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# The quality of life in the treatment of maxillofacial fractures using open reduction: A prospective study



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## ABSTRACT

**Purpose:** To assess the impact of open reduction on quality of life in patients with maxillofacial fractures.

**Methods:** A prospective study of 15 patients admitted to a general hospital in Bandung for maxillofacial trauma from October 2017 through February 2018 was conducted. Trauma severity was assessed using facial injury severity scale (FISS) score, while the quality of life was assessed using Oral Health Impact Profile (OHIP)-14 questionnaires at one day before surgery ( $T_0$ ) and 14 ( $T_1$ ) and 60 days ( $T_2$ ) after surgery.

**Results:** Male ( $3.92 \pm 1.89$ ) and younger patients ( $3.89 \pm 1.69$ ) had a greater mean FISS score than their respective counterparts. The most common areas involved in maxillofacial fractures were mandible body (80%) and dentoalveolar (46.67%). The overall quality of life was worse in younger patients as indicated with a higher mean OHIP-14 score. There was a disparity in the domain

of interest where younger patients (17-30 years) had more concern over psychological discomfort, whereas older patients (31-50 years) were more concerned about physical disability. Both qualitative and quantitative improvement in quality of life was observed in the follow-up period. Consistent and statistically significant improvement in mean OHIP-14 score before intervention ( $20.80 \pm 5.94$ ), 14 days post-intervention ( $17.93 \pm 4.68$ ), and 60 days post-intervention ( $14.67 \pm 3.42$ ) was observed.

**Conclusion:** Open surgery approach yielded a good outcome in quality of life improvement. Further study on demographic factors, timing, and quality of life domain affected in maxillofacial fractures is recommended.

**Keywords:** Maxillofacial fracture, facial trauma, open reduction, quality of life.

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## INTRODUCTION

Maxillofacial fractures are commonly considered as one of the most dreadful experience throughout a lifetime, especially with the possibility of life-threatening complication that ensues. Compromised airway is the leading complication of maxillofacial fractures due to the nature of their close anatomical proximity. It is further aggravated by subsequent risk of aspiration and vomiting.<sup>1</sup> Suboptimal outcome resulting from a multitude of complications in both early and late settings is more likely to occur with inadequate management.<sup>2</sup>

The epidemiological aspect of maxillofacial fractures exhibited a considerable heterogeneity based upon different socioeconomic and cultural factors involved. Studies in developing countries highlighted road traffic accidents as the main cause of injury with the mounting number of vehicles, violation of traffic rules, and lack of proper head protection.<sup>3</sup> The incidence of facial fractures in 2017 was estimated to exceed 7.5 million cases globally, while approximately 78,421 cases (~1.05%) of which were contributed by Indonesia. These cases

caused 117,402 years lived with disability in the global population. Furthermore, a weighted average disability of 6.5% corresponded to the average health status loss experienced by the casualties.<sup>4</sup>

Operative management of maxillofacial fractures directed to restore the function of stomatognathic system is broadly divided into two modalities, namely closed and open reduction with internal fixation.<sup>5</sup> Despite being less preferred for lack of feasibility, especially confronted with cost burden and limited resources limitations in developing countries' setting; open reduction was shown to generate more favorable outcome with shorter length of stay and total charges. Provided with excellent postoperative complications prevention and management, the open reduction approach offers the benefit of enhanced restoration of anatomical structures and stability, decreased maxillo-mandibular fixation, and earlier functional establishment.<sup>6</sup>

The improvement of therapeutic outcomes in maxillofacial fractures should not only concern about physical recovery, given the growing

evidence of disruptive psychological impact it provoked.<sup>7</sup> Quality of life assessment served as objectification of recovery endpoint in this regard.<sup>8</sup> Thus, this study aimed at investigating the quality of life of maxillofacial fractures patients treated with open reduction approach. This study's findings are expected to spark interest in a rarely sought for aspect of treatment outcome.

