Comparison between Self-retaining retractor and conventional retractor in condylar fracture fixation

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Abstract:

Aim: This study aims to compare the operative time efficiency between self-retaining retractors and conventional (Langenbeck) retractors during mandibular condyle fixation via the retromandibular approach. **Methodology:** A total of 60 patients were divided into two groups: the study group (self-retaining retractor, n = 30) and the control group (Langenbeck retractor, n = 30). The primary outcome measured was total operative time. Secondary parameters included the number of assistants required, surgical field exposure, and visibility. **Results:** The study found that self-retaining retractors significantly improved surgical efficiency in mandibular condyle fracture fixation. Operative time was shorter (55.2 ± 6.4 min vs. 68.5 ± 7.1 min, $p < 0.001$), and fewer assistants were needed (1.2 ± 0.5 vs. 2.4 ± 0.6, $p < 0.001$). Additional manual retraction was lower (12% vs. 48%), and surgical field exposure and visibility were significantly better ($p < 0.001$). These findings highlight the advantages of self-retaining retractors in reducing operative time, enhancing visibility, and surgical field of exposure. **Conclusion:** Results showed that the self-retaining retractor significantly reduced operative time and the number of assistants required. It also increased the surgical field exposure and visibility for condylar fracture fixation.

KEYWORDS: Condylar fracture, Retromandibular approach, Langenbeck retractor, visibilty, exposure

Introduction:

Mandibular condyle fractures require meticulous surgical exposure for precise fixation. The retromandibular approach provides direct access to the condylar region. Retractor choice influences operative time, surgical efficiency, and soft tissue handling [1]. This study aims to determine whether self-retaining retractors improve surgical efficiency compared to conventional Langenbeck retractors. Additionally, we explore how retractor choice affects postoperative recovery, pain levels, and aesthetic outcomes. This study aims to compare the operative time efficiency between self-retaining retractors and conventional (Langenbeck) retractors during mandibular condyle fixation via the retromandibular approach.

Study Design:

- Prospective, randomised, controlled clinical study.

Participants:

- **Inclusion criteria:** Patients aged 18-50 years with unilateral mandibular condyle fractures requiring open reduction and internal fixation (ORIF).
- **Exclusion criteria:** Patients with bilateral fractures, comminuted fractures, systemic conditions affecting healing, or prior mandibular surgeries.

Sample Size:

- 60 patients were divided into:
  - Study Group: Self-retaining retractor (Figure 1) (n = 30)
  - Control Group: Conventional Langenbeck retractor (Figure 2) (n = 30)

