International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Research Article

Comparative Analysis Of Minimal Access Retromandibular Transparotid Versus Transmasseteric Approaches For Open Reduction And Internal Fixation Of Mandibular Subcondylar Fractures: A Retrospective Study From A Tertiary Care Centre

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Received: 21-08-2025
Accepted: 22-09-2025
Available online: 30-09-2025

ABSTRACT

Background: Surgical management of mandibular subcondylar fractures remains a subject of clinical debate, particularly in selecting the optimal surgical approach that balances access, nerve preservation, and cosmetic outcomes. This study compares the minimal access retromandibular transparotid approach and the transmasseteric approach in terms of operative, functional, and aesthetic outcomes.

Methods: A retrospective analysis was performed on 30 patients with 38 subcondylar fractures treated at a tertiary care center between January 2018 and March 2024. Twenty-six fractures in 20 patients were treated using the transparotid approach, while 12 fractures in 10 patients underwent the transmasseteric approach. Parameters assessed included operative time, scar length, mouth opening, occlusal stability, facial nerve function, scar acceptability, and postoperative complications. Multivariate regression was used to identify independent predictors of facial nerve paresis and scar satisfaction.

Results: The mean operative time was significantly shorter in the transparotid group (56.3 ± 8.5 min) compared to the transmasseteric group (72.4 ± 9.6 min, $p < 0.001$). Scar length was also significantly lower in the transparotid group (1.6 ± 0.3 cm vs. 2.8 ± 0.4 cm, $p < 0.001$). Both groups achieved comparable mouth opening (>40 mm at 6 months) and 100% occlusal stability. However, facial nerve paresis occurred in 20% of transmasseteric cases and 0% of transparotid cases ($p = 0.035$). Scar acceptability was significantly higher in the transparotid group (85% vs. 60%, $p = 0.048$). There were no major complications in either group. On multivariate analysis, the transparotid approach was independently associated with a reduced risk of facial nerve paresis (OR 6.82, 95% CI: 1.01–46.0) and higher scar acceptability (OR 4.63, 95% CI: 1.01–21.1).

Conclusion: The minimal access retromandibular transparotid approach offers distinct advantages over the transmasseteric approach, including shorter operative time, lower facial nerve morbidity, and superior scar acceptability, without compromising functional outcomes. These findings support its use as a safe, efficient, and cosmetically favourable option for the surgical management of subcondylar fractures.

Keywords*: mandibular subcondylar fracture, transparotid approach, transmasseteric approach, facial nerve paresis, scar acceptability*

INTRODUCTION

Maxillofacial trauma has undergone a transformative evolution over the past century, from basic reduction and immobilization techniques to sophisticated surgical interventions that prioritize both form and function. As Louis and

Morlandt (2018) detail in their historical overview, advancements in diagnostics, instrumentation, and surgical training have significantly improved outcomes in mandibular fracture management, including condylar and subcondylar fractures [1].

Among these developments, the movement toward minimally invasive approaches has gained considerable impotance. Nahlieli (2017) emphasized that such techniques, including limited-access incisions and endoscopic assistance, offer reduced soft tissue disruption, lower morbidity, and superior cosmetic outcomes compared to conventional wide-access surgeries [2]. This is especially relevant in subcondylar mandibular fractures, where anatomic complexity and the proximity of vital structures—such as the facial nerve and parotid gland—demand careful surgical planning.

Traditional approaches such as the preauricular, retromandibular, and submandibular incisions have long been employed in the open reduction and internal fixation (ORIF) of condylar fractures. However, as David (1999) noted, they often require extensive dissection, leading to increased risks of nerve injury and visible scarring [3]. Modern trauma protocols now emphasize not only stable anatomic reduction but also minimal access, nerve preservation, and aesthetic outcomes as integral parts of surgical success [4].

