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Research Article

Evaluating the Results for Different Methods of Internal Fixation Treating Mandibular Subcondylar Fractures

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Abstract

Among maxillofacial injuries, condylar fractures are a common topic of discussion and controversy. These fractures make up 11-16% of all facial fractures and 30-40% of mandibular fractures. The subcondylar area is the distal part of the condylar process, which is superiorly confined to the line passing through the sigmoid notch and anteriorly to the line obliquely connecting the sigmoid notch to the masseter tuberosity. Closed reduction has been the preferred treatment for decades, but complications such as pain, ankylosis, internal derangement of the temporomandibular joint (TMJ), and inadequate restoration of the vertical height of the ramus can possibly occur. Open reduction and anatomic reduction can create a better function for the temporomandibular joint compared with closed treatment. For subcondylar fractures, surgical treatment is most commonly done, and different treatment options have been described in adults. Among them, the mini plates fixation technique via retromandibular or submandibular incision was used. The retromandibular approaches provide good visualization of the subcondyle from the posterior edge of the ramus, allow the surgeon to work perpendicularly to the fracture, and enable direct fracture management.

Keywords: Sub Condylar Fractures; Single Y Shape Condylar Plate; Open Reduction Retromandibular Approach

Abbreviations

TMJ: Temporoma Ndibular Joint; ORIF: Open Reduction Internal Fixation; SMAS: The Superficial Musculoaponeurotic System; MMF: Maxillomandibular Fixation; SPSS: Statistical Package for Social (SPSS), RMA: Retromandibular Approach

Introduction

The subcondylar area is the distal part of the condylar process, superiorly limited to the line passing through the sigmoid notch and anteriorly to the line obliquely connecting the sigmoid notch to the masseter tuberosity. Among maxillofacial injuries, condylar fractures are a common topic of discussion and controversy. These fractures make up 11-16% of all facial fractures [2,5] and 30-40% of mandibular fractures [3,7]. Open reduction and anatomic reduction can lead to better function for the temporomandibular joint compared to closed treatment in mandible fracture surgery [1]. Despite the high incidence of these fractures, the treatment for condylar neck and subcondylar fractures remains a controversial topic in mandible surgery [10]. Among condylar fractures, surgical treatment is most commonly done for subcondylar fractures [11]. Recently, anatomic reduction and early mobilization of the jaw following surgery have been considered important for the functional rehabilitation of the TMJ [12]. Therefore, the choice of the surgical approach depends on the need to create an optimal view of the whole subcondyle without injury to the facial nerve or the vascularization to the condylar head during surgery [16]. The retromandibular incision, first proposed in 1967, is preferred by surgeons because it offers a clear view of the lower subcondyle and the entire ramus from the back [14]. Unlike the submandibular incision, this one is closer to the subcondyle, providing direct access to the fractured line and making it easier to manage the fracture. This incision allows the surgeon to work perpendicular to the fracture, reducing the need for excessive retraction and eliminating the need for a transfacial trocar [10].

The retromandibular is favored by surgeons because it provides good visualization of the lower subcondyle and the entire ramus from the posterior border [14].

The retromandibular approach was found to be expeditious in adequately exposing the fracture site and enabling ORIF. The anatomic reduction of the fractured segments and the fixation were satisfactory in all the cases. Average duration of surgery was 39 min (range: 17-56 min) for satisfactory exposure, reduction, and fixation of each condylar fracture [19]. By this retromandibular approach condylar fracture reduction; fixation and healing were managed comfortably. However, direct vision of facial nerve fibres has limited the risk of facial nerve injury [20]. Retromandibular access with trans masseteric antero-parotid approach is the technique of choice for treatment of high- and low-level subcondylar fractures with adequate visibility and direct access to the condylar area [21] It can also avoid direct contact with the facial nerve and preserves the integrity of the parotid gland as well as its capsule and leaves a barely noticeable scar in a relatively hidden region [10]. The skin incision of this approach is located just posterior to the mandibular ramus and the most proximal point of the incision is just below the ear lobe, runs parallel down to the posterior border of the mandible, and is limited to 25 mm in length. After exposing the superficial musculoaponeurotic system (SMAS), a vertical incision is made through the SMAS behind the parotid gland. Blunt dissection is made through the parotid gland and masseteric fascia towards the posterior border of the mandible. This permits preservation of the facial nerve fibers, which are easily identified when they pass superficially to the masseter muscle and can be protected with a retractor [10].

After reaching the mandibular angle, the pterygomasseteric sling is thinned out until the bone surface becomes visible. A sharp cut is made through the periosteum at the posterior border of the ascending ramus, opening access to the whole ramus, which is dissected subperiosteally. The periosteum at the posterior border of the ramus is then incised, and subperiosteal dissection is continued to the condylar area until the fracture line and the displaced or dislocated proximal fragment are identified. The fragment is then repositioned under direct visualization of the fracture line.

Wound closure is performed in layers after checking mandibular mobility and dental occlusion. The first step is refixation of the pterygomasseteric sling, followed by closure of the subcutaneous and cutaneous layers. The skin sutures are removed one week later.

