Facial Asymmetry Caused by Mandibular Condylar Hyperplasia: A Two Center Study

Waseem Abboud DMD MD[1,2,6,7], Dror Shamir DMD MSc[2,7], Rania Elkhatib MD[3,7], Heli Rushinek DMD[4], Yoli Bitterman DMD MSc[2,7], Mati Cohen Sela DMD[5], and Adir Cohen DMD MSc[4]

[1]Department of Neurology, Sheba Medical Center, Tel Hashomer, Israel
[2]Department of Oral and Maxillofacial Surgery, Bnai Zion Medical Center, Haifa, Israel
[3]Department of Plastic Surgery, Bnai Zion Medical Center, Haifa, Israel
[4]Department of Oral and Maxillofacial Surgery, Hadassah Medical Center, Faculty of Dental Medicine, Hebrew University of Jerusalem, Jerusalem, Israel
[5]Maxillofacial Surgery, Private Practice, Jerusalem, Israel
[6]Tel Aviv Sourasky Medical Center, Tel Aviv, Israel
[7]Rappaport Faculty of Medicine, Technion–Israel Institute of Technology, Haifa, Israel

ABSTRACT **Background:** Condylar hyperplasia is a non-neoplastic overgrowth of the mandibular condyle. The disorder is progressive and causes gradual jaw deviation, facial asymmetry, and dental malocclusion. The only treatment capable of stopping hyperplastic growth is surgical condylectomy to remove the upper portion of the condyle containing the deranged growth center. When this procedure is conducted in proportion to the length of the healthy side it may also correct the jaw deviation and facial asymmetry.

Objectives: To assess the degree to which condylectomy corrects the asymmetry and to determine the proportion of patients after condylectomy who were satisfied with the esthetic result and did not desire further corrective surgery.

Methods: We conducted a retrospective analysis of medical records of patients who underwent condylectomy that was not followed by corrective orthognathic surgery for at least 1 year to determine the degree of correction of chin deviation and lip cant. Patient satisfaction from treatment or desire and undergo further corrective surgery was reported.

Results: Chin deviation decreased after condylectomy from a mean of 4.8° to a mean of 1.8° ($P < 0.001$). Lip cant decreased after condylectomy from a mean of 3.5° to a mean of 1.5° ($P < 0.001$). Most patients (72%) were satisfied with the results and did not consider further corrective orthognathic surgery.

Conclusions: Proportional condylectomy could be a viable treatment to both arrest the condylar overgrowth and achieve some correction of the facial asymmetry.

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KEY WORDS: chin deviation, condylar hyperplasia, condylectomy, facial asymmetry, orthognathic surgery

Facial symmetry is an important factor in the perception of aesthetics, beauty, and health. Studies have shown that people with symmetrical faces are perceived to be more attractive, healthier, and more trustworthy, which positively affects their social, emotional, and professional opportunities [1,2]. The human brain is wired to detect facial symmetry quickly, and individuals with asymmetric faces usually feel self-conscious about their appearance. Although beauty standards vary across cultures, symmetry is a consistent parameter for the perception of beauty and health irrespective of societies and backgrounds [3].

Condylar hyperplasia is a medical condition characterized by excessive growth of the mandibular condyle. The growth is non-neoplastic accelerated growth that continues beyond pubertal years. The condition is typically unilateral, which causes jaw deviation and facial asymmetry. In addition, it may cause dental malocclusion and temporomandibular joint dysfunction. The asymmetry of the jaw is generally classified phenotypically into three patterns: asymmetry in the vertical plane, asymmetry in the transverse plane, or a combination [4-6]. The three patterns have been reported to be slightly more prevalent in females. It has been postulated that up to 30% of patients presenting with facial asymmetry express condylar hyperplasia. The occurrence of right versus left condylar hyperplasia is almost equal [6-10].

The cause of the hyperplasia is not fully understood, and different theories have proposed a relation to hormonal imbalances, genetic factors, trauma, heredity, intrauterine factors, and infection [7]. It usually affects teenagers and young adults, and the common complaint is generally of a gradual worsening of jaw deviation and dental malocclusion, often accompanied by temporo-

mandibular joint dysfunction [4]. The disorder may be self-limited with burn-out of the hyperplasia in the third or fourth decades of life; however, usually after significant facial asymmetry has developed [5,11].