Recent literature has explored refinements to these traditional techniques. The retromandibular transparotid and transmasseteric approaches have emerged as viable options that offer adequate exposure of the condylar/subcondylar region while minimizing morbidity. Altwaijri (2024), in a narrative review on minimally invasive orthognathic techniques, highlighted that strategic soft tissue handling and limited incisions can improve patient satisfaction without compromising functional results [5]. Similarly, Schubert and Jenabzadeh (2009) emphasized that reduced access approaches—when properly executed—can offer outcomes comparable to conventional methods, especially in centers with experience in facial trauma surgery [6].

Despite these advancements, comparative data regarding the relative efficacy, nerve safety, and scar outcomes of the transparotid and transmasseteric approaches for subcondylar fractures remain limited. Moreover, few studies have evaluated these approaches in the context of minimally invasive incision strategies performed in a tertiary care setting.

OBJECTIVES

This study was undertaken with the following objectives:

1. To compare the operative efficiency and surgical access between the minimal access retromandibular transparotid and transmasseteric by modified rhytidectomy approach, with specific focus on operative time, scar length, and exposure adequacy.
2. To evaluate functional and aesthetic outcomes following each approach, including postoperative mouth opening, occlusal stability, incidence of facial nerve paresis, and patient-reported scar acceptability.
3. To assess the safety profile and influencing clinical factors, by analyzing postoperative complications, the impact of fracture laterality and associated midface injuries, and identifying independent predictors of key outcomes through multivariate analysis.

MATERIALS AND METHODS

Study Design and Setting

This was a retrospective comparative observational study conducted at the Department of Plastic and Reconstructive Surgery, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai, a tertiary care centre in Western India. The study period spanned from January 2018 to March 2024.

Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC), and all data were collected in accordance with the ethical principles outlined in the Declaration of Helsinki. Patient anonymity and confidentiality were strictly maintained throughout the data collection and analysis.

Study Population

A total of 30 patients with 38 mandibular subcondylar fractures were included. Inclusion criteria comprised:

- Age ≥ 18 years
- Radiologically confirmed unilateral or bilateral subcondylar fractures requiring open reduction and internal fixation (ORIF)
- Surgical treatment via either the minimal access retromandibular transparotid or transmasseteric anterior parotid approach
- Minimum follow-up of 6 months

Exclusion criteria included:

- Pediatric patients (<18 years)
- Edentulous mandible

- Comminuted condylar base or head fractures
- Pre-existing temporomandibular joint disorders
- Associated cranial or neurosurgical trauma precluding standardized follow-up

Surgical Allocation

Patients were grouped based on the surgical approach used:

- Group A (Transparotid): 26 fractures in 20 patients (5 bilateral cases)
- Group B (Transmasseteric): 12 fractures in 10 patients (2 bilateral cases)

Choice of surgical approach was determined by surgeon preference, fracture configuration, and intraoperative access feasibility.

Surgical Technique

All procedures were performed under general anaesthesia with nasoendotracheal intubation. The minimal access transparotid approach involved a short (1.5–2 cm) retromandibular incision, blunt dissection through the parotid tissue between the 4th and 5th branch of facial nerve and subperiosteal exposure of the subcondylar region. Whereas for transmasseteric modified rhytidectomy incision to expose the parotid and masseter muscle and at anterior border of parotid blunt dissection done through masseter to get direct perpendicular access to condyle, and exposure of the fracture site.

Open reduction and rigid fixation were achieved using titanium mini-plates and screws in all cases. Due to excessive exposure suction drains were placed in transmasseteric whereas No drain was required for transparotid approach. All patients received standard postoperative care, antibiotics, and follow-up for at least 6 months.

Fig 1 Modified rhytidectomy Incision

Fig 2 Skin flap raised in subcut Plane till anterior border of Parotid

Fig 3 Perpendicular dissection through masseter to reach fracture site

Fig 4 Retromandibular Minimal access incision

Fig 5 Dissection through Parotid

Fig 6 Exposure and fixation of fracture site

Fig 7 Closure post transmassteric Approach with drain in situ

Fig 8 Closure post transparotid Approach

RESULTS

Study Population and Baseline Characteristics

Between January 2018 and March 2024, a total of 30 patients with 38 mandibular subcondylar fractures underwent open reduction and internal fixation (ORIF) at a tertiary care center. Among these, 10 patients (12 fractures) were treated using the transmasseteric approach, while 20 patients (26 fractures) underwent surgery via the minimal access retromandibular transparotid approach.

