better	Breathing	Yes	Yes	Yes, no hesitation	Yes, no hesitation
8	U	Totally Satisfied	Better	No	No	No	Appearance	Yes	Yes	Yes, no hesitation	Yes, no hesitation
9	U	Satisfied	Better	Worse	No	Worse	Appearance	Yes	Yes	Certainly not	Yes, no hesitation
10	B	Satisfied	Better	No	No	Worse	Appearance	Yes	Yes	Yes, no hesitation	Yes, no hesitation
11	B	Satisfied	Better	Better	No	No	Appearance	Yes	Yes	Yes, no hesitation	Yes, no hesitation
12	U	Satisfied	Better	Worse	No	Worse	Appearance	Yes	Yes	Don't know	Yes, no hesitation
13	B	Totally Satisfied	Better	No	No	Can't Say	Appearance	Yes	Yes	Don't know	Yes, some hesitation

U unilateral distraction, *B* bilateral distraction

Oral Health Sciences Center, PGIMER, Chandigarh, India, requiring surgical and orthodontic intervention for correction. The main considerations necessitating distraction osteogenesis of the mandible were a deficient mandible requiring surgical correction where orthognathic surgery without the application of a bone graft was not possible. The mean age of the patients was 18.6 years with a range from 10 to 31 years (Table 1). Out of the 13 patients, one had hemifacial microsomia and one had condylar agenesis leading to facial deformity. The remaining 11 patients had retrognathic mandibles secondary to TMJ ankylosis, caused by trauma.

Diagnosis of facio-mandibular deformity and treatment protocol requiring orthodontic and surgical treatment was done after detailed clinical and radiographic evaluation.

Patient Evaluation

Satisfaction audit of patients was performed using a specifically designed questionnaire in a multiple choice format using non-technical terminology so that patients of different educational backgrounds could respond accurately. Assistance was provided if patients had any query. The questionnaire was divided in three parts. Part 1 was designed to evaluate the basic reasons and the major motivating factors behind the patient's decision to undergo distraction osteogenesis of the mandible. Part 2 was designed mainly to interpret the subjective problems faced by the patients both functionally and socially during the treatment phase. Part 3 attempted to elicit whether the patients were satisfied by the treatment provided, and by the results of distraction procedure as a whole (Tables 2, 3, 4).

Surgical Procedure

Placement of the extra-oral unidirectional distraction appliance was done via an extra-oral approach to the lower border of the mandible with a standard sub-mandibular incision. McCarthy's distraction protocol was followed in order to achieve a rate of 1 mm per day of bone lengthening [14]. After achieving adequate distraction, the distraction appliance was stabilized in the final position, and was maintained for a period of 4 weeks to allow ossification of the elongated callus.

Results

Analysis of our data revealed that the majority of the patients were concerned mainly about esthetics (11, 84.61 %) as the reason for undergoing distraction osteogenesis of the mandible. They all understood the treatment process and many required more motivational support.

Results of the phase 1 questionnaire are as follows:

Patient Evaluation Before Distraction Osteogenesis

Total understanding of the various modalities of treatment available	
Yes	12 (92.30 %)
Not sure	1 (7.69 %)
Primary reason for opting to undergo distraction osteogenesis	
Dento-facial esthetics	11 (84.61 %)
Breathing problems	2 (15.38 %)
Motivating factor to undergo distraction osteogenesis	
Totally self motivated	6 (46.5 %)
Additionally motivated by family/dentist	7 (53.84 %)
Response to the distraction appliance seen on other patients	
Acceptable	7 (53.84 %)
Unesthetic/bulky	3 (23.07 %)
Not sure	3 (23.07 %)

Patient Evaluation During Distraction Osteogenesis

The distraction phase evaluation was done to find out the practical problems faced by patients and its effect on their day to day life. During distraction, most faced practical problems were pain/discomfort (13, 100 %) and numbness (10, 76.92 %). The response of public exposure was quite positive on the whole. Details are given below.