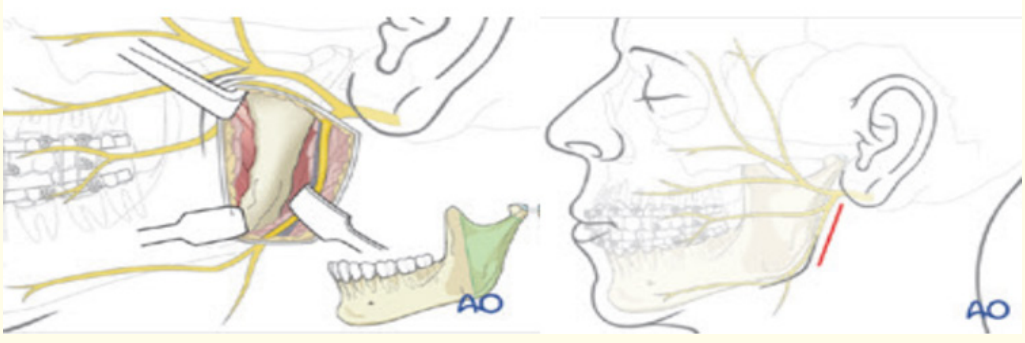

Figure 1: Retromandibular approach.

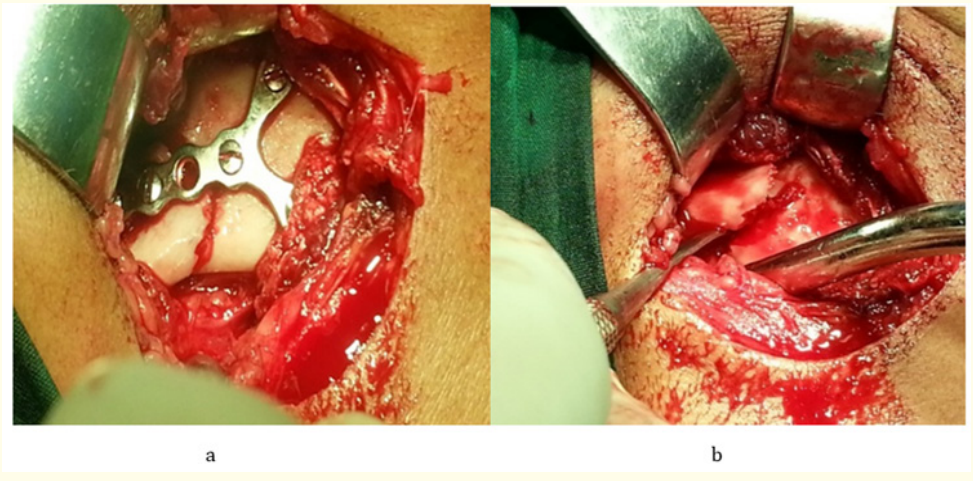

Figure 2: R(a) Fixation, (b): Reduction.

Figure 3: Postoperative panoramic view.

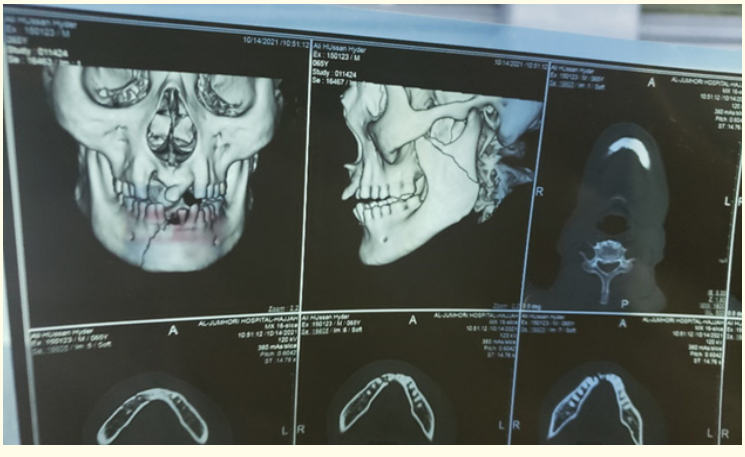

Figure 4: 3d ct preoperation.

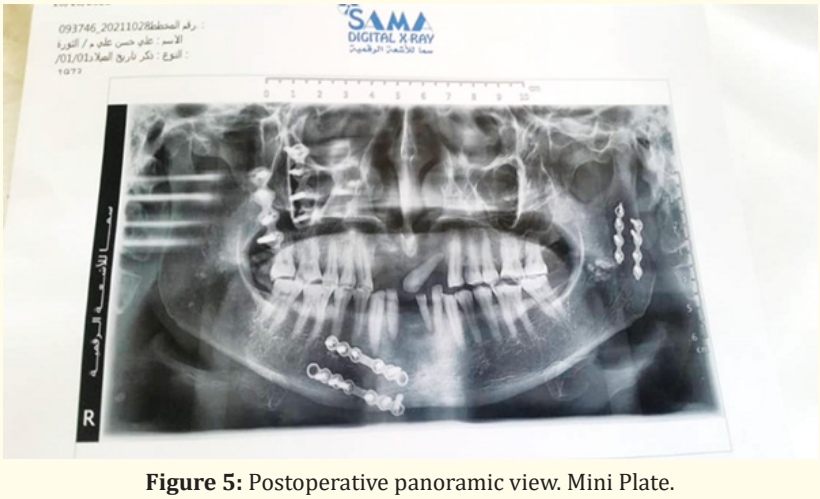

Figure 5: Postoperative panoramic view. Mini Plate.

