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Assessment of clinical and radiographic changes of the mandibular condyle following orthognathic surgery

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Abstract

Aim: Changes of the mandibular condyle are unwanted and unpredictable complications of orthognathic surgery. This pilot study investigated the prevalence and severity of mandibular condylar changes after orthognathic surgery. **Materials and Method:** In this prospective study 20 patients with class II and III malocclusion who needed orthognathic surgery were evaluated. Ramus height, condylar width, joint pain, overjet and overbite, angular changes on lateral cephalogram, maximal mouth opening, maxillary and mandibular movements before and 6 months after surgery were assessed. **Results:** In this study condylar atrophy was radiographically evident on panoramic radiographs of 6 (30%) of the patients; one patient was treated for class II malocclusion and the other 5 were treated for class III malocclusion. **Conclusion:** This study showed radiographically evident condylar atrophy in 30% after surgery; however none had any related clinical signs or symptoms. None of the cases that developed condylar atrophy postsurgery correlated significantly with the variables assessed in this short term pilot study. Further studies and longer follow-up is needed to validate the results.

Keywords: Orthognathic surgery, Condylar atrophy, Complications.

INTRODUCTION

In Changes of the mandibular condyle are unwanted and unpredictable complications of orthognathic surgery. Condylar atrophy or resorption has been reported following orthognathic surgery. Based on different criteria, the prevalence of condylar resorption has been stated between 1-31% [1-3]. Progressive condylar resorption (PCR) is a multifactorial disease, which is more common in females and adolescents [4,5]. The etiology of this condition is unknown, but several local and systemic conditions have been related to it. Important factors include osteoarthritis, active arthritis, avascular necrosis, infection and trauma. Systemic diseases such as autoimmune and connective tissue diseases are other contributors to this pathologic condition. Many researchers also state orthognathic surgery among the causative factors [2,3,6-15].

Progressive condylar resorption is a serious complication of orthognathic surgery, and when it develops the patient and surgeon are both concerned. The optimal treatment for progressive condylar resorption is unknown [16]. This study investigates the prevalence and severity of condylar changes after orthognathic surgery.

MATERIALS AND METHOD

Twenty patients with class II and class III malocclusion were studied. All the patients had undergone orthodontic treatment before surgery. None of the patients had cleft lip or palate, or syndromes nor signs and symptoms of local or systemic inflammatory or autoimmune diseases. Our research was approved by our local institutional review board. It was in accord with the World Medical Association Declaration of Helsinki on medical research protocols and ethics. The institutional review board (IRB) approved the study protocol and approved it in accord with local IRB standards. Orthognathic surgery was performed from

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April- December 2012 by the same surgeon; sagittal split (BSSRO) was performed with or without Lefort I. Three patients with class II malocclusion had mandibular advancement. In 16 patients with class III malocclusion, both maxillary advancement via Lefort I technique and mandibular setback were done. In one class III patient mandibular setback alone was performed. In all the patients mandibular fixation was done using 2 bicortical screws and maxillary fixation was performed using 4 miniplates (2.0mm).

Radiographic assessment. Panoramic radiographs and lateral cephalograms were taken before surgery, one day after and 6 months later. The outlines of the condyles and rami were traced on the panoramic radiograph. All the radiographs were digitalized and of actual size (100%). A ramus tangent and a line perpendicular to it on the most superior point of the condyles were drawn. The distance between the superior part of the condyle and the most inferior part of the tangent was measured as the ramus height (RH). The second tangent to the posterior border of the condylar neck and a perpendicular line at the widest part of the condyle(CW)defined the width of the condyle. Condylar resorption or atrophy was defined as a >6% change in ramus height and or condylar width [28].

Cephalometric analysis. The cephalometric analysis was done before surgery (for treatment planning), immediately after surgery and 6 months later. The measurements taken were SNA, SNB, MPA(mandibular plane angle to SNA), gonial angle, and articular angle. All radiographs were taken at the same center with the same device.

Clinical assessment. Pain, click, crepitation and maximum mouth opening (MMO) were also evaluated before surgery and 6 months after. Clinical criteria were compared for each patient before and after surgery. RH, CW, and angular measurements on lateral cephalograms were compared immediately after surgery and 6 months later (**Fig. 1**).

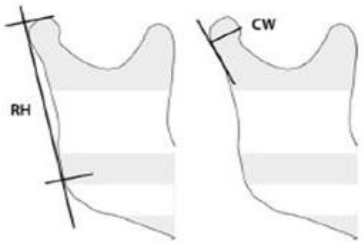

Figure 1: Schematic drawings of panoramic radiographic measurements based on Wohlwender *et al*. [28].

Statistical analysis

Statistical analyses were performed with SPSS (version 20, SPSS Inc. Chicago, IL). Quantitative date were presented as mean±SD and qualitative data as frequencies and proportions. To investigate the relationship between condylar resorption with the qualitative variables Fisher's exact test was used. For comparison between before and after data Macnemar and the Wilcoxon signed rank test was used. For comparison between means of two groups the Mann- Whitney U test was used. Statistical significance level was set at P<0.05.

RESULTS

In this study we analyzed condylar changes after orthognathic surgery in 10 men and 10 women. The mean age was 22.3 for men and 27.1 for women; 3 patients (15%) had malocclusion class II and the other 17 (85%) had class III malocclusion.