The differential diagnosis of condylar hyperplasia includes osteoma or osteochondroma affecting the mandibular condyle on one side, and condylar resorption or hypoplasia on the other side [4]. Proper diagnosis of active condylar hyperplasia typically involves a combination of clinical evaluation and imaging studies. Serial photographs and radiographs taken one or two years apart may be of utmost value for proper diagnosis [3,4]. The panoramic X-ray is the routine radiograph used to evaluate changes in gross morphology and mass of the condylar head and neck. Preferably a frontal photograph is also taken at the same time point as the X-ray for long-term evaluations. In addition, bone scans (nuclear scintigraphy with technetium-99) to detect high metabolic turnover of the condylar bone may aid in establishing the diagnosis [8-10].

Once a diagnosis of active condylar hyperplasia is confirmed, the only treatment able to stop the overgrowth is surgical removal of the upper portion of the mandibular condyle head, which includes the articular cartilage that contains the deranged growth center [11-13]. The procedure is aimed at stopping the hyperplastic growth of the condyle and thus the progressive worsening of facial asymmetry, and if conducted in proportion to the healthy side it may also achieve correction of the jaw deviation to some degree [3,10,14,15]. A second corrective surgery may be required to further improve the facial symmetry. This secondary corrective surgery is termed orthognathic surgery (from Greek *orthos* meaning straight and *gnathos* meaning jaws), thus orthognathic means jaw straightening [12].

The purpose of the present study was to present the experience gathered in two departments of oral and maxillofacial surgery. The objective was to determine the efficacy of proportional condylectomy as a sole treatment to achieve facial symmetry and to examine patient satisfaction and the need or desire to undergo secondary corrective orthognathic surgery.

PATIENTS AND METHODS

A retrospective analysis was conducted of medical records from the departments of oral and maxillofacial surgery at Sheba Medical Center and Hadassah Medical Center during a 7-year period. Consecutive patients diagnosed with active condylar hyperplasia and treated by proportional condylectomy were included in the study. The diagnosis of active condylar hyperplasia was based on characteristic jaw asymmetry as demonstrated on clinical and radiographic examinations. All patients had a panoramic X-ray that exhibited the characteristic enlargement of the affected side compared to the contralateral side. In addition, comparison to old photographs, and when available radiographs, revealed the asymmetry to be progressive with time. Last, a bone scan (nuclear scintigraphy with technetium-99) was positive to increased uptake of the suspected condyle relative to the contralateral condyle (a difference ≥ 10% between the hyperplastic and unaffected side).

The surgical procedure was performed under general anesthesia via a preauricular or endaural incision by certified maxillofacial surgeons (authors W.A. at Sheba Medical Center and A.C. in Hadassah Medical Center). After a skin incision, a flap containing the temporoparietal fascia above the zygomatic arch and the superficial musculoaponeurotic system below the zygomatic arch were raised. The temporalis fascia was then exposed, and the root of the zygomatic arch revealed. Subperiosteal dissection along the zygomatic arch was followed by gentle dissection to reveal the joint capsule [Figure 1A]. The capsule was incised and the condylar head revealed and osteotomized [Figure 1B]. After removing the segment, the resultant height became equal to the height of the contralateral healthy condyle as measured on radiography before surgery. A sagittal electric saw (Stryker, Microcore, USA) or a piezoelectric saw (Piezomed, W&H, Austria) was used.

The length of the segment to be osteotomized was determined by evaluating the difference between the heights of ramus-condyle units on the hyperplastic side compared to the healthy side. The ramus-condyle height was measured as the distance between the condylion point (most superior-posterior point of the condylar head) and the gonion point (most inferior-posterior point of the mandibular angle).

Postoperatively, the dental occlusion was allowed to self-settle by spontaneous dental compensations for at least 6 months, after which some patients received dental treatments to balance the occlusion, such as orthodontics, selective grinding, or dental elastics. The choice of dental treatment depended primarily on patient preferences.

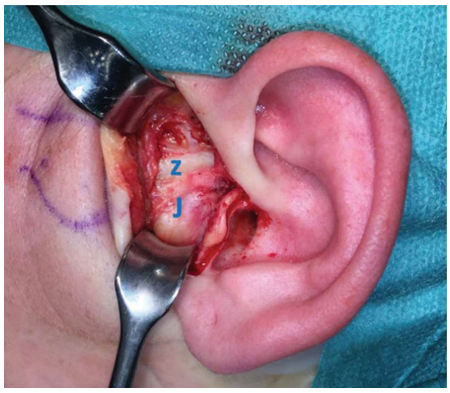
Outcome parameters were chin deviation, lip canting, subjective esthetic evaluation by the patient and/or desire to undergo further corrective orthognathic surgery, dental occlusion, and temporomandibular joint function. In addition, postoperative complications were noted.