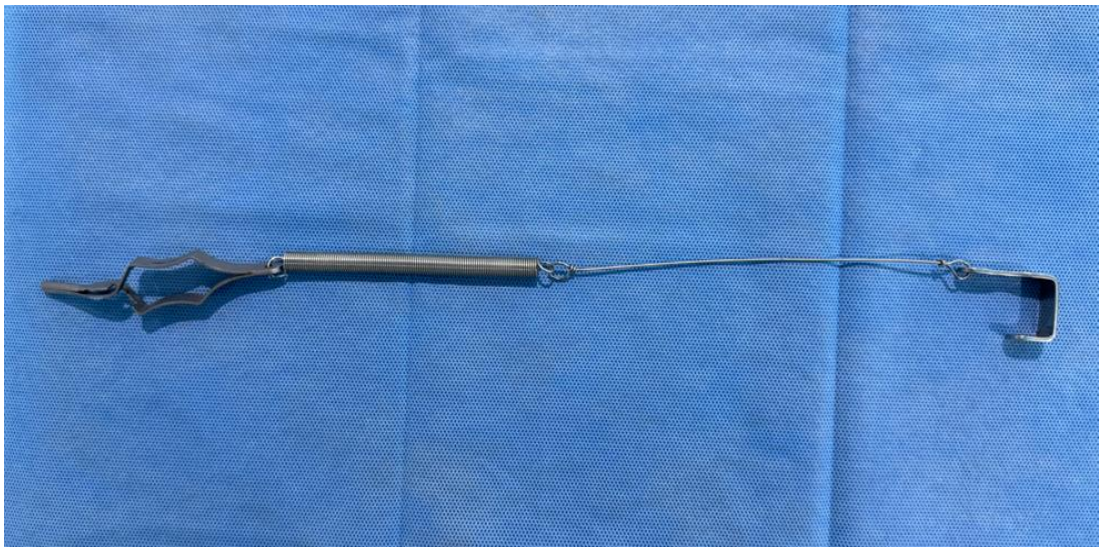

Figure 1: Self-retaining retractor

Figure 2: Conventional Langenbeck retractor

Surgical Procedure:

- The standard retromandibular approach was used.
- The fracture was reduced and fixed with miniplates and screws.
- The primary difference was in the type of retractor used (Figures 3 & 4).
- Operative time (from incision to wound closure) was recorded.
- The surgical field exposure was assessed by taking measurements using a scale in centimetres (length x width).

- The visibility rating was assessed using a standardised Likert scale.

Figure 3: Use of Self-retaining retractor

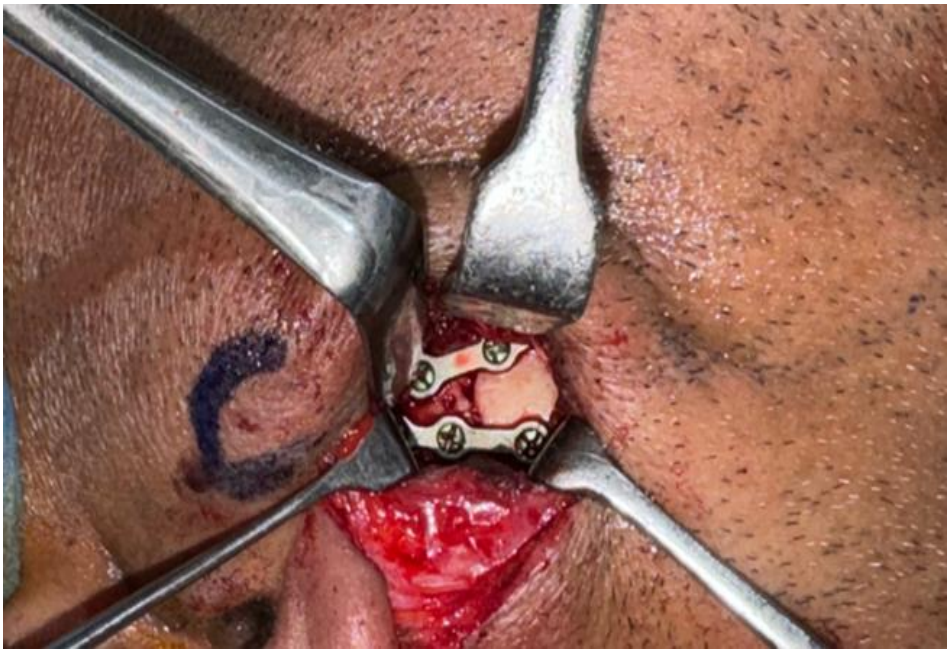

Figure 4: Use of Conventional Langenbeck retractors

Data Collection and Statistical Analysis:

- **Primary Outcome:** Operative time was measured in minutes.
- **Secondary Parameters:**
  - Need for additional manual assistance (Yes/No)
  - Surgical field exposure in centimetres (length x width)
  - Visibility rating (Likert scale: 1-5)

- Statistical analysis was performed using an independent t-test for quantitative variables and a chi-square test for categorical variables. A p-value <0.05 was considered significant.