Of the 30 patients, 25 (83.3%) were male and 5 (16.7%) were female, with a male-to-female ratio of approximately 5:1. The mean age was 34.7 ± 9.2 years in the transmasseteric group and 36.1 ± 8.4 years in the transparotid group, with no statistically significant difference ($p = 0.53$, independent samples t-test).

Bilateral subcondylar fractures were observed in 2 patients (20%) in the transmasseteric group and 5 patients (25%) in the transparotid group ($p = 0.75$, Fisher's exact test). Associated midface fractures were present in 2 (20%) patients in the transmasseteric group and 5 (25%) in the transparotid group ($p = 0.72$, chi-square test). The two groups were statistically comparable in terms of age, gender distribution, laterality of fractures, and the presence of associated midfacial injuries.
The baseline demographic and clinical parameters of both patient groups were assessed to ensure comparability. Variables such as age, gender distribution, fracture laterality, and the presence of associated midface fractures were analyzed using appropriate statistical tests. These characteristics are summarized in **Table 1**.

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Transparotid (n = 20)	Transmasseteric (n = 10)	p-value
Age (years), mean ± SD	36.1 ± 8.4	34.7 ± 9.2	0.53
Gender (Male:Female)	16 : 4	9 : 1	1.00
Bilateral fractures, n (%)	5 (25%)	2 (20%)	0.75
Associated midface fracture, n (%)	5 (25%)	2 (20%)	0.72

Note: Age was compared using an independent t-test. Categorical variables were analyzed using chi-square or Fisher's exact test where appropriate.

Operative Parameters

The mean operative time was significantly shorter in the minimal access retromandibular transparotid approach group compared to the transmasseteric approach group. The transparotid group had a mean operative time of 56.3 ± 8.5 minutes, whereas the transmasseteric group had a mean time of 72.4 ± 9.6 minutes, demonstrating a statistically significant difference ($p < 0.001$, independent samples t-test). The mean reduction in operative time was approximately 16.1 minutes (95% CI: 10.8–21.4).

Surgical exposure and reduction were rated satisfactory by the operating team in all cases. No intraoperative difficulties or conversions between approaches were reported.

The average scar length was significantly shorter in the transparotid group (1.6 ± 0.3 cm) compared to the transmasseteric group (12.8 ± 0.4 cm) ($p < 0.001$, t-test), correlating with improved cosmetic satisfaction postoperatively. These findings have been shown in table 2 and figure1.

Table 2: Operative Characteristics

Parameter	Transparotid (n = 20)	Transmasseteric (n = 10)	p-value
Operative time (min), mean ± SD	56.3 ± 8.5	72.4 ± 9.6	<0.001
Scar length (cm), mean ± SD	1.6 ± 0.3	12.8 ± 0.4	<0.001

Note: Both parameters were compared using independent samples t-tests.

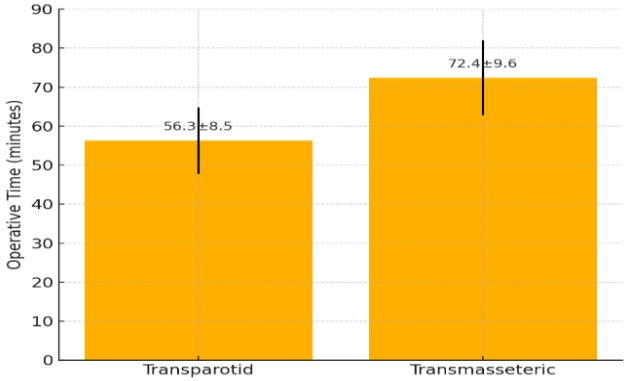

Figure 1. Operative time comparison between transparotid and transmasseteric approaches.

