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Comparative Study of Different Approaches for Subcondylar Fracture Repair

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Abstract

Background: The mandible is a typical site for face fractures. Extraoral rather than intraoral treatments are typically recommended for treating subcondylar fractures among the various surgical techniques because they may be given an adequate surgical vision. The majority of physicians concurred that fractures of the mandibular condylar neck or subcondyle, either displaced bilaterally or unilaterally are the right surgical indications for ORIF.

Aim of the work: To compare between intraoral, transparotid and retromandibular approaches in management of submandibular fracture.

Patients and methods: This study included 20 patients complaining of subcondylar fracture of mandible in plastic Menoufia University's medical faculty has a department of surgery. Three groups of patients were assigned to them based on surgical approach: Group A included seven patients undergoing surgical fixation *via* the intraoral approach. Group B included seven patients undergoing surgical fixation *via* the transparotid approach. Group C included six patients undergoing surgical fixation *via* the retromandibular approach.

Results: Between groups, a statistically significant difference was discovered. Regarding operating and time. Intraoral approach had a signifcanlty longer operating time compared to transparotid and retromandibular approaches. Between groups, a statistically significant difference was discovered regrading field of surgical exposure retromandibular and trasnpartid have wide field of exposur. Surgical site infection was reported in two (28.6%), one (14.3%), Facial weakness was reported in four (57.1%) patients in group A and One (14.3%) patient in group B. Two (28.6%) and One (14.3%) patient in groups A and B respectively suffered from a salivary fistula. Implant loosening was reported in one (14.3%) patient in group A, and one (16.7%) patient in group C. Trismus was reported in one (14.3%) patient in group B, and one (16.7%) patient in group C.s SIX patient in group A (78.1%) and four patient (57.1%) in group B complaining of visible scar . No occlusal stability was reported in either group and one No cases of postoperative bleeding were reported.

Conclusion: Transparotid and retromandibular were better approaches in management of submandibular fracture.

Keywords: Mandibular condyle • Mandible • Temporomandibular joint • Mandibluar fracture • Subcondylar fracture

Introduction

Facial fractures are frequently caused by mandibular fractures, particularly fractures of the subcondylar and condylar areas [1]. 20 to 62% of all mandibular fractures are sub condylar fractures. However, there is still debate over their management [2]. Despite being the most effective procedure, closed reduction might be more challenging than Open Reduction and Internal Fixation (ORIF) to accomplish anatomical reduction [3]. Extraoral rather than intraoral treatments are typically preferable since they may be supplied with an adequate surgical vision among the different surgical techniques that can be employed to treat subcondylar fracture [4]. Extraoral techniques do, however, frequently have a higher risk of postoperative problems than intraoral procedures, such as the emergence of a salivary fistula, obvious scarring, and facial nerve damage [5]. The majority of physicians concurred that Mandibular condylar neck or subcondyle fractures that are unilateral, bilateral, or displaced are the right surgical indications for ORIF [6]. To assess the clinical outcomes mandibular fractures, we compared the angulated screwdriver intraoral method, transparotid approach, and retromandibular technique in this research [7]. In order to manage submandibular fractures, this study compares intraoral, trans parotid, and retromandibular methods.

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Patients and Methods

This study included 20 patients complaining of subcondylar fracture of mandible in plastic surgery department, faculty of medicine, Menoufia University.

Ethics: With the Local our study was conducted in accordance with the Helsinki Declaration with the approval of the Menoufia University Ethical Committee and the Faculty of Medicine.

Inclusion criteria: Patients who were aged older than 16 years and presented with displaced subcondylar fracture with occlusion disturbance were included the study.

Exclusion criteria: Patients who were under 16 years old or patients presented with subcondylar fracture without occlusion disturbance were cut off from the research.

Methods: Informed consents were obtained from all patients participated in the study. Clinical evaluation included a thorough history and physical examination. All patients underwent common laboratory tests [such as Complete Blood Counts (CBC), a renal function test, and a profile of the liver are included., bleeding profile, blood glucose level and virology] and radiological investigations (including CT of the facial bone and X-ray panorama)

Preoperative planning: A clinical examination was used to assess the dental occlusion, and a self-cheek retractor was used to check the photos. Utilizing computed CT, the fracture fragments' nature and orientation prior to surgery.

