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A comparative study between preauricular retromandibular anteroparotid approach and retromandibular transparotid approach in open reduction and internal fixation of subcondylar fracture on facial nerve injury and parotid fistula: A randomized clinical trial

Dr. Hani Taher Hibatullah Ali*
Faculty of dentistry, Cairo University
* Corresponding Author

Prof. Dr. Khairy Elmorsy
Faculty of dentistry, Cairo University

Ass. Prof. Tarek Al Ghareeb
Faculty of dentistry, Cairo University

Ass. Prof. Sherif Ali
Faculty of dentistry, Cairo University

***Abstract*---**Background: Condyle fractures account for 17.5 percent to 50 percent of all mandibular fractures, although there are still many debates on whether to treat them close or open. There are several techniques of managing the mandibular condyle, each with its own set of benefits and drawbacks. Aim: compare the innovative preauricular transmasseteric anteroparotid approach (P-TMAP) to the usual retromandibular transparotid technique. Patients and methods: 20 cases, patients with an odd number (1,3,5,7,9,11,13,15,17,19) received a preauricular transmasseteric anteroparotid approach (study group), while patients with a double number (2,4,6,8,10,12,14,16,18,20) had a retromandibular transparotid approach (control group) (control group). Patients were closely monitored for six months. Results: Fractures were caused by a road traffic accident (RTA) in 6(60%) of the cases, interpersonal violence in 3(30%) of the cases and falling in 1(10%) of the cases in both groups. Immediate postoperative facial nerve affection was higher in the transparotid approach group (30%) than in the anteroparotid

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approach group (10%), but both groups exhibited no statistically significant difference three months after surgery. There were no parotid injuries in any of the cases in either group. At 3 and 6 months, 9(90%) of the control group's cases had a visible but thin and linear scar, while 1(10%) case had a broad scar. While all of the instances in the study group had a visible but thin and linear scar, there was no statistically significant difference between the two groups (p=0.739). Intragroup analysis of mouth opening showed different intervals in both groups, with values measured pre-operatively being significantly different from other intervals (p0.001). Intergroup analysis revealed that moth opening restored to normal range occurred more frequently in anteroparotid, but the difference between the two groups was not statistically significant (p=0.481). Conclusion: The transmasseteric anteroparotid method proved to be a viable alternative to the transparotid approach in the treatment of condylar neck fractures, with excellent accessibility and a low complication rate.

***Keywords*---**transmasseteric anteroparotid approach, condylar neck fracture, transparotid approach.

Introduction

Condyle fractures account for 17.5 percent to 50% of all mandibular fractures (1). Despite multiple studies, there is still debate about whether close or open treatment is preferable (2), whether incision strategy is better for open reduction and internal fixation (ORIF), and which form of fixation should be employed to handle these fractured segment fractures (3). Submandibular, preauricular, intraoral, rytidectomy, and retromandibular techniques are all used to treat the mandibular condyle, each method has its own set of advantages and drawbacks (4).

For many years, the gold standard approach to treating condylar fractures has been the traditional retromandibular transparotid approach (5). This treatment relies primarily on deep blunt dissection through the parotid gland to reach the fracture site. For tissues passed in the surgical field, this operation has a significant morbidity rate. Preauricular approaches with facial nerve exposure have been studied with reported complications, Frey's syndrome, sialocoele, and salivary fistulae are also common complications that may occur due to the blunt dissection through the parotid gland (6) as well as (5). Many different incision approaches have been used to preserve anatomical landmarks, prevent previous difficulties, and provide the best access to the fracture site.

Through dissection along the subdermal fat plane, the preauricular transmasseteric anteroparotid (P-TMAP) approach reaches the anterior margin of the parotid gland. After that, the gland is retracted posteriorly, and the masseter muscle fibres are stripped to reach the fracture site (7). In this study, we will compare this procedure to the standard retromandibular transparotid approach

for condylar neck fractures, to see if it can be used as a substitute for the standard transparotid approach with fewer complications.

Aim of study

Objective

Compare the preauricular transmasseteric anteroparotid approach versus conventional retromandibular transparotid approach.