## MATERIALS AND METHODS

The longitudinal study design is appropriate for prospective (i.e., advance in time) manner of investigation with serial assessments within an abbreviated follow-up period.<sup>9</sup> Fifteen patients visiting oral and maxillofacial surgery polyclinic of "Rumah Sakit Umum Pusat Dr. Hasan Sadikin" general hospital in Bandung who fulfilled the study criteria and consented to participate in this study were recruited based on purposive sampling technique during four months study period lasting from October 2017 through February 2018. The sample size was determined using appropriate formula comprehensively described elsewhere.<sup>10</sup> Inclusion criteria comprised of patients aged 17-50 years, experienced maxillofacial trauma with planned open reduction surgery, and completed a short form of Oral Health Impact Profile (OHIP)-14 questionnaires. Exclusion of patients with trauma other than maxillofacial trauma and psychological or neurological comorbidity yielded the number of eligible participants. This study was approved by the health research ethics committee in Medical Faculty of Universitas Padjadjaran (No. 1040/UN6.C10/PN/2017) and executed in accordance with the Helsinki Declaration ethical standards along with its amendments.

The operational definition of three fundamental elements in this study is summarized as follows: maxillofacial fracture is defined as fractures confined in facial bones (i.e. os nasoorbitoethmoid, temporal, nasal, maxilla, zygomaticomaxilla, and mandibula);<sup>5</sup> open reduction as a mean of maxillofacial management is done by the reduction of fracture fragment through intra- or extraoral surgical intervention<sup>11</sup>; quality of life is an emotional response evoked by a patient towards social,

emotional, occupation, interfamilial relationship, conformity between hope and reality, and overall satisfaction in life.

Study samples were previously subjected to history taking, physical examination, and radiological examination to obtain necessary data registered in the medical records. Written informed consent was obtained from selected participants one day prior to open reduction treatment. The facial injury severity scale (FISS) score was retrieved from medical record access, while OHIP-14 score was obtained one day before surgery ( $T_0$ ) and 14 ( $T_1$ ) and 60 days ( $T_2$ ) after surgery. Follow-ups were done in an outpatient setting.

The FISS score was determined by anatomic region (i.e., mandible, mid-face, or upper face), fracture type, and the total length of facial laceration. Sum of which would fall into a score ranging between 0 to 30.<sup>12</sup> Meanwhile, OHIP-14 score, ranging from 0 to 56, was obtained by interviewing using OHIP-14 questionnaires, which consisted of 14 questions related to 7 domains. Responses were graded using qualitative frequency, which was subsequently quantified into a 5-point Likert scale for each item.<sup>13</sup> The sum of OHIP-14 score was further classified into good (0-18,6), moderate (>18,6-37,3), and poor (>37,3-56) quality of life.<sup>14</sup>

Statistical analysis was done using SPSS® statistics 20.0. We employed a descriptive analysis to describe sociodemographic characteristics and comparative analysis to analyze the impact of surgical treatment on each subject. Descriptive data was presented in appropriate central tendency and its respective dispersion based on the Shapiro-Wilk normality test. Paired t-test was performed to analyze the difference in the quality of life before and after surgical treatment. Statistically significant threshold was set to be at  $\alpha < 0.05$ .

## RESULTS

Fifteen subjects participated in this study as implied in the calculation of minimum sample requirement. Baseline characteristics in Table 1 showed that most patients were male within the 17-30 age range.

A detailed list of maxillofacial fracture severity assessment by FISS score was included in Table 2. The average FISS score was more remarkable in males ( $3.92 \pm 1.89$ ) compared to females ( $2.50 \pm 0.71$ ) and also in patients aged 17-30 years ( $3.89 \pm 1.69$ ) as opposed to older patients aged 31-50 years ( $3.50 \pm 2.17$ ). The most frequent fracture areas were the mandible body (80%) and dentoalveolar (46.67%).