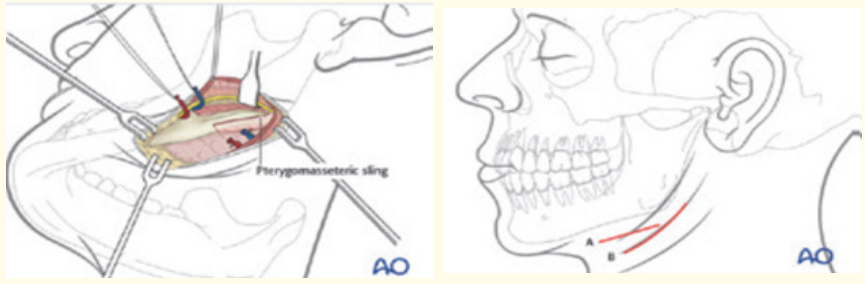

Figure 6: The submandibular approach.

The submandibular approach was first described in 1934 by Risdon. [17] The skin incision is 4 to 5 cm in length, 2 cm below the angle of the mandible. Optimally, the skin incision should be positioned in an existing skin crease to hide the scar and should be made at right angles to the skin surface. The subcutaneous fat and superficial fascia are dissected to reach the platysma muscle [17]. Whether anterior or posterior to the facial artery, all branches of the nerve innervated the depressors of the lower lip, past the inferior border of the mandible. Those branches remaining below the inferior border distal to the facial artery innervated the platysma muscle. The marginal mandibular branch consisted of two branches in 62% and one branch in 21% of patients, 8% had three branches, and 3% had three or more branches [17].

The dissection is continued beneath the deep cervical fascia to the inferior border of the mandible. The submandibular gland and its capsule will become evident, and the lower pole of the parotid may be encountered [17]. The dissection is carried to the masseter muscle, with the surgeon taking care to retract the nerve fibers superiorly. Once the muscle is encountered, it is sharply divided at the inferior border to expose the bone. The muscle, periosteum, and soft tissue are retracted superiorly to expose the body, ramus, and fracture site. If facial vessels cannot be retracted successfully, they may be divided and ligated. Typically, the submandibular lymph node can be identified adjacent to the facial vessels. Exposure can be increased and closure enhanced by dissecting the medial pterygoid and stylomandibular ligaments from the inferior and posterior borders [17]. The parotid gland is generally posterior to the ramus but may wrap around the inferior angle. The capsules of both should be avoided during dissection. Disruption of gland parenchyma may lead to sialoceles or salivary fistulas [17].

Postoperative care

The drain was removed within 3 to 4 days and the stitches removed within 7 days. MMF was not generally needed but restricted jaw movement with bandaging and a soft diet were used for 1 week. In a few patients who had malocclusion, elastic traction with a rubber band was used for several days. In most of the patients, limited mouth opening exercises were started several days after surgery and normal occlusion and mouth opening was restored within 1 month.

Materials and Methods

A retrospective analysis of registration files of various subcondylar fracture patients was conducted on cases diagnosed during 2023 in patients of AL-THORA hospital, which was treated in the maxillofacial department. Fifteen patients presenting with subcondylar fractures requiring open reduction and internal fixation were included in this study from 1/2023. They were divided into two groups, A (submandibular approach) and B (retromandibular), and were evaluated during a 3-month follow-up on clinical parameters, such as hematoma, infection, mouth opening, deviation during opening, facial nerve injury, pain, swelling, and radiologic parameters, such as fracture alignment. The data was checked for completeness, coded then was entered into computer by statistical package for social (SPSS).

Obtained data was analyzed by using descriptive statistical tables (frequencies, percentages). Data was presented in tables and graphs by using computer applications (Excel and Word).

Results

The Relationship

The results of the study showed in Table (1) and Figure (1) that there is relationship between Hematoma with(Submandibular-Retromandibular) in the study sample, where the value was (P-value = 0.000 < 0.05) resulting from the (Chi-Square) test. “Where it was shown that (62.50%) of the sample (Submandibular) have a Hematoma, while all the study sample from (Retromandibular) do not have a Hematoma.

Hematoma	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	10 (62.50)	0 (0.0)	16.000	0.000
No	0 (0.0)	6 (37.50)		

Table 1: Shows the Relationship between Hematoma with(Submandibular- Retromandibular).