Research question

Does retromandibular anteroparotid approach cause less complication than retromandibular transparotid approach in open reduction and internal fixation of subcondylar fracture?

Hypothesis

The new technique decrease the common drawback presented by retromandibular transparotid approach.

Primary objective

Decrease facial nerve injury.

Secondary objective

Minimaize risk of salivariy gland fistula and enhance patient satsification by establishment of a technique that will be more esthetic to patient.

Patients and Methods

The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2003

Trial design

- Randomized clinical trial.
- 20 cases were selected from oral and maxillofacial surgery department faculty of dentistry Cairo university during perior between 2018-2021, then consecutively divided into two groups, group A include patients with odd number (1,3,5,7,9,11,13,15,17,19) had done preauricular transmasseteric anteroparotid approach while group B patients with events number (2,4,6,8,10,12,14,16,18,20) had done retromandibular transparotid approach.

Elgibility criteria

1. Patients age should be more than 18 year.

2. Patients with subcondylar fracture and need to open reduction and internal fixation using titanium miniplates.
3. Patients should be free from any traumatic injuriys to facial nerve or parotid gland.
4. Availability of preoperative and postoperative panoramic radiographs and/or computed tomography (CT) images.
5. Mental status permitting an adequate neuromotor examination.
6. Regular clinical follow-up, documented in our clinical and radiographic evaluation charts, at 1 week, 1 month, 3 months and 6 months postoperatively.

Intervention

Pre-surgical preparation

- History data had been gathered as well as full clinical examintion.
- Routine haematological along with radiological investigation had been done in all patients.
- Informed consent for participation in the study was obtained from each patient.

Surgical face

General operative procedures

- All the patients have been operated under general anaesthesia with nasoendotracheal intubation**.**
- Armamentarium:
  - Basic diagnostic sets, trauma kit, handpiece, micromotor, condylar retractor, titanium miniplates as well as screws screw holder and driver.
  - 3-0 vicryl and 5-0 prolene.
  - The operation site was infiltrated with a solution of lidocaine containing epinephrine to control bleeding.
- Two techniques have been used consecutively as the following:
  1. Control (conventional) retromandibular transparptid approach:
     The retromandibular approach incision starts 5mm below the ear lobe and extends 3 to 3.5cm inferiorly. It was inserted behind the mandible's posterior edge in a similar manner. The initial incision was made through the skin and subcutaneous tissues to the sparse platysma muscle, which was then aggressively incised in the same plane as the skin incision. The superficial musculo-aponeurotic layer (SMAS) and the parotid capsule were incised at this point, and blunt dissection within the gland was conducted in an anteromedial direction towards the posterior border of the mandible. A hemostat was repeatedly inserted and spread open in the same way as the facial nerve. The periosteum of the pterygomassetric sling the only tissue was left on the posterior margin of the mandible after further dissection. With a scalpel, the pterygomassetric sling was sharply incised. The fracture site was revealed, and the size of the fracture was reduced. After that, titanium miniplates were used to secure the fracture parts (8).

2. Study (new) preauricular retromandibular transmasseteric anteroparptid approach: Preauricular incision was made, and the incision was extended downwards in the cervicomastoid skin crease with retromandibular incision. To improve access to the masseter near the anteroinferior edge of the parotid gland, the flap was raised in the subdermal fat plane while dissection was done superficial to the superficial musculoaponeurotic layer. The area of the parotid gland's anterior margin is normally defined, then retracted posteriorly, while the masseter is recognized. To disclose the condylar fractur, the masseter was incised, divided, and posterolateral subperiosteal dissected. After that, the fracture is minimized and stabilized with plates and screws (9).

