

# Indications of Titanium Mini-Plate Removal in Maxillofacial Trauma Patients

Titanium Mini-Plate Removal in Maxillofacial Trauma

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## ABSTRACT

**Objective:** To examine the frequency of indications for the removal of mini-plates in individuals with maxillofacial trauma.

**Study Design:** Prospective study

**Place and Duration of Study:** This study was conducted at the oral and maxillofacial surgery, Nishtar Institute of Dentistry, Multan, from January to December 2021.

**Methods:** A total of 172 patients enrolled in study who was admitted for titanium miniplate removal, implanted for fixation after maxillofacial trauma. The collected data includes information on patients' age, gender, the indication behind miniplate removal, the specific anatomical site of removal, the duration between the initial surgery and miniplate removal.

**Results:** The most common fracture site was mandible 84.9% followed by maxilla 6.4%, mandible and maxilla 4.6% and least common fracture site was zygomaticomaxillary complex 4.1%. Duration of manipulates removal was below 1 year in 79% patients, 1-2 years in 9.8% patients and 11.2% were having duration above 2 years. The most common reason for plate removal demand of patients as 76.7% followed by exposure 5.2%, prosthetic rehabilitation 4.7%, extraction of tooth 4.7%, screw loosening 3.5%, pain 3.5% and infection 1.7%.

**Conclusion:** The primary factor leading to the removal of plates is patient preference, with exposure being the second most common reason. Rates of removal due to miniplate exposure or inflammation are consistent with previous reports, and there is insufficient evidence to advocate for the routine removal of titanium mini-plates.

**Key Words:** Miniplates removal, Maxillofacial trauma, Indication, Fracture site, Duration of removal

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## INTRODUCTION

The use of mini-plates in maxillofacial or oral surgery gained traction since their introduction in the 19<sup>th</sup> century, with increased utilization following Champy et al.'s<sup>1</sup> introduction of a surgical technique involving mini-plates in 1978, specifically for the management of trauma patients with maxillofacial injury and orthognathic surgery<sup>2</sup>. Titanium is frequently chosen for mini-plates due to its superior biocompatibility and physical properties compared to other metals; however, complications like metal toxicity<sup>3</sup>, allergy, stress shielding, metalloids, migration, palpability, and thermal sensitivity have been reported, leading to

ongoing debate about the appropriate removal of this mini-plates<sup>4</sup>.

The ongoing debate surrounding the recommendation to retain or remove miniplates after jaw surgery is fueled by concerns over complications such as plate loosening, infection and exposure of plate, which are common reasons for removal due to their potential to lead to serious consequences<sup>5</sup>. Infections, if left unaddressed, may necessitate removal to prevent further complications, while the compromise of stability and the potential for discomfort or pain resulting from plate loosening and exposure are additional factors supporting removal<sup>6</sup>. However, the act of removal itself poses risks, including pain, an increased risk of infection, and reduced stability. Furthermore, in some studies an extra problem was reported like miniplate act like a granulomas of foreign body or facial nerve entrapment<sup>7</sup>.

Miniplates and screws, commonly employed for stabilizing fractured bones, offer both positive and negative outcomes<sup>8</sup>. On the positive side, these devices play a vital role in maintaining bone alignment, expediting the healing process, and restoring normal function by counteracting forces on the fractured bone, enabling quicker mobility recovery compared to traditional methods<sup>9</sup>. However, the decision to remove these miniplates post bone healing, though seeming beneficial for reducing discomfort, infection risks, and

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stress-induced bone weakening, introduces its own set of complexities in orthopedics<sup>10,11</sup>.

Researchers' recommendations on the removal of miniplates vary, with some suggesting removal in general, while others advise against it unless clinical symptoms arise; a clear consensus is lacking, and recent studies have yielded controversial findings, reporting removal rates ranging from 7% to 33.8%<sup>12</sup>.

This study contributes to the development of evidence-based guidelines for maxillofacial trauma management, helping clinicians make informed decisions regarding the necessity of mini-plate removal.

**METHODS**

Study was conducted at department of oral and maxillofacial surgery, Nishtar Institute of Dentistry, Multan, from January to December 2021. The department received one hundred and seventy-two patients experiencing clinical symptoms or complications at previously operated sites, warranting miniplate removal, following ethical approval from the Institutional Review Board and obtaining informed consent from all patients. The collected data includes information on patients' age, gender, the indication behind miniplate removal, the specific anatomical site of removal, the duration between the initial surgery and miniplate removal.

The study investigated various reasons for the removal of miniplates, categorizing them into distinct groups such as pain, patient's request, asymptomatic miniplate exposure, infection, prosthetic rehabilitation, pediatric trauma, and other factors. The removal sites encompassed both the mandible and midface. To discern patterns, the Chi-square test was employed to analyze correlations between indications for miniplate removal concerning time gap, metallic composition, age group, and the number of miniplates present. Additionally, the study examined the correlation between the metallic composition of miniplates and the time gap for removal using the Chi-square test.

**RESULTS**

Overall, 172 patients were included in this study. The average age of the patients was 33.76±3.91 years. There were 109 (63.4%) males and 63 (36.6%) females. (Table. I).

The most common fracture site was mandible 146 (84.9%) followed by maxilla 11 (6.4%), mandible and maxilla 8 (4.6%) and least common fracture site was zygomaticomaxillary complex 7 (4.1%). Duration of manipulates removal was below 1 year in 135 (79%) patients, 1-2 years in 17 (9.8%) patients and 20 (11.2%) were having duration above 2 years (Table. II).