Intra operative

Retromandibular approach: Under general anesthesia, first arch bars were placed to obtain satisfactory intraoperative occlusion. Following standard scrubbing, painting, and draping, the surgical procedure was commenced. A 3 cm long incision was marked posterior and parallel to the posterior border of the ascending ramus from a point just below the lobe of the ear inferior to a point just above the angle of the mandible. The incision was vertical, parallel to the posterior border of the mandible, and was about 2 cm behind the posterior border of the mandible and 0.5 cm below the ear lobe. The initial incision was made with a No. 15 surgical blade extending through the skin and subcutaneous tissue to the level of the scant platysma muscle. The skin was undermined with scissor dissection in all directions for ease of retraction and closure. The platysma muscle was sharply incised in the same plane as the skin incision. The Superficial Musculoaponeurotic System (SMAS) and parotid capsule were incised. Blunt dissection was then followed within the gland in an anteromedial direction following the anticipated course of the facial nerve toward the posterior border of the mandible.

Transparotid approach: A longitudinal incision was made along the skin on the surface of the mandibular condylar neck and was extended beyond the earlobe according to the degree of skin laxity to release the tension. After initial incision, the skin was released from the underlying tissue in a plane superficial to the parotid capsule. The parotid capsule was incised parallel to the facial nerve branch axis (transverse/horizontal incision on parotid capsule). Blunt dissection using a heavy hemostat in perpendicular direction directly to the ramus was carried out between the trunks of buccal and zygomatic branches of facial nerve. Blunt dissection was carried out by opening of the beaks of the hemostat perpendicular to the long axis of the facial nerve branches and no closure of hemostat was done when within the tissue to avoid injury to vital structures to expose the fascia masseterica. Once beyond the masseter muscle, cautery with low intensity was used to incise the muscle and periosteum, and the fracture site was exposed. This allowed for direct vision with adequate exposure. There will be no bleeding or major vessel encountered in this region. The proximal part of the mandibular ramus was pulled down to obtain reduction of the condylar head. Two 4-hole mini-titanium plates were applied to the fracture site of the mandibular condylar neck for rigid fixation (Figure 1).

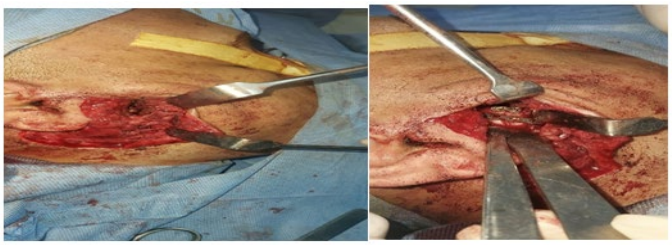
Intra oral approach: intra oral approaches have been done to cases with low subconylar fracture assisted by endoscope.

preoperative infiltration of 1:200,000 of epinephrine along the intraoral incision line for hemostasis. IMF is done as a first step to adjust and maintain occlusion. If concomitant mandibular fractures other than subcondylar are present, they will be treated first by Open Reduction and Rigid Fixation in the proper dental occlusion by miniplates, and then the subcondylar fractures will be addressed.

A 5 cm intraoral incision is made from the ascending ramus to the vestibular mucosa, lateral to the second molar region. Dissection using electrocautery is performed to open the periosteum of the anterior border of the ramus. Dissection is done subperiosteally by periosteal elevator to the condyle and the sigmoid notch superiorly, lower border of the mandible inferiorly and to posterior border of ramus to create adequate optical cavity.

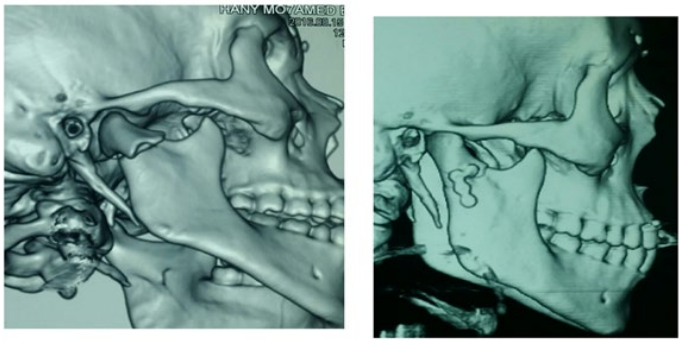
- A standard 4mm diameter, 18 cm length and 30° endoscopic lens connected to the light source and the camera system is used. All endoscopic set are produced by Storz. After testing, the lens within a retractor sheath is inserted to identify the fracture site. Sometimes the endoscopic lens is inserted through a small
- Incision 1 cm at a lower border of the mandible to improve visualization of the posterior border of the mandible.
- After adequate visualization of the fracture line, the reduction is performed. Reduction is facilitated by releasing the IMF and pulling downward on the angle of the mandible by using 1-0 wire drilled to the angle. The proximal condylar segment is positioned in the correct place or manipulated into.