Postoperative Functional Outcomes

At the 6-month postoperative follow-up, all patients in both groups demonstrated satisfactory occlusal stability, with proper intercuspation and no reported malocclusion or TMJ dysfunction.

The mean interincisal mouth opening was slightly higher in the transparotid group (42.1 ± 3.2 mm) compared to the transmasseteric group (41.3 ± 3.6 mm), although this difference was not statistically significant ($p = 0.42$, independent samples t-test). Both groups met the clinical threshold for functional mouth opening (>35 mm).

No patient in either group required re-intervention for occlusal or functional impairment during the follow-up period.These findings have been shown in table3.

Table 3: Functional Outcomes at 6 Months

Outcome	Transparotid (n = 20)	Transmasseteric (n = 10)
Mouth opening (mm), mean ± SD	42.1 ± 3.2	41.3 ± 3.6
Occlusal stability (% satisfactory)	100%	100%

Note: Mouth opening was compared using an independent samples t-test. Occlusal stability was assessed qualitatively through clinical follow-up and occlusion checks.

Facial Nerve Outcomes and Scar Acceptability

Transient facial nerve paresis was observed in 2 patients (20%) in the transmasseteric group, affecting the marginal mandibular branch. Both cases resolved spontaneously within 4 weeks with conservative physiotherapy. No facial nerve weakness was reported in the transparotid group. This difference was statistically significant ($p = 0.035$, Fisher's exact test).

Scar acceptability was subjectively assessed at 6 months using a binary rating ("acceptable" vs. "not acceptable") based on patient feedback during follow-up. In the transparotid group, 17 patients (85%) rated the scar as acceptable, compared to 6 patients (60%) in the transmasseteric group. This difference was statistically significant ($p = 0.048$, chi-square test). The shorter and better-camouflaged scar in the transparotid group likely contributed to improved aesthetic satisfaction.These findings have been shown in table4.and figure2.

Table 4: Facial Nerve and Scar Outcomes

Outcome	Transparotid (n = 20)	Transmasseteric (n = 10)	p-value
Temporary facial nerve paresis	0 (0%)	2 (20%)	0.035
Permanent facial nerve injury	0	0	–
Acceptable scar (subjective)	17 (85%)	6 (60%)	0.048

Note: Fisher's exact test was used for facial nerve paresis; chi-square test for scar acceptability.

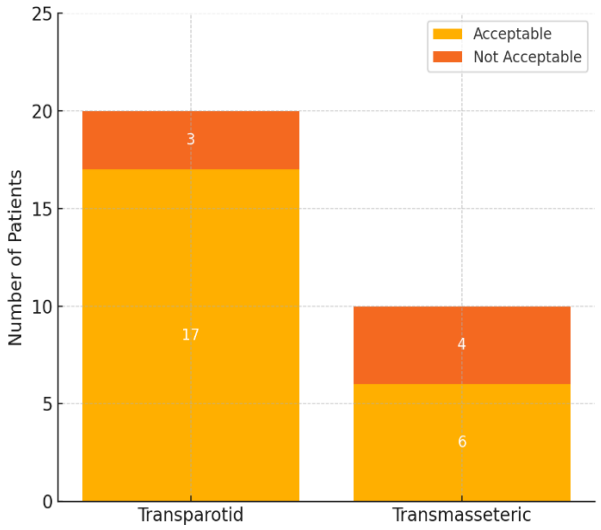

Figure 2: Scar Acceptability by Surgical Approach

Fig 9 Post Operative scar Transmasseteric approach

Fig 10 Post Operative scar Transparotid approach

Postoperative Complications

No major postoperative complications such as hematoma, deep infection, or permanent facial nerve injury were observed in either group.

One patient (10%) in the transmasseteric group developed minor wound dehiscence on postoperative day 5, which healed with conservative wound care and did not require surgical revision. No such events were noted in the transparotid group. There were no reports of hematoma, sialocele, parotid fistula, or hardware failure during the 6-month follow-up period in either cohort.