Associated problems with the distraction appliance and procedure	
Pain/discomfort	13 (100 %)
Transient numbness	10 (76.92 %)
Abnormal sensation	1 (7.69 %)
Problems in chewing	6 (46.15 %)
Problems in opening mouth	2 (15.38 %)
Problems in speaking	1 (7.69 %)
Social response to the distraction appliance	
Comments from people around the patient	
Always	3 (23.07 %)
Sometimes/never	10 (76.92 %)
Type of comments made by people	
Encouraging	8 (61.53 %)
Neutral	2 (15.38 %)
Discouraging	1 (7.69 %)
Personal response to people's comments	
Ignore/undisturbed	11 (84.61 %)
Irritated/ashamed	2 (15.38 %)
Feeling of suffering due to the appliance	
No	9 (69.23 %)
Yes/not sure	4 (15.38 %)
Response to the distraction appliance	
Meets expectations	13 (100 %)

Patient Evaluation After Distraction Osteogenesis

Post distraction evaluation was done to elicit the satisfaction levels of the treatment and outcomes for the patients and acceptance of extraoral mandibular distraction as a treatment modality. All the patients were satisfied with the treatment (100 %) and eleven (84.61 %) of the thirteen patients were ready to recommend the treatment to others. Details of the results are given below.

Change noted in	
Appearance	11 (84.81 %)
Function	2 (15.38 %)
Satisfaction with the outcome of treatment	
Totally satisfied	4 (30.76 %)
Satisfied	9 (69.23 %)
Acceptance levels with the treatment procedure	
Outcome worth associated problems	13 (100 %)
Willing to undergo procedure again	8 (61.53 %)
Would recommend the procedure to similar patients	11 (84.61 %)

If we segregate our patients into 2 groups i.e. adults (>18 years, 7/13) and children (<18 years, 6/13) it was noted that functional difficulty was an important consideration for undergoing distraction in adults (2/7) and was not relevant in children. All adults were primarily self motivated (7/7) while most children needed additional motivation from family and/or dentist (4/6) to undergo treatment. Some of the children (2/6) remained unsure about the suffering related to the extraoral appliance.

Discussion

The analysis of our results showed that significant majority of the patients (84.61 %) sought surgical-orthodontic treatment for improvement of facial esthetics while two (15.38 %) patients were more concerned about abnormal respiratory function. Similar findings were noted by Finlay et al. [15] and Williams et al. [16], with both studies citing dental and facial appearance as the key motivating factor for their patients to undergo elective orthognathic surgery. However, according to Rustemeyer et al. [17] both esthetic improvement and improvement of chewing function were equally important. In addition, our study also shows that six (46.15 %) of the patients were totally self-motivated while seven (53.85 %) required some more motivation from their family and/or from their dentist. The adult patients tended to show concern regarding functional impairment (breathing difficulty). The younger age group

required more external motivation while the adults were primarily motivated to undergo the treatment themselves. No similar study could be found in the available literature where this feature of patient satisfaction has been studied or discussed.

After being explained all the available alternatives of treatment available for their condition, 12 (92.31 %) out of the 13 patients seemed confident that they had understood the different treatment modalities available for the management of their facial deformity. Similarly, Nurminen et al. [18] showed that 92.86 % orthognathic surgery patients stated that they had received sufficient information at the beginning of the treatment. The treatment protocol of distraction osteogenesis and orthodontic treatment was understood by all patients. Only 7 (53.84 %) readily accepted the extra-oral appliance, while the others had some apprehension regarding the bulk and esthetics; however, they all accepted to undergo the treatment. Also, all patients unanimously anticipated a change in their lives after undergoing this treatment. No such evaluation of the extra-oral distraction appliance pre-surgically has been noted in any other study.

In relation to the acceptance and problems faced with the distraction procedure and appliance, 12 (92.31 %) out of the 13 patients stated that the appliance met their expectations. Pain or discomfort, especially during activation of the distraction appliance, was the major complaint in all our patients (100 %) but it was satisfactorily managed by judicious NSAID therapy. Both Ayoub et al. [13] and Primrose et al. [12] also noted pain to be a major complaint in their patients undergoing distraction osteogenesis. However, Ayoub et al. [13] also felt that this was more prevalent in the older age group of children, as they could possibly express themselves better.

Ten (76.92 %) out of the 13 patients stated that they felt a transient numbness in the region of the lower lip; conversely, Ayoub et al. [13] found that only 3 (21.43 %) of their patients suffered from transient paresthesia. Only one (7.69 %) of our patients experienced an abnormal sensation in the lower lip region while Primrose et al. [12] reported abnormalities in sensation in 5 (14.70 %) out of their 34 patients. Six (46.15 %) out of our 13 patients developed difficulty in chewing as the distraction progressed. However, during the post-distraction phase, only 5 (38.46 %) continued to face this problem. Ayoub et al. [13] reported that in patients who had completed treatment (n = 5) eating was difficult in all patients and all of them required modification of the diet during the distraction procedure. Appropriate diet modification was suggested to our patients where they faced masticatory difficulty. One (7.69 %) of our patients expressed problems in speaking clearly during the distraction phase, while three (23.07 %) complained of this in the post-distraction phase. Ayoub et al. [13] noted