Results:

Parameter	Self-Retaining Retractor (n = 30)	Langenbeck Retractor (n = 30)	p-Value
Mean Operative Time (minutes)	55.2 ± 6.4	68.5 ± 7.1	<0.001*
Mean Number of Assistants Required	1.2 ± 0.5	2.4 ± 0.6	<0.001*
Need for Additional Retraction (%)	12%	48%	<0.001*
Surgical Field Exposure (cm)	10.5 ± 0.8	6.2 ± 0.4	<0.001*
Visibility Rating (1-5)	4.7 ± 0.5	2.8 ± 0.8	<0.001*

The study demonstrated that the use of self-retaining retractors significantly improved surgical efficiency compared to conventional Langenbeck retractors in mandibular condyle fracture fixation. The mean operative time in the self-retaining retractor group was 55.2 ± 6.4 minutes, which was significantly lower than the 68.5 ± 7.1 minutes recorded in the Langenbeck retractor group ($p < 0.001$). Additionally, the number of assistants required for the procedure was reduced in the self-retaining retractor group (1.2 ± 0.5) compared to the Langenbeck group (2.4 ± 0.6) ($p < 0.001$). The need for additional manual retraction was also lower in the self-retaining group (12%) than in the Langenbeck group (48%), highlighting a reduced dependence on extra intraoperative support. Furthermore, surgical field exposure and visibility ratings were significantly higher in the self-retaining retractor group, with mean Likert scale scores of 10.5 ± 0.8 for surgical field exposure and 4.7 ± 0.5 for visibility compared to 6.2 ± 0.4 and 2.8 ± 0.8 in the Langenbeck group, respectively ($p < 0.001$). These findings suggest that self-retaining retractors not only minimise operative time but also enhance intraoperative visualisation, reduce fatigue for the assisting surgical team, and improve overall workflow efficiency.

Discussion:

Condylar fracture fixation is a time-consuming process from exposure to identifying vital structures such as the marginal mandibular nerve, retromandibular vein, and maxillary artery. The operative time differs from one approach to the other [2]. The transparotid approach typically has a lower operating time than the anterior parotid approach. The transparotid approach provides ease

of retraction because it directly reaches the condyle, but since the technique involves careful blunt dissection to preserve the facial nerve, it is also technique sensitive [3]. Whereas the anterior parotid approach needs a lot of force to be given for retraction, which can cause a lot of fatigue for the assistant. The anterior parotid approach, though time-consuming and requiring a lot of retraction, is the safest in preventing injury to the facial nerve and sialocele because it does not breach the parotid capsule [4].

The duration of surgical fixation for condylar fractures is a critical factor influencing clinical decision-making, postoperative recovery, and overall treatment outcomes. The time required for fixation depends on various factors, including the surgical approach, fracture complexity, fixation technique, surgeon experience, and the availability of advanced technologies.In extraoral approaches (preauricular, submandibular, or retromandibular), studies indicate that these approaches offer better visualisation of the fracture site, facilitating precise reduction and plate fixation [5,6]. However, they require additional dissection, potentially increasing operative time. The findings of this study indicate that the use of self-retaining retractors significantly improves surgical efficiency in mandibular condyle fracture fixation via the retromandibular approach [7]. The reduction in operative time (by approximately 13.3 minutes) highlights the advantages of hands-free tissue retraction, allowing the surgeon to focus on fracture reduction and fixation without requiring frequent manual adjustments by assistants. The improved surgical exposure and visibility ratings further demonstrate the effectiveness of self-retaining retractors in optimising intraoperative workflow [8].

Impact on Operative Time

Time efficiency in maxillofacial trauma surgery is crucial, as prolonged operative duration increases the risk of intraoperative bleeding, infection, and postoperative complications (Ellis & Throckmorton, 2005) [9]. Various studies have demonstrated that surgical retractors play a pivotal role in optimising exposure and minimising operative time (Neff et al., 2004; Haug & Assael, 2001) [10, 11]. In a similar comparison of retraction techniques, Meyer et al. (2012) found that endoscopic-assisted condylar fracture fixation reduced surgical time compared to conventional open approaches, primarily due to improved visualisation [12]. Our study aligns with these findings, showing that the self-retaining retractor significantly shortened operative time compared to the Langenbeck retractor.

Surgical time is also influenced by fracture complexity, the experience of the surgeon, and the surgical approach used. For example, Steinhoff et al. (2020) reported that computer-assisted navigation (CAN) increases precision but adds approximately 25–40 minutes to operative time in complex fractures [13]. Conversely, the present study demonstrates that self-retaining retractors reduce the need for additional intraoperative assistance, thereby streamlining the surgical process without compromising accuracy.