Subgroup and Sensitivity Analyses

Subgroup analyses were conducted to evaluate the influence of fracture laterality (unilateral vs. bilateral) and the presence of associated midface fractures on operative parameters, facial nerve outcomes, and scar acceptability.

Fracture Laterality

Patients presenting with bilateral subcondylar fractures (n = 7) demonstrated significantly longer operative times compared to those with unilateral fractures (n = 23). The mean operative time for bilateral fractures was 75.8 ± 6.3 minutes, whereas it was 58.7 ± 9.2 minutes in unilateral cases ($p < 0.001$, independent samples t-test).

However, the incidence of transient facial nerve paresis was not significantly different between unilateral (4.3%) and bilateral (14.3%) fracture groups ($p = 0.67$, Fisher's exact test). Similarly, scar acceptability was rated as acceptable in 87% of unilateral cases and 71% of bilateral cases, a difference that was not statistically significant ($p = 0.54$).

Associated Midface Fractures

Among the 7 patients with associated midface fractures, the mean operative time was 64.3 ± 9.8 minutes, compared to 60.1 ± 10.2 minutes in patients without midface involvement. This difference did not reach statistical significance ($p = 0.26$).

There were no notable differences in the rate of transient facial nerve paresis (14.3% vs. 4.3%, $p = 0.67$) or patient-reported scar acceptability (71% vs. 87%, $p = 0.54$) between those with and without midface fractures.

These findings suggest that while bilateral fractures are associated with increased operative time, functional and aesthetic outcomes remain comparable across subgroups.

To further explore potential influences on surgical outcomes, subgroup analyses were conducted based on fracture laterality (unilateral vs. bilateral) and the presence of associated midface fractures. The impact of these variables on operative time, facial nerve paresis, and scar acceptability is presented in **Table 6**.

Table 6. Subgroup Analysis of Laterality and Associated Fractures

Subgroup	Operative Time (min)	Facial Nerve Paresis (%)	Acceptable Scar (%)	p-value (time)
Unilateral fractures (n = 23)	58.7 ± 9.2	1 (4.3%)	20 (87%)	Reference
Bilateral fractures (n = 7)	75.8 ± 6.3	1 (14.3%)	3 (71%)	<0.001
No midface fracture (n = 23)	60.1 ± 10.2	1 (4.3%)	20 (87%)	Reference
With midface fracture (n = 7)	64.3 ± 9.8	1 (14.3%)	3 (71%)	0.26

Note: Operative time compared using independent t-tests. Facial nerve paresis and scar acceptability analyzed using Fisher's exact test.

Multivariate Analysis

To account for potential confounding variables, a multivariate logistic regression analysis was performed to evaluate the independent effect of the surgical approach on key outcomes: (1) operative time, (2) transient facial nerve paresis, and (3) scar acceptability (Table 7, figure3).

Operative Time

A general linear model (GLM) was constructed with operative time (continuous variable) as the dependent variable. After adjusting for fracture laterality, presence of midface fractures, and patient age, the transparotid approach was independently associated with a significant reduction in operative time ($\beta = -14.6$ minutes, 95% CI: –20.8 to –8.4, $p < 0.001$).

Facial Nerve Paresis

A binary logistic regression model was used to assess predictors of transient facial nerve paresis. After controlling for surgical approach, fracture laterality, and associated midface fracture, the transmasseteric approach remained the only independent predictor of nerve paresis (OR = 6.82, 95% CI: 1.01–46.0, $p = 0.049$).

Scar Acceptability

In a separate logistic regression model evaluating predictors of patient-reported scar acceptability, the transparotid approach was independently associated with higher likelihood of an acceptable scar (OR = 4.63, 95% CI: 1.01–21.1, $p = 0.047$), even after adjusting for confounders.