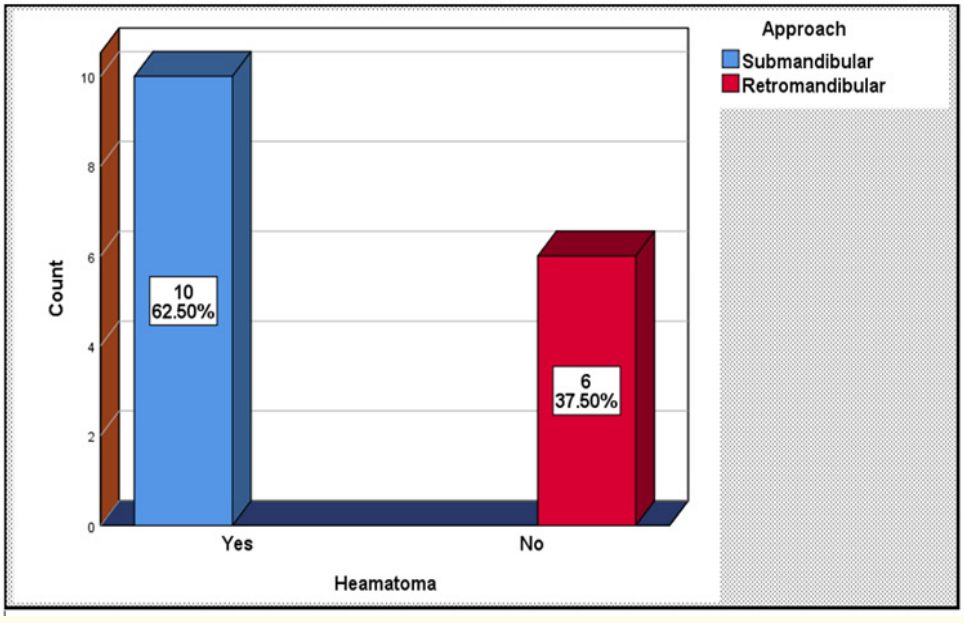

Figure 7: Shows the Relationship between Hematoma with (Submandibular- Retromandibular).

Infection	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	3 (18.75)	0 (0.0)	2.215	0.137

Table 2: Shows the Relationship between Infection with (Submandibular- Retromandibular).

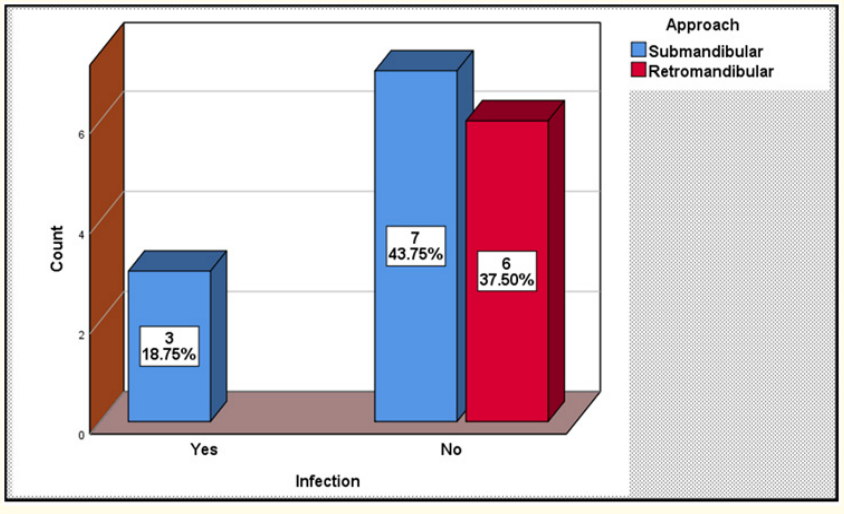

Figure 8: Shows the Relationship between Infection with(Submandibular- Retromandibular).

The results of the study showed in Table (2) and Figure (2) that there is no relationship between Infection with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.137 > 0.05) resulting from the (Chi-Square) test.

Where it turns out that (18.75%) of the sample (Submandibular) have an infection, and (43.75%) do not have an infection, while all the infected individuals in the study sample (Retromandibular) do not have an infection.

Limitation of mouth opening	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	9 (56.25)	2 (12.50)	5.605	0.018
No	1 (6.25)	4 (25.00)		

Table 3: Shows the Relationship between Limitation of mouth opening with (Submandibular- Retromandibular).