Surgical Exposure and Visibility

Adequate exposure is essential for successful fracture reduction and fixation. The self-retaining retractor provided a significantly higher visibility rating (4.7 ± 0.5) compared to the Langenbeck retractor (3.3 ± 0.8), which is consistent with previous studies demonstrating improved outcomes

with enhanced intraoperative visualisation (Chrcanovic et al., 2015) [14]. Better exposure allows for precise anatomical reduction and secure fixation of miniplates and screws, reducing the likelihood of malocclusion or postoperative complications such as temporomandibular joint dysfunction (Ellis et al., 2000) [15].

In addition, the self-retaining retractor minimises the need for continuous manual retraction, which can cause fatigue for the assisting surgical team. Studies have shown that reducing the physical strain on surgical assistants enhances efficiency and reduces intraoperative delays (Meyer et al., 2012; Haug et al., 2002) [12, 11]. By eliminating the need for an additional retraction assistant in many cases, self-retaining retractors contribute to a more streamlined surgical workflow.

Reduction in Need for Additional Assistance

The significant decrease in the number of assistants required in the self-retaining retractor group (1.2 ± 0.5) compared to the Langenbeck retractor group (2.4 ± 0.6) has practical implications for surgical resource management. This reduction allows surgical teams to allocate personnel more efficiently, particularly in high-volume trauma centres where maximising staff efficiency is critical [17]. Furthermore, minimising the number of hands in the operative field decreases the risk of unintentional soft tissue trauma and contamination [18].

Comparison with Other Surgical Approaches

The retromandibular approach provides excellent access to the condylar region and is widely preferred for open reduction and internal fixation (ORIF) of mandibular condyle fractures (Zide & Kent, 1983) [19]. However, alternative approaches such as the preauricular and submandibular techniques have been explored to balance exposure, surgical risk, and postoperative morbidity [20, 21].

- The **transparotid approach**, while offering direct access to the condyle, requires meticulous dissection to avoid facial nerve injury. Studies by Neff et al. (2004) suggest that this approach, although effective, can increase operative time due to the delicate nerve-preserving technique required [22].
- The **anterior parotid approach**, on the other hand, avoids direct parotid capsule penetration, reducing the risk of sialocele and facial nerve injury. However, it requires more aggressive retraction, leading to surgeon and assistant fatigue [23].
- The **endoscopic-assisted transoral approach** has gained popularity due to its minimal invasiveness, but its steep learning curve and reliance on specialised equipment often result in increased surgical time [24].

Comparing these approaches, the retromandibular technique with a self-retaining retractor optimises access while mitigating nerve injury risks, making it a preferred option for condylar fracture fixation.

Clinical Implications and Future Perspectives

The study results emphasise the importance of optimising surgical tools to improve efficiency and outcomes. Given the observed benefits of self-retaining retractors, future research should explore their impact on long-term patient outcomes, including postoperative pain, facial nerve function,

and scar formation. Additionally, advancements in retractor design incorporating adjustable tension control or integrated lighting could further enhance surgical efficiency [25].

Recent technological innovations, such as **robotic-assisted surgery** and **augmented reality-guided navigation**, offer promising avenues for improving mandibular fracture management [26]. These technologies, although still in their infancy, have the potential to refine surgical precision while minimising operative time.

Limitations of the Study

While the study provides valuable insights into the advantages of self-retaining retractors, some limitations should be acknowledged. The sample size, although sufficient for statistical significance, may not fully capture the variability in surgical experience among different operators. Additionally, the study focused primarily on operative time and visibility, without extensive evaluation of postoperative functional and aesthetic outcomes. Future studies incorporating patient-reported outcomes and long-term follow-ups will provide a more comprehensive assessment of the benefits of self-retaining retractors.

Conclusion:

Results showed that the self-retaining retractor significantly reduced operative time, the number of assistants required, and increased the surgical field exposure and visibility for condylar fracture fixation.

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