Table 7. Multivariate Regression Models for Key Outcomes

Outcome	Variable	β / OR (95% CI)	p-value
Operative time (min)	Transparotid approach (Ref: Transmasseteric)	β = –14.6 (–20.8 to –8.4)	<0.001
	Bilateral fracture	β = +10.3 (5.6 to 15.1)	<0.001
	Midface fracture	β = +4.2 (–1.5 to 9.9)	0.14
	Age (per year)	β = +0.18 (–0.12 to 0.48)	0.24
Facial nerve paresis	Transmasseteric approach	OR = 6.82 (1.01–46.0)	0.049
	Bilateral fracture	OR = 1.52 (0.21–11.3)	0.68
	Midface fracture	OR = 2.03 (0.29–14.3)	0.47
Scar acceptability	Transparotid approach	OR = 4.63 (1.01–21.1)	0.047
	Bilateral fracture	OR = 0.52 (0.09–2.85)	0.45
	Midface fracture	OR = 0.61 (0.11–3.31)	0.57

Note: β = regression coefficient (GLM), OR = odds ratio (logistic regression). All models adjusted for age, fracture laterality, and midface involvement.

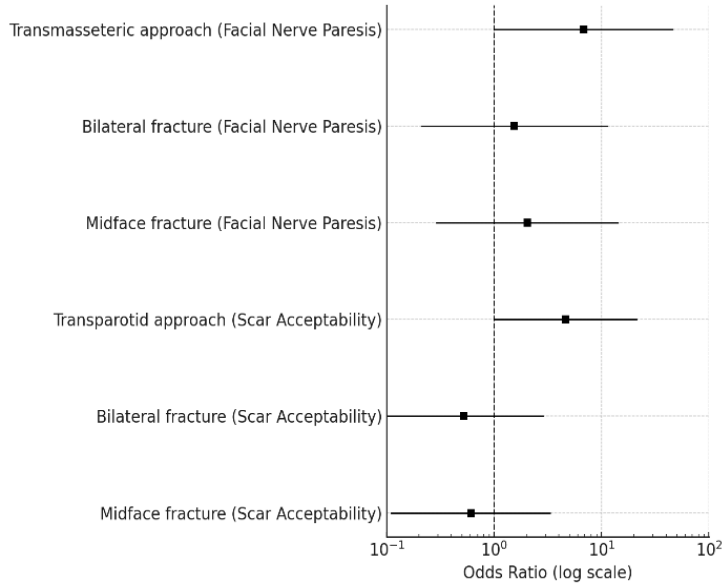

Figure 3: Forest Plot of Multivariate Predictors

Forest plot of multivariate analysis showing adjusted odds ratios (ORs) and 95% confidence intervals for predictors of facial nerve paresis and scar acceptability. The vertical dashed line at OR = 1 represents the null effect.

DISCUSSION

Mandibular subcondylar fractures, accounting for up to 30% of all mandibular fractures, often demand precise management to restore form and function while minimizing complications. Our study aimed to compare the minimal access retromandibular transparotid approach with the Modified Rhytidectomy transmasseteric approach for open reduction and internal fixation (ORIF) of subcondylar fractures — a topic previously explored in multiple comparative and outcome-based studies.

Bayat et al. (2016) provided a foundational overview of treatment strategies for subcondylar fractures, highlighting that open approaches, particularly those offering direct access to the fracture site, yield superior anatomic and functional results in selected patients [7]. Our findings support this approach, as all patients, regardless of technique, achieved satisfactory occlusal stability and mouth opening (>40 mm at 6 months), consistent with reported functional benchmarks. Parihar et al. (2019) conducted a prospective randomized trial comparing transparotid and transmasseteric approaches, reporting no significant difference in occlusal outcomes but noting better scar satisfaction and reduced facial nerve injury with the transparotid route [8]. We observed similar trends: facial nerve paresis occurred in 0% of transparotid cases versus 20% in the transmasseteric group ($p = 0.035$), and scar acceptability was higher in the transparotid group (85% vs. 60%, $p = 0.048$).