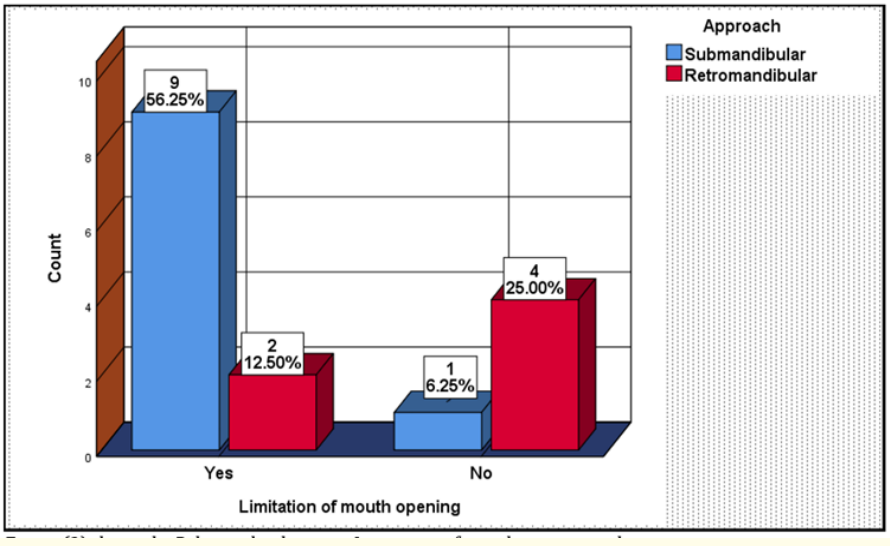

Figure 9: Shows the Relationship between Limitation of mouth opening with (Submandibular- Retromandibular).

The results of the study showed in Table (3) and Figure (3) that there is relationship between Limitation of mouth opening with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.018 <0.05) resulting from the (Chi-Square) test.

"Where it was found that (56.25%) of the sample (Submandibular) suffer from limited mouth opening, and also (12.50%) of the sample (Retromandibular) suffer from limited mouth opening."

Deviation during opening	Approach		Chi-Square Tests	p- Value
	SubmandibularN (%)	Retromandibular N (%)		
Yes	5 (31.25)	0 (0.0)	4.364	0.037
No	5 (31.25)	6(37.50)		

Table 4: Shows the Relationship between Deviation during opening with (Submandibular- Retromandibular).

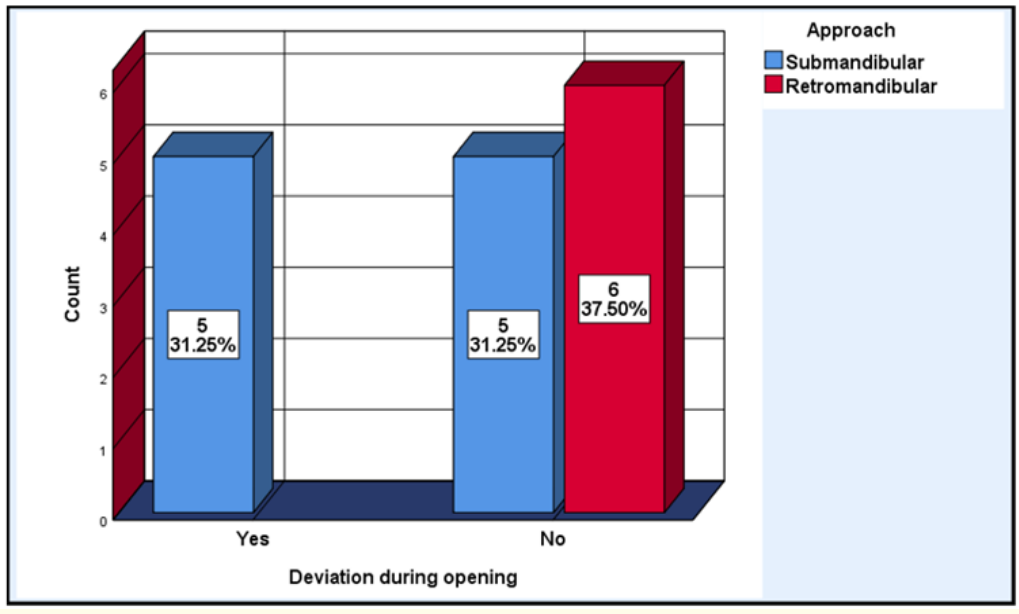

Figure 10: Shows the Relationship between Deviation during opening with.

The results of the study showed in Table (4) and Figure (4) that there is relationship between Deviation during opening with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.037 <0.05) resulting from the (Chi-Square) test.

"Where it was found that (31.25%) of the sample (Submandibular) suffer from deviation during opening, while all the study sample affected by (Retromandibular) do not suffer from deviation during opening."

Nerve facial injury	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	5 (31.25)	1 (6.25)	1.778	0.182
No	5 (31.25)	5 (31.25)		

Table 5: Shows the Relationship between Nerve facial injury with(Submandibular- Retromandibular).