The most common reason for plate removal demand of patients as 132 (76.7%) followed by exposure 5.2%, prosthetic rehabilitation 4.7%, extraction of tooth 4.7%,

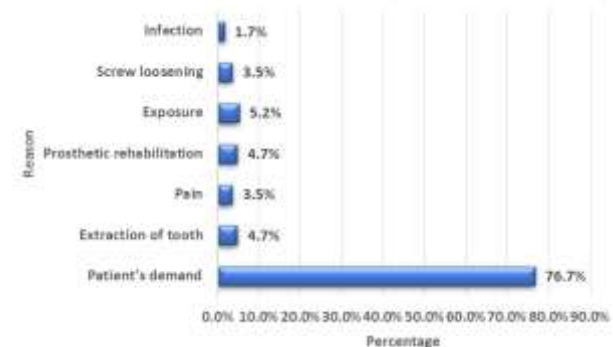
screw loosening 3.5%, pain 3.5% and infection 1.7%. (Figure. I).

**Table. No. 1: Demographic characteristics of the study patients**

Characteristic	Presence
Age (years)	33.76±3.91
Gender	
Male	109 (63.4)
Female	63 (36.6)
Mean ± S.D, N (%)	

**Table No. 2: Fracture site in plate removal of the study patients**

Fracture site	N (%)
Mandible	146 (84.9)
Maxilla	11 (6.4)
Mandible and maxilla	8 (4.6)
Zygomaticomaxillary complex	7 (4.1)
Duration between miniplate insertion and removal	
Below 1 year	135 (79%)
1-2 years	17 (9.8%)
Above 2 years	20 (11.2%)



**Figure No. 1: Reason for plate removal of the study patients**

**DISCUSSION**

The removal of mini-plates in various studies lacks a clear consensus, with some researchers advocating for removal based on clinical symptoms, while others argue against it, citing factors such as biocompatibility, low complication rates, risks of general anesthesia, potential damage to adjacent structures, and the associated expenses<sup>13</sup>. Contrarily, proponents of mini-plate removal contend that these devices may act as foreign objects, posing a risk of complications, and emphasize concerns about growth restrictions, particularly among pediatric patients<sup>14</sup>.

In this study average age of the patients was 33.76±3.91 years. There were 63.4% males and 36.6% females. In the study conducted by Melek et al<sup>15</sup>, the research findings revealed a notable gender distribution among the patient population, with a significant majority being males. Specifically, out of the total cases examined, 20 individuals, constituting a substantial 71.43%, were reported to be male. Park et al<sup>16</sup> conducted a study

comprising 120 patients, of which 94 (78.3%) were men and 26 (21.7%) were women, with an average age of approximately 29.2 years (range, 13-79 years). The study population included 39 patients (32.5%) aged 10 to 19 years, followed by 33 patients (27.5%) aged 20 to 29 years.

Duration of manipulates removal was below 1 year in 79% patients, 1-2 years in 9.8% patients and 11.2% were having duration above 2 years. Haug et al<sup>17</sup>, in a previous study, recommended the removal of mini-plates in pediatric patients within two to three months following fracture surgery, citing concerns about the potential risk of growth restriction.

In this study most common fracture site was mandible 84.9% followed by maxilla 6.4%, mandible and maxilla 4.6% and least common fracture site was zygomaticomaxillary complex 4.1%. Chaushu et al<sup>18</sup> found that mini-plate removal from the mandible is most commonly done at the mandibular angle 39.5%, followed by the mandibular body 21.1%, indicating a higher incidence of complications in these areas. In Aramanadka's study<sup>19</sup>, it was observed that a greater number of plates were extracted from the mandibular region, with 24 out of 42 patients undergoing plate removal specifically in this area.

The most common reason for plate removal demand of patients as 76.7% followed by exposure 5.2%, prosthetic rehabilitation 4.7%, extraction of tooth 4.7%, screw loosening 3.5%, pain 3.5% and infection 1.7%. In their previous study, Khandelwal et al<sup>20</sup> identified infection at the surgical site or exposure of the mini-plate as the primary reasons for mini-plate removal, with a notable occurrence of infections predominantly in mini-plates situated in the anterior regions of the mandibular and maxillary bones. In the study conducted by Llandro et al<sup>21</sup> in 2015, the researchers found that the most prevalent reasons for plate removal, as indicated by their findings, were primarily associated with complications such as infection and/or wound dehiscence.

In their study, Ali S et al<sup>22</sup> found that the mandible was the most common location for plate removal, with 68.08% of the plates being removed from this area. The primary reason for plate removal was infection, accounting for 42% of cases. The minimum duration for plates to remain in situ was observed to be 3 months. In a separate study, Mulk et al<sup>23</sup> reported that the primary cause for plate removal in their cohort of 20 cases was infection and/or exposure, constituting 42.5% of the cases, a finding consistent with previous reports. Limitations: If the study is conducted at a single institution, the results may not be representative of the broader population. Differences in patient demographics, treatment protocols, and surgeon expertise between institutions may impact the external validity of the findings.

## CONCLUSION

The primary factor leading to the removal of plates is patient preference, with exposure being the second most common reason. Rates of removal due to inflammation or mini-plate exposure are consistent with previous reports, and there is insufficient evidence to advocate for the routine removal of titanium mini-plates..

### Author's Contribution:

Concept & Design of Study:	Sumaira Zahoor
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Revisiting Critically:	Sumaira Zahoor, Mohsin Majeed
Final Approval of version:	Sumaira Zahoor

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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