Postoperative care and Medication

- Ice packs for the first 12 hours.
- Patient advised on soft diet for two weeks.
- Patient was followed in next day and first week to examine wound healing and observed any complications.
- Early physiotherapy was done to encourage mouth opening.
- Sultamicillin 1.5 gm IM injection twice a day for 5 days.
- Diclofenac sodium 75 mg IM injection twice a day for 3 days
- Dexamethasone sodium phosphate 4 mg IM injection twice a day for 2 days**.**

Outcomes evaluation face

Primary outcomes

The primary goals were to lower the risk of facial nerve injury. The peripheral branches of the facial nerve were assessed immediately after surgery to see if they were involved. The severity of facial nerves was rated using the House-Brackmann facial nerve grading system (HBFNGS) scale. Patients with postoperative facial nerve injury will be assessed using the HBFNGS every week for 1 month then at 2, 3, and 6 months to see if they have improved or deteriorated. Preoperatively, postoperatively, and during the follow-up period, all patients' facial nerve function will be examined by the same team of examiners (10), table 1 (11).

Table 1 showed House-Brackmann facial nerve grading system measurements

Grade	Description	Characteristics
I	Normal	Normal facial function in all areas
II	Mild dysfunction	Slight weakness noticeable on close inspection; may have very slight synkinesis
III	Moderate dysfunction	Obvious, but not disfiguring, difference between 2 sides; noticeable, but not severe, synkinesis, contracture, or hemifacial spasm; complete eye closure with effort
IV	Moderately severe dysfunction	Obvious weakness or disfiguring asymmetry; normal symmetry and tone at rest; incomplete eye closure
V	Severe dysfunction	Only barely perceptible motion; asymmetry at rest
VI	Total paralysis	No movement

Secondary outcomes

Secondary outcomes will be used to evaluate:

a) A salivary gland fistula (characterized as a prolonged clear drainage of saliva from the incision site) is best measured by a clinical examination once a week for one month (12).
b) Scars will be classified as (1) no scar, (2) visible but thin and linear scar, (3) wide scar, or (4) hypertrophic scar or keloid. At 3 and 6 months (12).

Statistical methods

Numerical data were presented as mean and standard deviation values and were analyzed using independent t-test. Categorical and ordinal data were presented as frequencies and percentage values. Categorical data were analyzed using Fisher's exact test. Ordinal data were analyzed using MannWhitney U test for intergroup comparisons and Friedman's test followed by Nemenyi post hoc test for intragroup comparisons. The significance level was set at $p \le 0.05$ for all tests. Statistical analysis was performed with R statistical analysis software version 4.1.2 for Windows.

Results

Demographic data

The study was conducted on 20 cases that were randomly and equally allocated to each of the studied groups (i.e. 10 cases each). The most cause of fracture in the 20 patient is RTA 12 (60%), followed by 6(30%) were caused by interpersonal violence and 2(10%) fracture was caused by falling. In both groups, there were 8(80.0%) males and 2(20%) females. The mean age of the cases in the control group was (31.60±11.98) years and in the study group it was (32.60±13.84). There

was no significant difference between both groups regarding different demographic characteristics (p>0.05), in table (2) and in fig from (1) to (3).

Table (2): Summary statistics of demographic data

Parameter			Control	Study	p-value
Sex	Male	n	8	8	1ns
		%	80.0%	80.0%	
	Female	n	2	2	
		%	20.0%	20.0%	
Age		Mean±SD	31.60±11.98	32.60±13.84	0.865ns
Cause of fracture	RTA	n	6	6	1ns
		%	60.0%	60.0%	
	Interpersonal violence	n	3	3	
		%	30.0%	30.0%	
	Fall	n	1	1	
		%	10.0%	10.0%	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05)