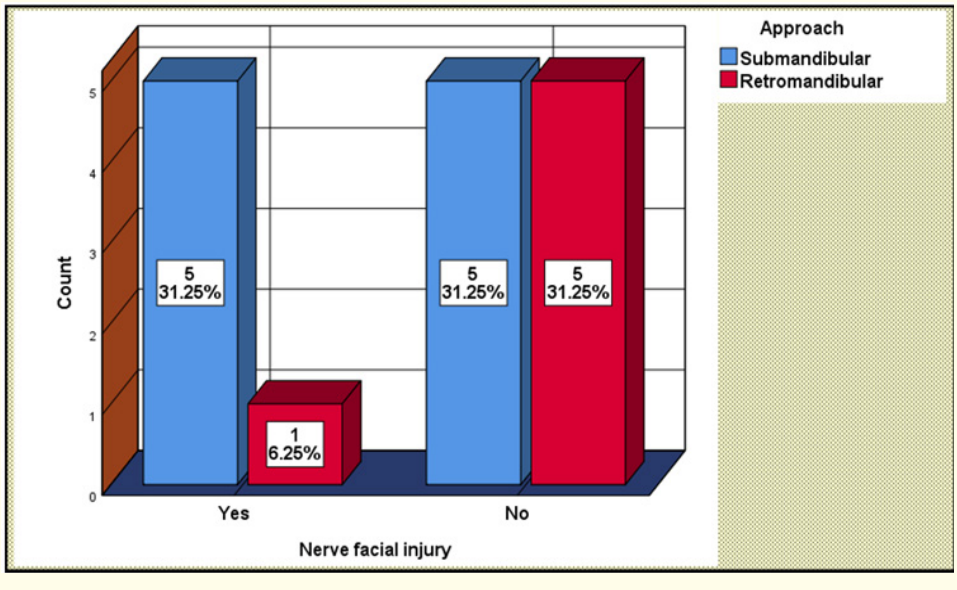

Figure 11: Shows the Relationship between Nerve facial injury with (Submandibular- Retromandibular).

The results of the study showed in table (5) and Figure (5) that there is not relationship between Nerve facial injury with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.182 > 0.05) resulting from the (Chi-Square) test.

"Where it was found that (31.25%) of the sample (Submandibular) do not suffer from facial nerve injury, as well as (31.25%) of the sample (Retromandibular) do not suffer from facial nerve injury."

Pain	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	7 (43.75)	2 (12.50)	2.049	0.152
No	3 (18.75)	4 (25.00)		

Table 6: Shows the Relationship between Pain with (Submandibular- Retromandibular).

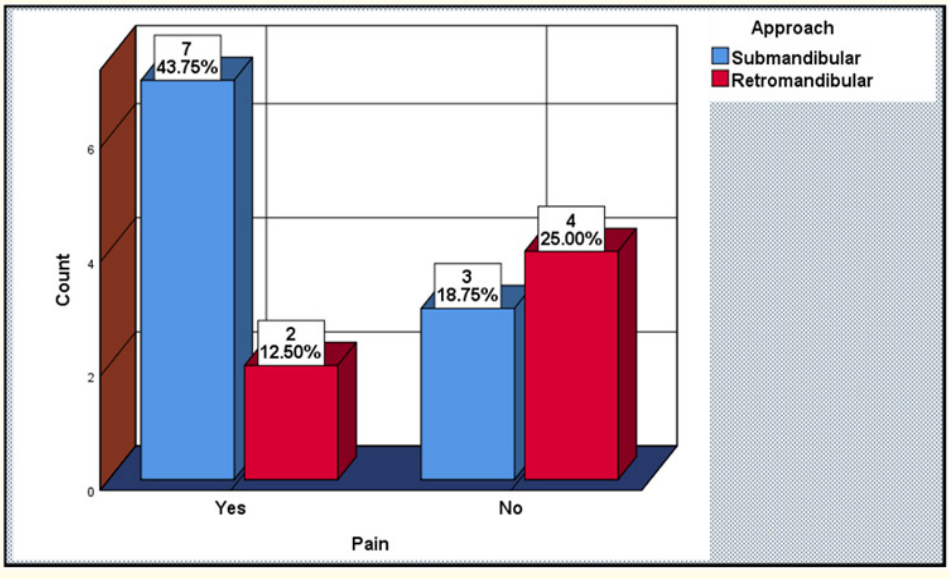

Figure 12: Shows the Relationship between Pain with (Submandibular- Retromandibular).

The results of the study showed in Table (6) and Figure (6) that there is not relationship between Pain with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.152 >0.05) resulting from the (Chi-Square) test.

"Where it was revealed that (18.75%) of the sample (Submandibular) do not suffer from pain, as well as (25.00%) of the sample (Retromandibular) do not suffer from pain."

Swelling	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	10 (62.5)	2 (12.50)	8.889	0.003
No	0 (0.0)	4 (25.00)		

Table 7: Shows the Relationship between Swelling with (Submandibular- Retromandibular).