Postoperatively: The postoperative follow-up included clinical and radiographic procedures phase. Infection of the wound, nonunion, and exposing of the plate or screw were reported (Figures 2 and 3).



(A) (B)

Figure 1. 40 years old male patient presented with rightcominuted subcondylar. **A)** Intraopertive incsioin transparotid approache and size of incsion and parotid gland and facial nerve branches and **B)** Showing reduction of subcondylar fracture and fixation with plate and screw.



(A) (B)

Figure 2. 35 years old male patient presented with right subcondylar. **A)** Preoperative CT imaging showing right subcondylar and **B)** Postoperative CT showing reduction and fixation of fracture with plate and screw.

Figure 3. Fracture subcondylar fracture reduction and fixation with plate and screw (retromandbibular approach).

Evaluation: The anesthetic data for the corresponding intraoral, transparotid, and retromandibular groups were used to calculate the operation timings. Direct payment information was used to analyze the cost of a procedure between intraoral, trans parotid retromandibular groups. Occlusion status, mouth opening range, and deviation were used to assess the clinical results of both methods. Complication of these approaches were evaluated.

Analytical statistics

Data processing software called SPSS was used to validate, input, and analyze a data. The following statistical methods were used to examine the investigation's findings. The data were presented as mean + Standard Deviation (SD) for quantitative factors and as number and percentage for qualitative variables.

The Mann Whitney test, the Chi-square test, the student "t" test, Z-test for percentage, and odds ratio were used for the comparison. P value greater than 0.05 denotes non-significant findings (Figure 4).

Results

There was no statistically significant difference between the groups in Table 1 for any of the variables fracture type (Chi-square test, P=0.776).

As shown in table 2, a statistically significant difference was found between groups regarding operating time (Kruskal-Wallis test, P=0.002). Pairwise comparison demonstrated that intraoral approach had a signifcanlty longer operating time compared to transparotid and retromandibular approaches. However, transparotid and retromandibular approaches regarding operating time (P=0.922).

Also, between the groups, there was a statistically significant difference. Regarding Range of surgical field exposure (Kruskal-Wallis test, P=0.002). Pairwise comparison demonstrated that intraoral approach had a signifcanlty narrow Range of surgical field exposure compared to transparotid and retromandibular approaches. However, Transparotid had wide range of surgical field exposure compared with retromandibular approach statistically significantly. Approaches Range of surgical field exposure (P=0.834). Between groups, Surgical site infection was reported in two (28.6%), one (14.3%), Facial weakness was reported in four (57.1%) patients in group A and One (14.3%) patient in group B. Two (28.6%) and One (14.3%) patient in groups A and B respectively suffered from a salivary fistula. Implant loosening was reported in one (14.3%) patient in group A, and one (16.7%) patient in group C. Trismus was reported in one (14.3%) patient in group B, and one (16.7%) patient in group C.s SIX patient in group A (78.1%) and four patient (57.1%) in group B complaining of visible scar . No occlusal stability was reported in either group and one No cases of postoperative bleeding were reported.

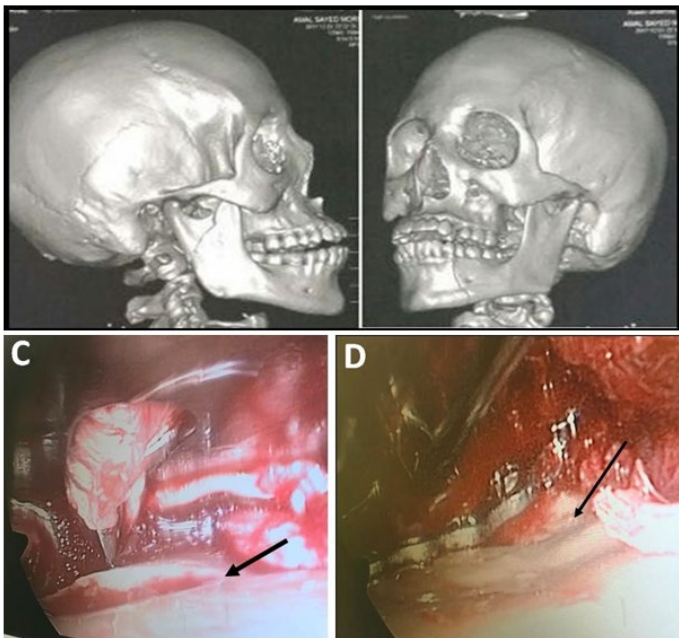


Figure 4. 32 years old female patient presented with right subcondylar and left fracture body of the mandible. Figures (A and B) are preoperative, (C and D) during endoscopic fixation - black arrows points to the fracture lines. (E, F) are postoperative after fixation.