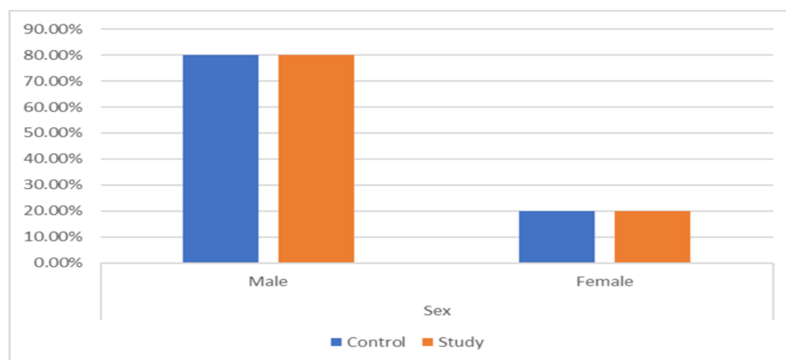

Fig 1: Bar chart showing sex distribution

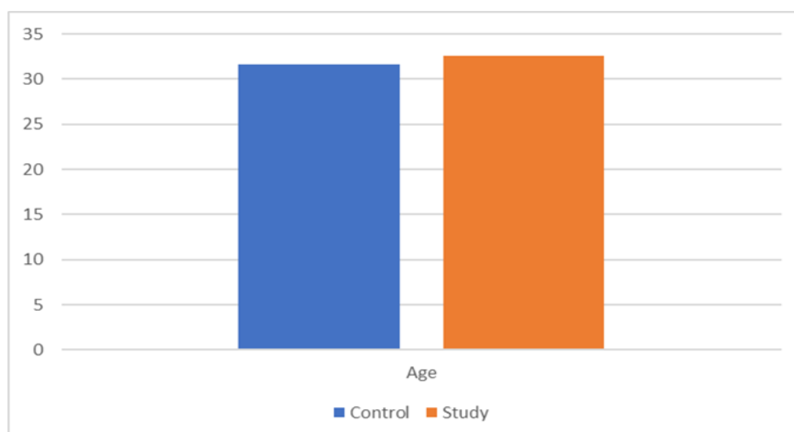

Fig 2: Bar chart showing average age (years)

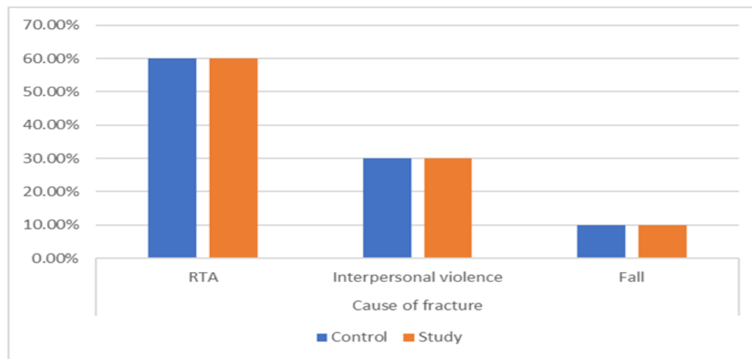

Fig 3: Bar chart showing cause of trauma

Facial nerve injury

Results showed 7(70%) cases of the control group had grade (I) and 3(30%) cases had grade (II). While in the study group, 9(90%) cases had grade (I) and 1(10%) case had grade (II) and the difference between both groups was not statistically significant (p=0.481); frequencies (n) and percentages (%) of HBFNGS scale were presented in table (3) and fig (4)

Table (4): Frequencies (n) and percentages (%) of HBFNGS scale

HBFNGS scale		Control	Study	p-value
I	n	7	9	0.481ns
	%	70.0%	90.0%	
II	n	3	1	
	%	30.0%	10.0%	
III	n	0	0	
	%	0.0%	0.0%	
IV	n	0	0	
	%	0.0%	0.0%	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05)

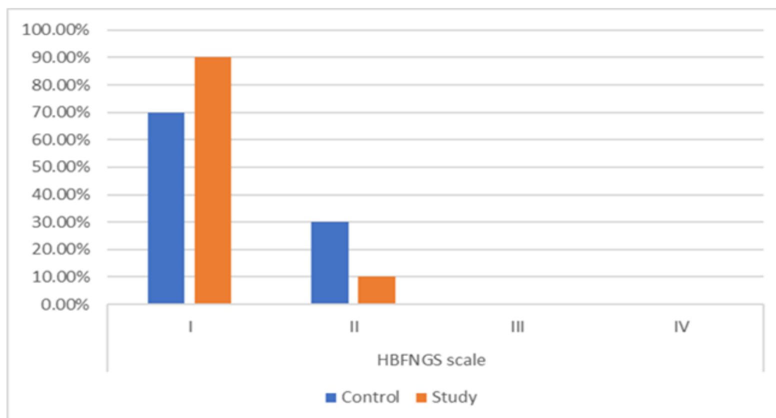

Figure (4): Bar chart showing percentage of HBFNGS scale distribution

Parotid injury

All the cases in both groups were free from parotid injuries. Frequencies (n) and percentages (%) of parotid injury were presented in table (4) and fig (5)