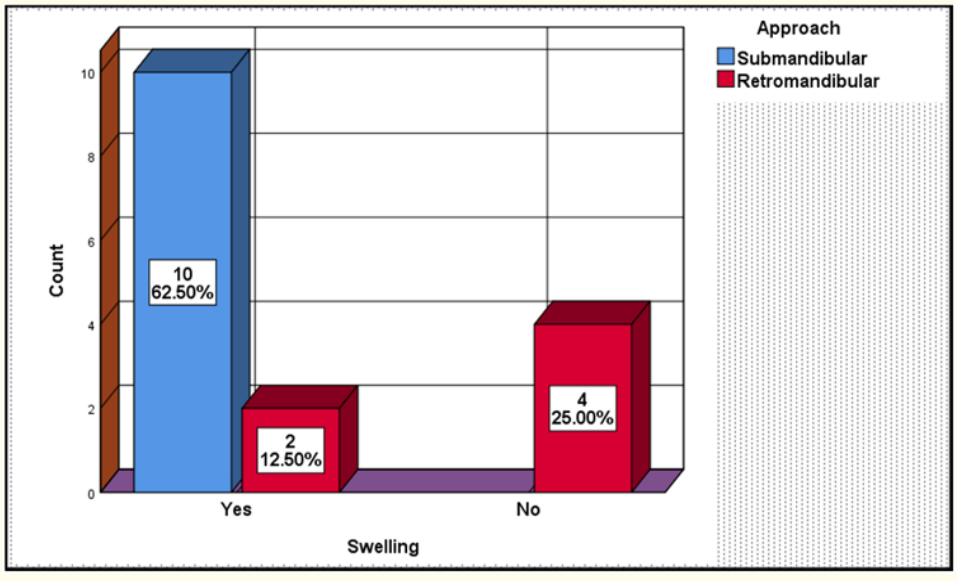

Figure 13: Shows the Relationship between Swelling with (Submandibular- Retromandibular).

The results of the study showed in Table (7) and Figure (7) that there is relationship between Swelling with(Submandibular- Retromandibular) in the study sample, where the value was (P-value = 0.003 <0.05) resulting from the (Chi-Square) test.

Where it was revealed that all the study sample under the lower jaw are suffering from swelling, while (12.50%) of the sample b Retromandibular are suffering from swelling.

Fracture alignment	Approach		Chi-Square Tests	p- Value
	Submandibular N (%)	Retromandibular N (%)		
Yes	(10)	(6)	-	-

Table 8: Shows the Relationship between Fracture alignment with (Submandibular- Retromandibular).

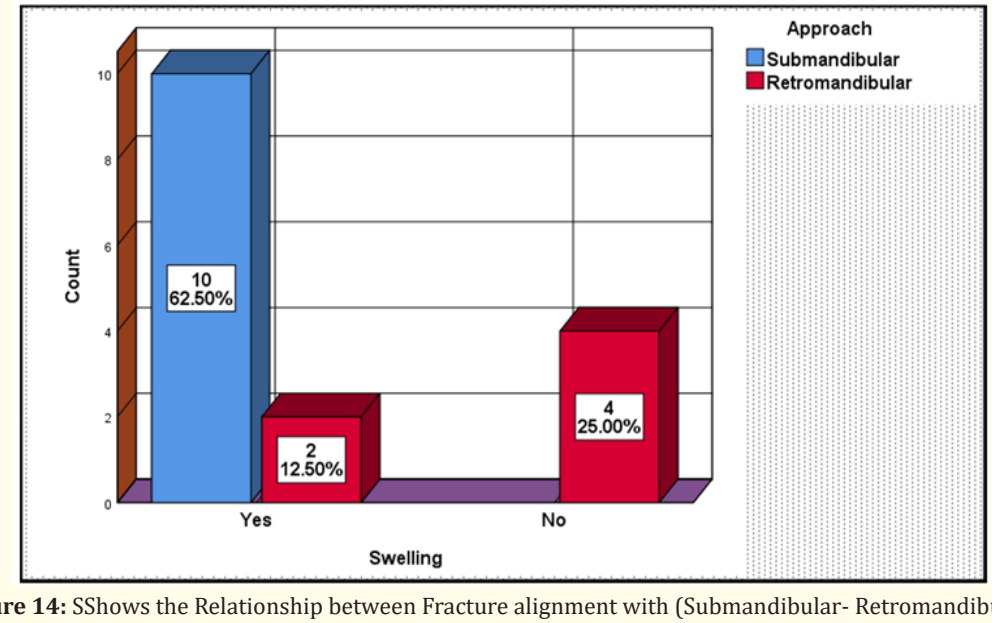

Figure 14: SShows the Relationship between Fracture alignment with (Submandibular- Retromandibular).

The results of the study showed in Table (8) and Figure (8) that: "All study sample are capable of aligning the fraction."