Discussion

The condylar fracture, which makes about 25% to 35% of all mandibular fractures, is one of the most common. Whether to use Open Reduction and Internal Fixation (ORIF) or a conservative approach to treating these fractures remains controversial despite extensive research and clinical trials [8]. Several procedures, including pre-auricular, intra-oral, retromandibular, and sub-mandibular, have been described in the literature for the treatment of condylar and sub-condylar fractures. The closest distance possible was measured between the incision and the fracture site is provided by the retromandibulartransparotid technique, as reported by Hinds and Girroti [9]. In order to address submandibular fractures, our study compared intraoral, trans parotid, and retromandibular methods. On 20 patients who complained, this comparative study was carried out at the plastic surgery department of the Menoufia University Faculty of Medicine. Three groups of patients were created based on the surgical method: Group A had seven patients receiving intraoral surgery for fixation. Group B had seven patients receiving transparotid surgical fixation. Six patients from Group C had surgical fixation using the retromandibular technique. In our current study, the mean age was 37.1 ± 7.6, 33.3 ± 7.3 and 39 ± 7.7 years in groupings A, B, and C, in that order. Regarding age, no statistically significant difference between groups was found distribution (Kruskal-Walli's test, P=0.158). Male patients accounted for 71.4%, 57.1%, and 66.7% of groups, female patients accounted for 28.6%, 42.9%, and 33.3% of groupings A, B, and C, in that order. No change that is statistically significant was found between groups regarding gender distribution (Chi-square test, P=0.850). Our study can be supported by Koirala U and Subedi S [10] who retrospectively studied 9 Patients who underwent internal fixation and open reduction using the retromandibulartransparotid technique had 35 sub-condylar mandibular fractures. According to their survey, 6 women (20.7%) and 23 males (79.3%) were present. the average age (SD 11.1) ranged from 16 to 57 was 29.8 years.

Regarding laterality, right side was involved in four (57.1%), five (71.4%), and four (66.7%) patients according to groups A, B, and C. Left side was involved in two (28.6%) in group A, two (33.3%) patients in group C compared to one (14.3%) in group B. Bilateral involvement was reported in one (14.3%) patient in group A, and one (14.3%) individual in group B. Between the groups, there was no statistically significant difference in side distribution (Chi-square test, P=0.828).

In agreement with our findings, Kanno T, et al. [11] who aimed to assess Condylar neck fractures were present in 13 patients unilaterally, 6 patients bilaterally, 3 patients with condylar neck fractures on one side and subcondylar neck fractures on the other, and 3 patients with condylar head fractures. These findings were reported in the retromandibulartransparotid technique for stiff internal fixation with two locking miniplates in fractures of the mandibular condylar neck.

Concerning mechanism of injury, RTA was reported in five (74.1%), four (57.1%), and three (50%). FFH was reported in two (28.6%) patients in group A, two (28.6%) in group B, and two (33.3%) in group C. Assault was reported in one (14.3%) patient in group B, and one (14.3%) patient the C group. No statistically significant difference between groups was discovered regarding mechanism of injury (Chi-square test, P=0.846). In harmony with our findings, Koirala U and Subedi S [10] reported that Physical assaults (6, 20.7%), motor accidents (18, 62.1%), and fall injuries (5, 17.2%) were the most frequent etiologies. According to Lindahl Classification, deviated fracture was observed in two (28.6%), three (42.9%), and two (28.6%) patients correspondingly. Displaced fractures were reported in four (57.1%) patients in group A, two (28.6%) three (50%). Dislocation was reported in one (14.3%) three patients group B, and one (group A) patient. No statistically significant difference

between groups was discovered regarding Lindahl classification (Chi-square test, P=0.862).