The average OHIP-14 score across all domains were notably higher in 17-30 years age range

**Table 1.** Distribution of patients by gender and age

Variables	n (%)
Gender	
Male	13 (86.67)
Female	2 (13.33)
Age range, years	
17-30	9 (60.0)
31-50	6 (40.0)
Total	13 (100.0)

**Table 2. Distribution of FISS score and fracture area by demographic characteristics**

Subject no.	Gender		Age range		Fracture area	Score
	Male	Female	17-30 years	31-50 years		
1	√			√	Dentoalveolar, body	3
2	√		√		Dentoalveolar, body	3
3		√	√		Dentoalveolar, body	3
4	√		√		Condyle, Le Fort I, zygoma, body	6
5	√			√	Zygoma	1
6	√			√	Dentoalveolar, Le Fort I, body	6
7	√		√		Body	2
8	√		√		Body, zygoma	3
9		√	√		Dentoalveolar, body, condyle	5
10	√			√	Dentoalveolar, ramus	3
11	√		√		Orbital rim, body, condyle	4
12	√			√	Body	2
13	√			√	Dentoalveolar, Le Fort II, ramus	7
14	√		√		Le Fort II, body	6
15	√		√		Body	2

**Table 3. Mean OHIP-14 score according to age range and timing of assessment**

Domain	Age range			
	17-30 years		31-50 years	
	Before	After	Before	After
Functional limitation	23	19	20	16
Physical pain	39	34	26	20
Psychological discomfort	45	40	26	21
Physical disability	37	32	27	24
Psychological disability	14	14	8	7
Social disability	13	11	5	4
Handicap	18	16	11	11

Assessment timing was divided into before and after surgical intervention.

**Table 4. Qualitative data distribution of quality of life assessed with OHIP-14 score**

Quality of life	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>
Good	4 (26.67)	9 (60)	13 (86.67)
Moderate	11 (73.33)	6 (40)	2 (13.33)
Poor	0 (0)	0 (0)	0 (0)

T<sub>0</sub>, before surgical intervention; T<sub>1</sub>, 14 days post-surgical intervention; T<sub>2</sub>, 60 days post-surgical intervention.

**Table 5. Comparative analysis of quality of life assessed with OHIP-14 score before and after intervention**

Variable	Mean (SD)	95% CI	p
T <sub>0</sub> -T <sub>1</sub>	2.87 (1.99)	1.76-3.98	<0.001
T <sub>0</sub> -T <sub>2</sub>	6.13 (4.69)	3.54-8.72	<0.001
T <sub>1</sub> -T <sub>2</sub>	3.27 (3.43)	1.37-5.17	0.002

CI, confidence interval; SD, standard deviation; T<sub>0</sub>, before surgical intervention; T<sub>1</sub>, 14 days post-surgical intervention; T<sub>2</sub>, 60 days post-surgical intervention.

regardless of the timing of assessment (Table 3). The highest mean scores were found in psychological discomfort and physical disability domains for the age range of 17-30 and 31-50 years, respectively; meanwhile, the lowest mean of both age ranges overlapped in social disability domain. Post-intervention mean score reduction was greatest in physical pain, psychological discomfort, and physical disability domains and lowest in psychological disability within the group aged 17-30 years. Similarly, in the group aged 31-50 years the greatest reduction in mean score was found in physical pain domain and the lowest was in handicap domain.

The majority of patients had moderate quality of life before the intervention, but the position was overtaken by good quality of life as soon as 14 days after the intervention. Quality of life improvement was most profound within 14 days post-surgical intervention, where the number of patients who had good quality of life more than doubled compared to the baseline. The improvement continued to increment nearly one half to the final follow-up at 60 days after intervention. There was not any participants reporting poor quality of life throughout the assessments (Table 4).

A consistent decreasing trend in mean OHIP-14 score before intervention (20.80±5.94), 14 days post-intervention (17.93±4.68), and 60 days post-intervention (14.67±3.42) was observed. The paired t-test result demonstrated significant mean differences at any given pair of assessment timing (Table 5).