Table (4): Frequencies (n) and percentages (%) of parotid injury

Parotid injury		Control	Study	p-value
No	n	10	10	NA
	%	100.0%	100.0%	
Yes	n	0	0	
	%	0.0%	0.0%	

NA: Not Analyzed

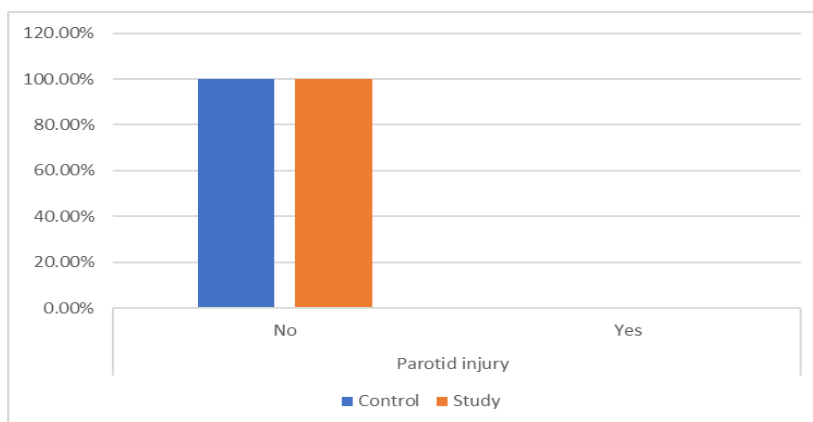

Fig 5: Bar chart showing percentage of parotid injury

Scar formation

Results revealed 9(70%) cases of the control group had visible but thin and linear scar and 1(10%) case had wide scar at 3 and 6 months. While all cases in the study group had visible but thin and linear scar and the difference between both groups was not statistically significant (p=0.739). Frequencies (n) and percentages (%) of scar formation were presented in table (5) and fig (6).

Table (5): Frequencies (n) and percentages (%) of scar at 3 and 6 months

Scar		Control	Study	p-value
No perceptible scar (1)	n	0	0	0.739ns
	%	0.0%	0.0%	
Visible but thin and linear scar (2)	n	9	10	
	%	90.0%	100.0%	
Wide scar (3)	n	1	0	
	%	10.0%	0.0%	
Hypertrophic scar (4)	n	0	0	
	%	0.0%	0.0%	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05)

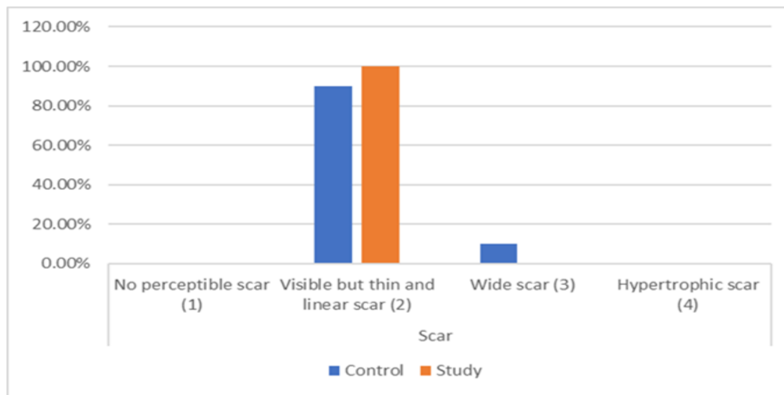

Fig 6: Bar chart showing percentage of scar formation at 3 and 6 months

Mouth opening

Intergroup comparisons

Pre-operatively, 4(40%) cases of the control group had a mouth opening of less than 25 mm width, 6(60%) cases had a mouth opening 25-40 mm wide and the difference between both groups was not statistically significant (p=0.481). After 1 week, 4(40%) cases of both groups had 25-40 mm wide opening and 6(60%) cases had a mouth opining of more than 40 mm width (p=1). After 1 month, all cases in both groups had a mouth opining with a width of more than 40 mm (p=1). Frequencies (n) and percentages (%) of mouth opening for different groups were presented in table (6) and fig (7).