Our results showed that closed fracture comprised 71.4%, 57.1%, and 66.7% of groups A, B, and C, respectively in that order. As opposed to that, open fracture was reported in 28.6%, 42.9%, and 33.3% of groupings, in that order between groups was discovered. Regarding fracture type (Chi-square test, P=0.776). Concerning associated Fractures, isolated sub condylar mandibular fractures were reported in three (42.9%), three (42.9%), and three (50%) patients group A, group B, and group C, correspondingly. Associated symphyseal fractures were reported in two (28.6%) patients Among the patients in group A, one (14.3%) was in group B, and one (16.7%) was in group C. Associated Para symphyseal fractures were reported in two (28.6%) patients in group A, three (42.9%) two (33.3%) two patients from group B and two patients from group C. Regarding the presence of, there was no statistically significant difference between groups associated fractures (Chi-square test, P=0.956). In concordance with our findings Koirala U and Subedi S [10] reported that There were seventeen (48.6%) isolated sub-condylar fractures. The most common related fractures (22.9%) were symphysis and parasymphysis fractures. At the condylar base, there were 18 fractures (51.4%), of which 15 (42.9%) were displaced (Table 1).

Regarding surgical outcomes, the mean operating time was 76.7 ± 12.8, 51.7 ± 5.1, and 52 ± 6.3 minutes in groupings A, B and C in that order. Between the groups, there was a statistically significant difference in operating time (Kruskal-Walli's test, P=0.002). Pairwise comparison demonstrated that intraoral approach had a significantly longer operating time compared to transparotid and retromandibular approaches. However, No statistically significant difference between retromandibular and transparotid approaches regarding operating time (P=0.922). The mean interincisal distance was 42.6 ± 1.9, 35.3 ± 4.2, and 34.7 ± 2.7 mm in groupings A, B, and C, in that order. Between groups, a statistically significant difference was discovered regarding interincisal distance (Kruskal-Walli's test, P=0.002). Pairwise comparison demonstrated that intraoral approach had a significantly larger interincisal distance compared to transparotid and retromandibular approaches. However, No statistically significant difference between retromandibular and transparotid approaches regarding interincisal distance (P=0.834) (Table 2).

Ghezta NK, et al. [12] stated that 39 patients with 47 fractures were investigated, which is consistent with our findings. There were 5 fractures in the head area in bilateral instances, and 34 sub condylar fractures (placed below the sigmoid notch) made up 87% of the total. 8 (21%) of the fractures were bilateral, whereas 31 (79%) were unilateral. In a multivariate study, For the condylar coronal displacement, coronal sagittal displacement, difference in ramal height, maximal interincisal distance, protrusive motions, and deviation of the mandible on opening, there were statistically significant variations between pretreatment and posttreatment patients (P=.001). (SD, 6.7 mm) The interincisal distance was 24.1 mm. before treatment and was 46.8 mm (SD, 5.2 mm) after surgery. The average range of protrusion was significantly less (P=.001) in patients before therapy, at 1.9 mm (SD, 1.2 mm), compared to 6.1 mm (SD, 2.0 mm) postoperatively. Due to a reduction in the ascending ramal height on the afflicted joint, Mandibular deviation during mouth opening is frequently a symptom of movement of the opposite joint as a result of compensation. Before treatment, patients' mean mandibular deviation It measured 4.2 mm (SD, 1.0 mm) from the midline with a significant change deviation, which was 1.9 mm (SD, 0.995 mm). Three individuals (8%) had temporary branches 1 week after treatment; these cases all recovered between 3 weeks to 3 months.

Also, Dalla Torre D, et al. [13] who aimed to in the study's surgical treatment of mandibular condyle fractures, using the retromandibular anterior transparotid approach and a triangular-positioned double miniplateosteosynthesis method, the mean maximum interincisal distance varied from 38 mm after 1 week to 45 mm after 6 months. One week following surgery, 22.5% of the patients had deviations or deflections, which fell to 2% at six months. 3.9% of patients were found to have a brief facial palsy at the initial follow-up, but no impairment was seen at the 3 or 6 month points. At the same time, no patient experienced issues with the osteosynthesis or parotid gland six months after surgery.

Finally, surgical site infection was reported in two (28.6%), one (14.3%), and one (16.7%) patient in groups A, B, and C, respectively. No cases of postoperative bleeding were reported. Facial weakness was reported in two (28.6%) patients in group B. One (14.3%) patient in group B suffered from a salivary fistula. Implant loosening was reported in one (14.3%) patient in group A, and one (16.7%) patient in group C. Trismus was reported in one (14.3%) patient in group B, and one (16.7%) patient in group C. No occlusal stability was reported in either group. Regarding postoperative complications, between the groups, there was no statistically significant difference (Chi-square test, P>0.05). Our research supports Bouchard C and Perreault MH [14] retrospective analysis of 108 patients who had ORIF using the retromandibular route and had sub-condylar fractures. Infection was detected in 11.9% of cases, transitory and lifelong paralysis in one instance. In addition, they found two seromas, one example of Frey's syndrome, two sialoceles, and four salivary fistulae. Shi D, et al. [15] retrospective analysis of 102 neck and subcondylar fractures revealed that 18% of patients had facial nerve injuries of varying severity. They claimed that the three causes of facial nerve damage were operator inexperience, fracture-dislocation, and condylar neck fracture. All together, these studies show that postoperative FNP risk ranges from 8% to 30%, and all but one patient had temporary FNP (Table 3).