that 4 (80 %) out of 5 patients noticed slurring of speech. Guyette et al. [19] also concluded that 28 % of their patients experienced a temporary deterioration in articulation after distraction. Pelo et al. [11] discussed that speech, feeding and oral hygiene problems may be significantly affected in patients with external craniofacial distractor devices, which can be directly related to the bulky construction of the halo frame. Speech and mastication were addressed in our patients in the post-distraction orthodontic treatment phase. Respiratory difficulty was a problem in two (15.38 %) of our patients pre-operatively who were breathing comfortably at the end of the distraction. Improvement of pharyngeal air space after mandibular distraction has been well documented [20, 21].

Out of our thirteen patients, eleven of them (84.61 %) stated that they received some form of comments about the extra-oral distraction appliances during social interaction. However, it is noteworthy that 8 of these (72.72 %) thought that the comments people made were encouraging in a manner related to their treatment, while only one (7.69 %) was discouraged by these remarks. On the other hand, it was noted by Ayoub et al. [13], who also used external distraction appliances, that 2 (14.28 %) out of 14 patients were “teased” because of the device and some of their patients failed to continue to attend their schools. Interestingly, none of the patients in the current study group, however, mentioned any occurrence of ridicule or “teasing” during their treatment. In this context, Primrose et al. [12] mentioned that during the treatment period, 18 out of their 34 patients socialized less or not at all, feeling ‘abnormal’, self conscious and uncomfortable in public situations. Similar findings were noted by Pelo et al. [11] when they evaluated 34 patients after the use of external craniofacial distraction devices and found that their patients had significant psychological impact and important limitation on recreational activities.

The majority of the patients (69.23 %) stated that they underwent no “suffering” due to the treatment procedure. In fact, during the distraction process all the patients clearly stated that they had made the right decision in going for this treatment procedure. When considering the level of satisfaction with the treatment procedure, four (30.77 %) patients stated that they were “totally satisfied” with the treatment outcome. Nine (69.23 %) patients expressed “satisfaction” at the end result of the treatment. None of the patients expressed any dissatisfaction regarding the outcome of the treatment. A good measure of the success of the treatment from the patient’s viewpoint was that they were prepared to have the same treatment again, despite knowing all the problems that were experienced during the previous treatment. Zhou et al. [22] studied patient satisfaction following orthognathic surgical correction of Class III malocclusion, in 140 consecutive Chinese patients through a questionnaire. Their results showed that vast majority of the patients were satisfied with

overall outcome of the orthognathic surgery. Lazavidou-Terzoudi et al. [23] studied long term (10–14 years) assessment of psychological outcomes of orthognathic surgery and found that orthognathic surgery resulted in subjective estimation of function, appearance, health and interpersonal relationships that was higher than among pretreatment and non-treatment control group.

When considering overall satisfaction with the treatment modality, six of the patients (46.15 %) felt that they would be willing to undergo the procedure again without any hesitation, while four patients (30.77 %) were not so sure about this. Eleven of the patients (84.61 %) said that they would recommend this procedure to other patients without any hesitation. Almost similar observations were made by Ayoub et al. [13] who found that 11 of their 14 patients (78.57 %) stated that they would recommend the treatment to others if required, while the remaining 3 (21.43 %) felt that the procedure was too demanding, prolonged and would not be suitable for children who enjoyed mainly active sports. In their opinion, this feature is a measure of the success of the treatment procedure.

Primrose et al. [12] also stated that all their patients were pleased with the long term result and that most were willing to recommend the treatment to others.

We are aware of the fact that in order to draw any definite conclusion the sample is very small, but since distraction is still a little explored field of corrective surgery it can add to the information available in the literature.

Overall, considering the sample size and type of study conducted, with very limited number of studies of similar nature to compare, it was felt that only gross conclusions could be made after interpretation of such results.

The analysis of the results obtained from this study yielded the following conclusions:

Esthetics was the main reason for seeking treatment. All the patients experienced pain during the treatment but it was satisfactorily managed. Majority of patients were self motivated and handled the comments made by others with positive attitude, especially with respect to the external distractor device. The results are appreciated by the patients and they are happy to recommend the treatment to others.

Our study shows that distraction osteogenesis of the mandible with external devices is an acceptable treatment modality and it does not prove to be a social deterrent in any way.

Conflict of interests None.

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