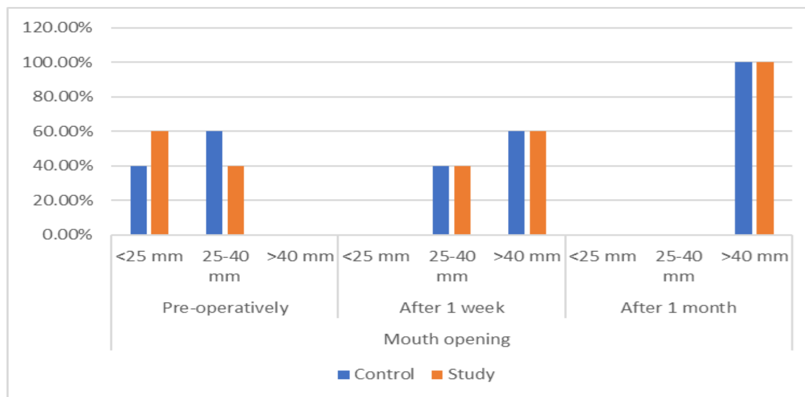

Fig 7: Bar chart showing percentage of mouth opening for different groups

Table (6): Frequencies (n) and percentages (%) of mouth opening for different groups

Time	Mouth opening		Control	Study	p-value
Pre-operatively	<25 mm	n	4	6	0.481ns
		%	40.0%	60.0%	
	25-40 mm	n	6	4	
		%	60.0%	40.0%	

Time	Mouth opening		Control	Study	p-value
	>40 mm	n	0	0	
		%	0.0%	0.0%	
After 1 week	<25 mm	n	0	0	1ns
		%	0.0%	0.0%	
	25-40 mm	n	4	4	
		%	40.0%	40.0%	
	>40 mm	n	6	6	
		%	60.0%	60.0%	
After 1 month	<25 mm	n	0	0	1ns
		%	0.0%	0.0%	
	25-40 mm	n	0	0	
		%	0.0%	0.0%	
	>40 mm	n	10	10	
		%	100.0%	100.0%	

Intragroup comparisons

In both groups, there was a significant difference in mouth opening between different intervals with values measured pre-operatively being significantly different from other intervals (p<0.001). Frequencies (n) and percentages (%) of mouth opening for different intervals were presented in table (7) and fig (8)

Table (7): Frequencies (n) and percentages (%) of mouth opening for different intervals

Group	Mouth opening		Pre-operatively	After 1 week	After 1 month	p-value
Control	<25 mm	n	4^{A}	0^{B}	0^{B}	<0.001*
		%	40.0%	0.0%	0.0%	
	25-40 mm	n	6	4	0	
		%	60.0%	40.0%	0.0%	
	>40 mm	n	0	6	10	
		%	0.0%	60.0%	100.0%	
Study	<25 mm	n	6^{A}	0^{B}	0^{B}	<0.001*
		%	60.0%	0.0%	0.0%	
	25-40 mm	n	4	4	0	
		%	40.0%	40.0%	0.0%	
	>40 mm	n	0	6	10	
		%	0.0%	60.0%	100.0%	

Different superscript letters indicate a statistically significant difference within the same horizontal row *; significant (p ≤ 0.05) ns; non-significant (p>0.05)