Furthermore, Bruneau S, et al. [16] reported 18.6% transient FNPin 43 patients with Risk factors included comminuted fractures and condylar neck fractures for FNP in 48 sub-condylar fractures that were operated on using the retromandibular sub-parotid approach. The greater incidence of FNP may be due to longer and increased traction force used to decrease and repair the fracture. Moreover, Kanno T, et al. [17] demonstrated that FNP was linked to seven fractures (12.7%), all of which disappeared entirely within six months. Significant risk factors for postoperative FNP were fractures of the displaced condylar neck and dislocated neck, according to further statistical analysis (p 0.05). There were little further postoperative problems. Sub-condylar fractures have been treated with the sub-mandibular technique, however reduction and fixation are exceedingly challenging due to the fracture's greater separation from the incision site. The danger of facial nerve palsy increases making ORIF through the sub-mandibular when the proximal segment is shifted antero-medially route much more challenging and necessitating considerable retraction effort to minimize the fractured segment and implant the cranial-most screw. Better aesthetic outcomes are possible using the trans-oral method, and there is theoretically no chance of facial nerve damage. For antero-

Table 1. Type of fracture and associated fractures (N=20).

		Group A (n=7)		Group B (n=7)		Group C (n=6)		*P* value*
		No.	%	No.	%	No.	%	
Type	Closed	s	71.4	6	85.7	s	83.3	0.776
	Open	2	28.6	1	14.3	1	16.7	
Associated Fractures	None	3	42.9	3	42.9	3	50	0.956
	Symphysis	2	28.6	1	14.3	1	16.7	
	Parasymphysis	2	28.6	3	42.9	2	33.3	

*Chi square test

Table 2. Operating time and interincisal distance (N=20).

		Group A (n= 7)	Group B (n=7)	Group C (n = 6)	*P* value*
Operating time, min	Mean ± SD	76.7 ± 12.8	51.7 ± 5.1	52.63	0.002
	Range	60-91	45-60	43-60	
Surgical Outcomes – Range of surgical field exposure (N = 20)					
		Group A (n= 7)	Group B (n=7)	Group C (n = 6)	*P* value*
Range of surgical field exposure	Mean ± SD	42.6 ± 1.9	35.3 ± 4.2	34.7 ± 2.7	0.002
	Range	40–45	30–40	31–39	

*Kruskal-Wallis test

Table 3. Complications (N=20).

Table 3 Surgical Outcomes – Complications (N = 20)							
	Group A (n= 7)		Group B (n=7)		Group C (n = 6)		*P* value*
	No.	%	No.	%	No.	%	
SSI	2	28.6	1	14.3	1	16.7	0.776
Bleeding	0	0	0	0	0	0	-
Facial nerve palsy	4	57.1	1	14.3	0	0	0.043
Salivary-related	2	28.6	1	14.3	0	0	0.376
Implant-related	1	14.3	0	0.043	1	14.3	0.112
Trismus	2	28.6	1	14.3	1	16.7	0.112
Scar visibility	6	78.1	4	57.1	1	16.7	0.043

SSI: Surgical Site Infection

medially displaced sub-condylar fractures, the trans-oral technique should be utilized in conjunction with either endoscopic or trans-buccal screw insertion, which might cause facial nerve palsy [18,19].

Conclusion

Intraoral approach was associated with longer operating time and special surgical instrument more expensive. While transparotid and retromandibular were associated with shorter operating time and less expensive surgical instrument. Regrading field of exposure retromandibular and trasnpartid have wide field of exposure suggesting that they were better approaches in management of submandibular fracture. Transparotid approach has more rate of complication as facial nerve compression and salivary fistula with more visible scar while retromandibular approach has less complication suggesting that retromandibular approach is better in management of sub condylar fracture

Disclosure

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For this kind of investigation, informed permission is not necessary. The Menoufia authorized the study.

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None.

Conflict of Interest

None.

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