Atrophy of ramus and condyle. Greater than 6% reduction in RH or CW was considered as resorption. On this basis 6 patients (30%) had resorption; 1 patient (16.66%) had class II malocclusion and 5 others (83.33%) had class III malocclusion. Fisher's exact test showed no difference between type of malocclusion treated and condylar atrophy (P>0.99). Distribution of data regarding age, gender and malocclusion is shown in **Table 1**. The mean± standard deviation of condylar changes was: 10±4.1 mm in the atrophic group and 6.1±0.6 in the non-atrophic group. The mean ± standard deviation of ramal width in the atrophic group was 6mm and in non atrophic group was 3mm.

Table 1: Variables not significant to CW or RH following surgery

Variables	Atrophic	Nonatrophic	P
Age	25.3 ± 2.4	24.4 ± 1.4	0.77
Gender			
Male	2(33.3%)	8(51.1%)	0.63
Female	4(66.7%)	6(42.9%)	
Malocclusion			
Class II	1 (33%/0)	2 (67%)	0.99
Class III	5(30%/0)	12 (70%)	

Pain and clicking. No pain was reported before nor after surgery in the atrophic group (P>0.99); 5 patients in the atrophic group had clicking on opening before surgery which increased to 6 patients after surgery. Macnemar's test showed no significant difference in this regard neither before nor after surgery. MMO was 45±0.0 and 44±2.4 mm in the pre-op and post-op time range respectively in the atrophic group. This variable was 45.4±2.6mm and 44.2±3.1mm in the non-atrophic group pre-op and post-operative period respectively; there was no statistical significance (p=0.82). The results are shown in **Table 2**.

Table 2: Variables not significant to CW or RH following surgery

Variables	Atrophic	Nonatrophic	P
Pain			
Pre-op	*0*	*2(100%)*	0.99
Post-op	*0*	*3(100%)*	0.52
Click			
Pre-op	5(29.4%)	12(70.6%)	>0.99
Post-op	4(66.7%)	6(42.9%)	>0.99

Overbite, overjet and angular measurements. Changes in angular measurements evaluated immediately after surgery and 6 months later are presented in **Table 3**. None of the measurements correlated with changes in CW or RH.

Table 3: Variables not significant to CW or RH following surgery

Variables	Atrophic	Nonatrophic	P
SNA	4/3±8/7	*2.7±2.2*	0.2
SNB	2.3±4.0	*2.3±2.3*	0.97
MPA	0.5±4.3	*2.5±5.2*	0.38
Gonial	1.2±10.6	*0.35±5.1*	0.82
Articular	3.0±3.7	*3.5±2.4*	0.76

DISCUSSION

Incidence. The incidence of condylar atrophy was found to be high in this study. The overall incidence of condylar resorption after orthognathic surgery has been reported between 1-31% [17]. Bouwman et al showed 26.4% of his patients had condylar atrophy after orthognathic surgery and intermaxillary fixation, but incidence of this complication was 11.9% in the rigid fixation group [1]. Kerstens et al showed 6.8% of 12 patients that had undergone bimaxillary surgery had condylar atrophy [2]. Other studies have reported different incidences of this complication: 2.4% [18], 7.8% [19], 10% [20], 19.3% ([21], 3.8% [22].

Table 4: Percentage of resorption

Case no.	% of changes
1	2%
2	8%
3	2%
4	4%
5	3%
6	2%
7	9%
8	2%
9	3%
10	2%
11	5%
12	2%
13	4%
14	8%
15	1%
16	3%
17	8%
18	7%
19	8%
20	2%

Gender. In this study gender was not correlated to atrophic changes of the condyle. This is in contrast with many studies [3,5,16,18,21,23,24], which report female gender to be at greater risk for condylar resorption. In our study 66.7% of patients with condylar atrophy were female but there was no statistical difference. In some reports gender was not correlated with condylar atrophy [19,20].

TMJ dysfunction. TMJ dysfunction has been considered to be an important factor in surgical outcome. Wolford showed patients with dysfunctional TMJs had higher rates of articular dysfunction after orthognathic surgery [26]. Our results on the other hand are similar to what Hoppereinjs [21] reported. No statistical differences between MMO and click before surgery and condylar atrophy after surgery were seen in our patients; click can be attributable to disk dislocation with reduction; no patient reported pain or limitation of opening. Click and the related clinical and radiographic findings were reported as a finding in the clinical assessment.

Condylar remodeling. Condylar remodeling is a physiologic process to adjust the structure of TMJ with functional loading. Orthognathic surgeries can place a high physical stress on the TMJ. There is no precise cut-off point between remodeling and condylar resorption interpreting by radiographic findings. Increased overjet and overbite, midline deviation, and articular signs and symptoms are considered as clinical evidence of progressive condylar resorption [17]. During the study period none of our patients showed the aforementioned signs. Risk factors related to condylar resorption (mandibular hypoplasia, counterclockwise rotation of the mandible, high mandibular plane angle, posterior inclination of condylar neck) were not present in any of our patients [27].

CONCLUSION

This study showed condylar atrophy radiographically evident in 30% after surgery; but none had any related clinical signs or symptoms. None of the cases that developed condylar atrophy post-surgery correlated significantly with the variables assessed in this study.

Limitation

One of the most important limitations of this study was the use of panoramic and lateral ceph- radiographs. Using CBCT may be a better choice; however use of this would have been unethical. The other limitation was the short-term follow-up. Longer follow-up is needed to assess resorption , remodeling or break-down.

Conflict of interest: None.

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