Chin deviation and lip canting were evaluated by performing cephalometric measurements on the facial photographs taken before surgery and approximately 12 months after surgery. Figures 2 and 3 depict the method of the angular measurements performed and demonstrate the changes that occurred in two cases following condylectomy.

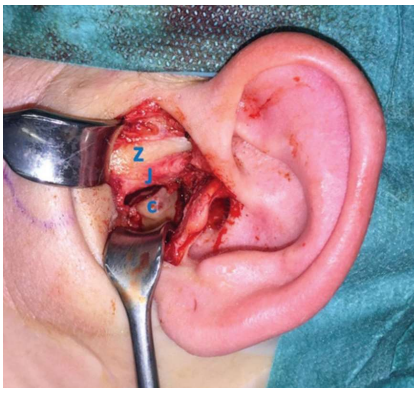
Subjective esthetic evaluation by the patients was given at least 12 months after condylectomy, when a decision regarding the need for additional corrective surgery became relevant. Patients were asked whether they were not fully satisfied with the esthetic result or whether they were interested or considering undergoing further corrective surgery. A positive answer to one or both questions was considered *dissatisfaction* and desire to undergo further treatment.

Dental occlusion was evaluated on a routine basis at each visit and documented in the medical files. The distance in millimeters at the area of non-contacting opposing teeth of greatest dimension when the patient is in the closed mouth position was documented. The preoperative and 12-month postoperative measurements were compared for this study.

Figure 1. Surgical approach to the temporomandibular joint and exposure of the mandibular condyle

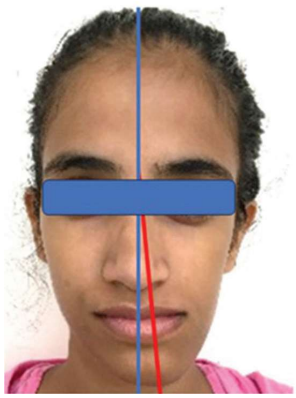


[A] Via a preauricular approach the zygomatic arch (Z) was exposed and the joint capsule (J) was dissected inferior to it

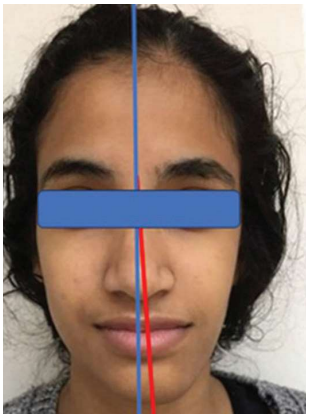


[B] The ostectomized condylar head (C) is seen deep to the transected joint capsule (J)

Figure 2. The corrected facial midline is indicated by a blue line, which is created by connecting the soft tissue glabella to the center of filtrum and extending the line to the chin. The red line is formed by connecting the central chin point to the glabella. Chin deviation is defined as the angle between the blue and red lines.



[A] Chin deviation before condylectomy



[B] The decrease in chin deviation 10 months after condylectomy

Figure 3. The plane of the lips is created by drawing a line between both lip commissures. Lip cant is defined as the angle between the plane of the lips and the interpupillary line.

[A] Lip cant before condylectomy

[B] The decrease in lip cant 12 months after condylectomy

Temporomandibular joint function was determined by measuring maximal mouth opening between the upper and lower incisor teeth. The data were retrieved from the medical files as they were documented routinely at each visit.

The study was approved by the institutional review board at Hadassah Medical Center, Jerusalem, Israel, and at Sheba Medical Center, Tel Hashomer, Israel.

Statistical analysis: continuous variables were analyzed using the Wilcoxon signed-rank test, and categorical variables were analyzed by using McNemar's test. All tests were 2-sided, and *P*-values ≤ 0.05 were considered statistically significant. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 26 (SPSS, IBM Corp, Armonk, NY, USA).

RESULTS

Fifty patients met the inclusion criteria and were included in the study. The mean age of the study population was 24.5 years (range 17–53 years). There were 26 females and 24 males. All patients had frontal photographs taken approximately 1 month before surgery and 9 to 12 months postoperatively.

Outcome parameters are shown in Table 1. The chin asymmetry decreased from a mean deviation of 4.8º to a mean deviation of 1.8º ($P < 0.001$). The lip cant decreased from a mean deviation of 3.5º to a mean deviation of 1.5º ($P < 0.001$).