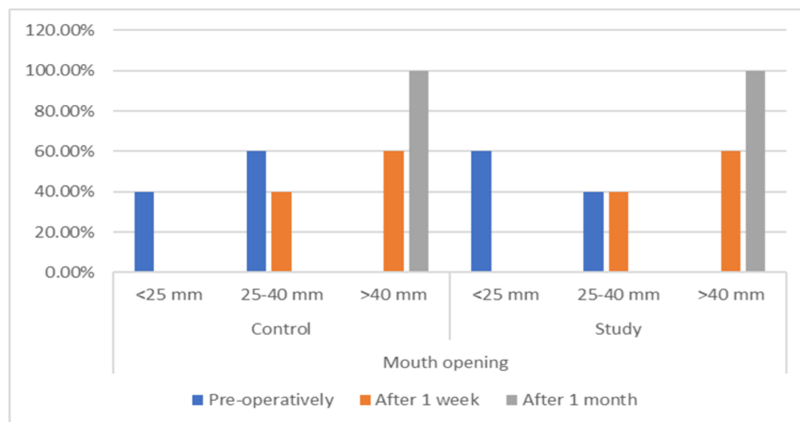

Fig 8: Bar chart showing percentage of mouth opening for different intervals

Discussion

Many studies in adults in various geographic areas and countries have shown that men account for roughly 4 out of 5 condylar fractures (13-15) similar results were found in this study, with 8 (80.0 percent) males and 2 (20 percent) females in each group. We explained that men are more vulnerable to personal violence and drive recklessly. Most investigators found that the incidence was highest in patients between the ages of 18 and 40 years, with a mean age of 32 (13, 16, 17). In this article, we discovered that the mean age of the cases in the control group was (31.6) years, and in the study group it was (32.6), which is consistent with the findings of previous authors. we describe this result as this age group represent the main working force in our community and thus susceptible to fracture. Vanpoecke et al 2020 (18) stated that the average age of presentation with a condylar fracture was 38 years and this to th wide patient age varied between 4 and 81 years.

This study found that both groups have fractures in 6(60%) cases caused by (RTA), 3(30%) cases caused by interpersonal violence, and 1(10%) fracture was caused by falling. (Marker et al) (13) and (Muhammad) (19) found that road traffic accident as well as falls were the most common cause of condylar fracture. The treatment of a fractured condyle should be started as soon as possible and as safely as possible to avoid treatment related morbidity, complications and aims to establish temporomandibular joint stability, mandibular continuity, and normal (physiologic) TMJ function, including undisturbed masticatory function, excellent occlusion, facial symmetry, mouth opening greater than 40 mm, and pain-free movement (20, 21).

Close management resulted in a decrease in ramus height and malocclusion, according to (Silvennoinen et al 1992) (22), while (Palmieri et al 1999) (23) claimed that conservative management of mandibular condyle fractures provided no benefit and that they were not actually reduced, moreover (Worsaae and Thorn 1994) (24) examined non-surgical and surgical treatment in 52 patients and discovered that patients treated conservatively had more mandibular asymmetry, pain confined to the afflicted joint masticatory muscles and reduced masticatory performance.

The current concern should be focused on the optimum surgical approach to the mandibular condyle; that should provide a comfortable, be the least intrusive way possible, provide satisfactory vision, be versatile, quick to operate, and have the fewest surgical problems (25). Surgical treatment of condylar fracture could be through intraoral technique both with and without an endoscope; this necessitates more operational time, more technological approach, prolonged postoperative malocclusion, and fragment misalignment (21) as compared to the extraoral approach. Literature has been described. A variety of extraoral approaches are available. Submandibular, retromandibular, preauricular, rhytidectomy, preauricular transmasseteric anteriorparotid approach (9). All of these procedures are only appropriate for treating fractures at certain levels, while access to other levels becomes increasingly difficult, every extraoral method carries a danger of damaging the facial nerve (26, 27).

(Hinds and Girotti 1967) (28) were the first to introduce the retromandibular transparotid method, The area of dissection in the transparotid approach is the window between the branches of the facial nerve; buccal and marginal. Parallel to the branches of the facial nerve, blunt dissection was performed. (Bhutia et al 2014) (4) because the facial nerve may be visualised and retracted under direct vision, the retromandibular method causes less morbidity, (Bharathraj 2017) (21) presented other benefits include excellent exposure of the posterior border of the ramus and the subcondylar region, as well as a short working distance between the incision and the fracture site.