Discussion

In all patients, of resent study the fracture had been properly reduced and the plates were in the correct position (fracture alignment), this result agrees with study by Alireza Parhiz, 1, 2 Milad Parvin in 2020. [21]. The clinical outcome of our study of the TMJ (limitation of mouth opening and diviation) with RMA was better than SMA and agree with study by Abdo Ahmed Saleh Mohamed # 1 2 3, Guangxin Rao (Is the retromandibular approach a suitable approach to anatomical reduction of unilateral subcondylar fracture? A non-randomized clinical trial) [23]. In this study a pain was lesser in the retromandibular approach, agree with study by K. Pugazhendi [a], Anuradha V (A comparative evaluation of the outcome of treating condylar fractures with the mini retromandibular and the preauricular approaches) [22].The facial nerve damage in the present study is low rate in the retromandibular approach than the submandibular approach agree with the study byAlireza Parhiz 1 2, Milad Parvin (Clinical Assessment of Retromandibular Antero-Parotid Approach for Reduction of Mandibular Subcondylar Fractures: Report of 60 Cases and Review of the Literature) [21] and agree with other study jn Osaka Univercity Graduate School of Dentistry, Suita, Osaka, Japan; by T. Imai, Y. Fujita, A. Motoki, H. Takaoka, T. Kanesaki, Y. Ota, S. Iwai, H. Chisoku, M. Ohmae, T. Sumi, M. Nakazawa, N. Uzawa [33].The treatment approach to the mandibular condyle fractures is one of the most widely debated subject in maxillofacial traumatology. [25] Conservative treatment may lead to malocclusion, anterior open-bite, facial asymmetry, internal derangement, chronic joint pain, and reduced mobility. [26] Surgical approaches to treating mandibular condylar fractures are broadly classified into intraoral and extraoral approaches.

Intraoral approaches can be performed with or without endoscopic assistance. Extraoral approaches are commonly used because they provide better visualization of the fracture site, thereby facilitating fracture reduction and fixation [31]. The choice of approach is often based on the type of fracture [31,32]. Fractures are subdivided into condylar head （intracapsular) and subcondylar fractures of the condylar neck（extracapsula）and condylar base [31,32].

The miniplate osteosynthesis of the subcondylar process using an extraoral approach is currently the most popular method followed by the miniplate osteosynthesis using a transoral approach [27].

Open reduction was first applied to a low subcondylar fracture in 1925 [18] and recently it has become more common, probably because of the introduction of plate and screw fixation devices that allow for the stabilization of such injuries [10]. Today, many surgeons prefer open reduction of displaced fractures, because such reduction and rigid fixation enables good anatomic repositioning and immediate function. [11]. The submandibular approach is a classic method of reaching the mandibular ramus and posterior body region.

It is occasionally referred to as the Risdon approach, as it was first described by Risdon in 1934 [28]. Approaching the mandible from an incision below the marginal mandibular nerve is the most crucial aspect of the Risdon approach and may complicate facial nerve palsy of the marginal mandibular branch [29,30].

A relatively longer incisional line is required, which may result in a longer and more conspicuous scar, compared to retromandibular approache. Many studies have described frequent lesions of the facial nerve, mainly of the marginal branch, reaching up to 48.1% [29,30]. The retromandibular approach was first described by Hinds in 1967 [28].

The advantages of this approach include a shorter working distance from the skin incision to the condyle. The good access and visualization of the posterior border of the mandible and sigmoid notch facilitate fracture manipulation and reduction and leave an inconspicuous scar [28].

The current study demonstrates that the RMA could re-establish the anatomical position of the unilateral subcondylar fracture in patients undergoing ORIF. The clinical outcome of the TMJ with RMA was better than SMA [23]. Clinical studies have shown that the retromandibular approach has many advantages.

Good exposure, minimal scarring, simple manipulation, short operating time, and minimal risk for facial nerve damage. Thus, it is the best choice for treating condylar neck and condylar base fractures with predictable results [28]. The retromandibular approach is the best choice because it is extremely easy and fast to perform, presents a very low risk to the facial nerve and leaves a barely noticeable scar in a relatively hidden region [22].

Conclusion

This study is an effort to evaluate and compare different special methods in the management of subcondylar fractures with a

mini-plating system by two variant approaches. Group B showed significant improvement in mouth opening at all intervals in comparison to group A. The mini plates with a retromandibular approach are versatile for both high and low subcondylar fractures, while submandibular is versatile for low subcondylar fractures. The retromandibular approach is the best choice compared to the submandibular approach because it is extremely easy and fast to perform, presents a very low risk to the facial nerve, and leaves a barely noticeable scar in a relatively hidden region.

In conclusion, the study compares different methods in the management of subcondylar fractures with a mini-plating system by two variant approaches. The retromandibular approach is preferred over the submandibular approach due to its ease of performance, low risk to the facial nerve, and barely noticeable scar. complications), and this method is recommended for ORIF of condylar fractures [21]. Clinical studies have shown that the retromandibular approach has many advantages: good exposure, minimal scarring, simple manipulation, short operating time, and minimal risk for facial nerve damage. Thus, it is the best choice for treating condylar neck and condylarbase fractures with predictable results [28]. According to a recent study, the preferred surgical approach should allow straightforward fracture management whilst minimizing the risk of potential pitfalls, such as facial nerve lesions or unsightly scars, and the retromandibular approach as compared to the submandibular approach is the best choice because it is extremely easy and fast to perform, presents a very low risk to the facial nerve and leaves a barely noticeable scar in a relatively hidden region [22].

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Conflict of Interest

Declare if any financial interest or any conflict of interest exists.

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