Table 1. Outcome parameters

	Preoperative	Postoperative	*P*-value
Chin deviation	4.8º	1.8º	$P < 0.001$
Lip cant	3.5º	1.5º	$P < 0.001$
Open bite > 2 mm	42% of patients	20% of patients	$P > 0.05$

Subjective esthetic evaluation by the patients was given at least 12 months after condylectomy. Fourteen patients (28%) reported they were either not fully satisfied with the esthetic result or they were interested in undergoing further corrective surgery, thus 72% of the patients were satisfied with the esthetic result and were not interested in additional corrective surgery.

The degree of dental *open bite* was used as an indicator of dental occlusion. Preoperatively, 21 patients (42%) had an open bite of greater than 2 mm whereas 12-months after condylectomy only 10 patients (20%) had an open bite > 2 mm. This difference however was not statistically significant ($P > 0.05$).

Regarding temporomandibular joint function, all patients regained their preoperative range of motion as documented at approximately 6 months postoperative.

Complications were few. Three patients presented with transient (< 4 months) paralysis of the frontal or zygomatic branch of the facial nerve. One patient complained of an unesthetic scar.

DISCUSSION

In the present study, we evaluated the degree of correction of facial asymmetry after proportional condylectomy. We found an average decrease of 3º in chin position, improving the transverse deviation from a mean of 4.8º to a mean of 1.8º, and an average decrease of 2º in lip cant, improving the vertical deviation from a mean of 3.5º to a mean of 1.5º after surgery. In addition, most patients (72%) were satisfied with the result and did not consider undergoing further corrective orthognathic surgery after the condylectomy.

To date, surgical removal of the upper part of the condylar head is the only treatment proven to arrest the hyperplastic condylar growth in patients with active condylar hyperplasia [13]. The fact that proportional condylectomy also achieves some improvement in facial asymmetry should be noted [3,10,14,15]. An alternative therapeutic approach could be to wait for the hyperplastic process to run its course and then perform orthognathic surgery; however, there is some unpredictability regarding the period to wait as few patients will continue to have active hyperplasia far beyond the third and fourth decades of life. In the present study, the average age was 24.5 years; however, the range was 17 to 53 years.

After condylectomy, a spontaneous and gradual self-correction of the dental occlusion occurs over a period of several months. Occlusal therapy in the form of elastics, selective grinding, or formal orthodontic treatment is warranted after this period to achieve a fully balanced occlusion [14-16]. Regardless of the dental method utilized, the objective of occlusal therapy was to result in intrusion or crown shortening of the upper and lower teeth on the operated side, and extrusion or over-eruption of the upper and lower teeth on the unaffected side.

Chin deviation is probably the most important feature of the jaw for the perception of asymmetry of the face [1,2]. The mean 3º correction was sufficient for patients with mild to moderate degrees of chin deviation; how-

ever, cases with severe asymmetry will probably require additional orthognathic surgery to achieve a satisfactory result. Multiple factors other than the objective correction of asymmetry play a role in the decision whether a patient decides to undergo additional corrective surgery. A person's age, health, self-image, esthetic demands, and personal expectations from surgery have a profound effect on the overall satisfaction from treatment and the desire to undergo further surgical corrections [17,18]. Surgeons must be aware that patients with high esthetic demands, especially if showing a baseline significant deformity, will probably require orthognathic surgery after condylectomy [19].

The dental midlines were not included as an outcome in this study for two reasons: patients without a formal orthodontic treatment may present with crowding of anterior incisors, which may greatly affect the magnitude of dental midline shift with no correlation to the skeletal (true) midline, and patients with the vertical phenotype of condylar hyperplasia present with normal or even reverse dental midline shift in contrast to patients with the transverse phenotype or combination form.

The main strengths of the present study are the large number of patients and the inclusion of two medical centers, which emphasizes the consistency of the results. The main limitations are the lack of a uniform computed tomography scan for all patients before and after surgery and the lack of uniform orthodontic treatment for all patients.

CONCLUSIONS

Proportional condylectomy is a viable option to both stop the hyperplastic growth and to correct the asymmetry in many patients presenting with active condylar hyperplasia. Although complete symmetry was not generally achieved by proportional condylectomy, most patients were satisfied with the results and did not consider further corrective surgery. Based on patient baseline values and expectations, surgeons should be able to anticipate the degree to which this procedure will correct the deviation and inform the patients of their likelihood of needing further orthognathic surgery.

Correspondence

Dr. W. Abboud
Dept. of Oral and Maxillofacial Surgery, Bnai Zion Medical Center, Haifa 3339419, Israel
Fax: (972-4) 950-2322
Email: waseem.abboud@gmail.com

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