In this article; the retromandibular transparotid method was used in the control group of this investigation. The facial nerve weakening was the primary parameter examined. Three patients in the control group had facial nerve problems (30 percent). This is in line with the findings of (Manisali et al 2003) (29) who found facial nerve palsy in 30% of cases while (Bhutia et al 2014) (4) summarized that the prevalence of temporary facial nerve branch injury has been observed to range from 12% to 48%.

We noted that the cases of severe displaced fractures need extra dissection and more manipulation time thus more facial branches will be prone to injury especially buccal branch, (21, 30, 31) concluded that access of surgical procedure through the parotid gland, where the branches of the facial nerve and soft tissues are retracted, may result in transient neuropraxia causing palsy as well as manipulation of displaced segments. No case of parotid fistulation was observed in this study/control group because we ensured that the parotid capsule was closed, which is comparable to other authors (31, 32), other authors presented some cases of fistulation (33, 34).

Regarding scar; good aesthetic outcome of scar was found in all patients of the control group; 9(70%) cases had visible but thin and linear scar and 1(10%) case had wide scar at 3 and 6 months, in this group all patient were satisfied by their scar and this correspondent with (Fleix and Singh 2020) (35) while (Parihar et al 2019) (3) noticed five cases developed hypertrophic scarring. In this study/study group; we only had one case of transient facial paralysis, which could be attributed to the postgraduated clinician experience, and the small sample size,

(Mohamad 2011, Khan and Sayed 2022) (36, 37) encountered some cases of transient facial paralysis resulted from practising this approach.

We thought that this approach had more cautious window of surgical area presented between the two branches buccal, marginal and is performed to safely access the mandible. As we go more forward this window raise. This surgical window is better when compared to the retromandibular approach (control group) thus resulting in smoother manipulation, less retraction, better viewing of facial branches thus good isolation and protection during dissection, concerning this advantage we share other authors conclusions (38-40) as well as (37).

Our results showed that the difference between both groups in regarded to facial nerve paralysis was not statistically significant (p=0.481), we restricted to both approaches design and followed the anatomical landmark as much as we can thus minimize the complication beside that our sample size was small, (Elhadidy et al 2021 and Hsieh 2021 (40, 41) both found there was no significant difference between two approaches, and does not permanent damage the facial nerve. Regarding salivary fistula we retracted the parotid gland posteriorly as we moved anteriorly and this protect gland as well as capsule so we encountered zero sialocoele in similar to (Gali et al 2016, Orvakonde and Mutum 2019) (7, 38) while (Mohamad 2011) (36) encountered only one case due to trauma to capsule. Concerning scar formation following P-TMAP approach all cases in the study group had visible but thin and linear scar and this corresponding with (Gali et al 2016) (7) found that the incision merges with cervicomastoid as well as preauricular skin creases so it is acceptable cosmetically.

In regard to scar formation the difference between both groups was not statistically significant (p=0.739), (Elhadidy et al 2021) (40) showed slightly higher patient satisfaction with transparotid but there was no statistically significant difference between the 2 groups (P-value 0.35). On subject of mouth opening intragroup comparison, between values measured pre-operatively being significantly different from other intervals postoperatively (p<0.001) all patients had improvement in their mouth opening.

While intergroup comparison the difference between both groups was not statistically significant (p=0.481) this may be due to small sample size and both groups could be used properly to treat this type of fracture, (Elhadidy et al 2021) (40) found that were no statistically significant differences between the two groups in mouth opening (P-value 0.47), we noticed that 2 cases operated by P-TMAP were less than 25mm reached more than 40mm in first week we could attribute this improvement to less manipulation and retraction done by this approach compare to conventional retromandibular.

Conclusion

The result of this study showed that both retromandibular transparotid and transmasseteric anterior approaches are effective for mandibular subcondylar treatment. Although the transmasseteric anterior parotid approach is less likely to have facial nerve injury compare to retromandibular transparotid approach, there’s no significant difference between two approaches regarding outcomes.

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