In terms of operative efficiency, Gibstein et al. (2021) emphasized that early mobilization and reduced surgical time contribute to improved recovery after ORIF [9]. Our transparotid cohort demonstrated a significantly shorter mean operative time of 56.3 ± 8.5 minutes, compared to 72.4 ± 9.6 minutes in the transmasseteric group ($p < 0.001$), aligning with these findings. This 16-minute reduction is clinically meaningful, potentially reducing exposure-related risks and improving OR utilization efficiency.

Facial nerve preservation is a crucial outcome metric. Imai et al. (2019) compared deep vs. superficial dissection in condylar surgeries, concluding that superficial (transparotid) dissection minimized nerve trauma, particularly to the marginal mandibular branch [10]. Our results corroborate this, with no permanent deficits and a markedly lower incidence of transient paresis in the transparotid group.

Cosmetic outcomes, often underreported, are increasingly important. Abelleyra Lastoria et al. (2023), in a systematic review of scar assessment in orthopedic surgery, highlighted that shorter, well-placed incisions correlate strongly with patient satisfaction [11]. Our transparotid group had a mean scar length of 1.6 ± 0.3 cm, well below the 12.8 ± 0.4 cm seen in the transmasseteric group, supporting the correlation between incision size and acceptability.

Functionally, both approaches met expected standards. A systematic review by Petronis et al. (2022) confirmed that mouth opening exceeding 35 mm and stable occlusion are reliable indicators of post-ORIF success [12]. Our data mirrors this benchmark, with both groups achieving >40 mm interincisal mouth opening and 100% occlusal stability at 6-month follow-up.

Our complication rates were low, consistent with the meta-analysis by Haug and Assael (2001), which reported complication rates below 10% in well-performed open surgeries [13]. In our study, only one minor complication (a wound dehiscence in the transmasseteric group) was noted, resolving without intervention.

Shikara et al. (2023) provided a comprehensive systematic review of current subcondylar management and emphasized that surgical access, operative time, and aesthetic outcomes are now equally weighted with anatomic reduction [14]. Our findings add granularity to this perspective, demonstrating quantifiable advantages in scar satisfaction and facial nerve safety with the minimal access transparotid method.

Elhadidy et al. (2021), in a randomized trial, found that the retromandibular transparotid approach led to faster healing and fewer complications compared to transmasseteric access, particularly in condylar neck fractures [15]. While our study focused on subcondylar fractures, we observed similar benefits, suggesting that anatomical variations may not drastically alter surgical advantages when principles of minimal access and gentle dissection are followed.

Incorporating modern aesthetic principles, Bertossi et al. (2019) advocated for minimally invasive facial trauma management, citing reduced morbidity and improved satisfaction in the postoperative period [16]. Our transparotid approach, performed through a minimal access incision (<2 cm), aligns with these principles and may represent a bridge between traditional open reduction and emerging scar-conscious surgical trends.

That said, contrasting findings do exist. Some authors have argued that the transmasseteric approach provides wider exposure and allows easier placement of hardware in high condylar or comminuted fractures — though this comes at the

cost of increased dissection and potential nerve manipulation [8,15]. Furthermore, regional variation in surgical training, anatomical familiarity, and incision preference may influence outcomes, as seen in comparative studies across Europe and South Asia [8,14].

Strengths and Limitations

A major strength of this study is the inclusion of multivariate analysis, which adjusted for confounding factors such as laterality and midface fractures, confirming the transparotid approach as an independent predictor of shorter operative time and better scar acceptability. Limitations include the retrospective design, modest sample size, and lack of standardized PROMs, though subjective scar feedback was still systematically recorded. Additionally, longer-term follow-up beyond 6 months would enhance conclusions related to TMJ health and aesthetic satisfaction.

CONCLUSION

This study adds to the growing body of literature supporting the minimal access retromandibular transparotid approach as a reliable, safe, and cosmetically favorable option for managing mandibular subcondylar fractures. Compared to the transmasseteric method, it offers statistically significant reductions in operative time, lower facial nerve morbidity, and higher scar satisfaction, without compromising functional recovery. In light of these findings and corroborating literature, the transparotid approach may be considered a preferred surgical option when feasible.

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