## DISCUSSION

Gender and age preponderance in maxillofacial trauma was observed quite consistently in numerous studies as well as prior large-scaled representative studies.<sup>15-18</sup> Male gender predominance, expressed as male-to-female ratio, in this study (6.5) was well within the combined range derived from those studies (3.24-7). However, the peak age distribution reported in studies carried out in Korea,<sup>16</sup> South India,<sup>17</sup> China,<sup>18</sup> (20-29 years), and also current study (17-30 years) was slightly younger than the one reported in European multicenter study (30-39 years). Consideration of falls and road traffic accidents as the alternating main causes or circumstances leading to the trauma<sup>15-18</sup> supports the assumption that early productive aged males are more vulnerable due to their more active trait.<sup>15</sup>

Mandibular fracture was confirmed to be the most common site of injury, except for the study by Park et al.<sup>15,17,18</sup> The distinctive characteristic possessed by the mandibular area which results in its susceptibility, other than the fact that it is

located at the edge framing the entire maxillofacial region, is its strength and dynamic relationship with adjacent structures. When mandibular bone sustains a blow of external force, it is capable of partially absorbing the force and redirecting that force with certain magnitude and vectoral direction to adjacent structures through dentition and occlusion. Therefore, mandibular fracture assessment necessitates meticulous investigation or conversely, may offer a clue to the mechanism of injury and possible trauma location.<sup>19,20</sup>

The average FISS score found in this study was lower than the past research in a level I trauma center in Oregon ( $4.4 \pm 2.7$ ), although it was higher than the average in Cipto Mangunkusumo Hospital in Jakarta ( $3.37 \pm 1.9$ ).<sup>12,21</sup> More recent studies investigated the score relevance to economic burden. Maxillofacial injury severity measured by FISS score was found to predict the cost and duration of hospitalization.<sup>22</sup> Specific measurement was derived by Bocchialini et al., who reported that for every unit increase in FISS score is equivalent to the average number of hospitalization days increase of 1.44.<sup>23</sup>

Psychological burden remained a remarkable issue for patients experiencing maxillofacial fracture, as demonstrated in the domains with the highest mean and lowest mean reduction in OHIP-14 score. This especially held true in the younger age group (17-30 years) in which psychological discomfort and psychological disability were the primary concern. Previous studies attempted to assess the existence of depression or anxiety comorbidity in maxillofacial trauma patients using Hospital Anxiety and Depression Scale (HADS). Both studies reported concerning figures of borderline to probable depression (12-27.45%) and anxiety (17-29.41%) in this subset of patients.<sup>24,25</sup> A pilot study of collaborative medical and psychological care for maxillofacial injury patients successfully screened 80% patients for psychological morbidity despite the multifaceted challenges.<sup>26</sup>

A comparison was done with three other similar studies assessing the improvement of quality of life in facial trauma patients treated with an open reduction approach. Time period was a significant determinant of patient life quality in a cohort study by Lupi-Ferandin et al. However, the mean difference in quality of life after follow up period was not investigated.<sup>27</sup> Another study by Boljevic et al. reported an intriguing finding in which a considerable number of patients (40%) reported no improvement in quality of life six months after surgery. It was mostly attributed to pain, appearance, and mood issues during postoperative period.<sup>28</sup> Conversely, a prospective study with more follow-

up time points by Kaukola et al. reported a finding similar to the current study. Among daily, weekly, and monthly follow-up score assessments; the peak improvement in the quality of life was observed at one month after surgery and continued to increase to a lesser extent. In the current study, we found a significant improvement in quality of life after open reduction treatment peaked at 14 days after surgery. Considering that there were rather variable findings concerning this topic, further investigation is needed to clarify and weigh the benefit of open reduction surgery in maxillofacial fractures.

There were several limitations worth mentioning in this study. Due to inevitable factor of patients' autonomy in surgical intervention agreement, there was a difference in time periods between diagnosis and surgical commencement which may affect the result of overall subjective assessment henceforth. Additionally, despite being justified with minimum sample calculation, the number of study samples was relatively small and may limit study generalisability.

## CONCLUSION

Clinical perspective on the repercussion that maxillofacial fractures implicated should be broadened to attain better apprehension and navigate more comprehensively when managing such cases. Careful consideration of demographic factors, timing, and quality of life domain afflicted is of utter importance.

## CONFLICT OF INTEREST

The authors have nothing to disclose.

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## ETHICAL CLEARANCE

Ethical approval was obtained by the health research ethics committee in Medical Faculty of Universitas Padjadjaran (No. 1040/UN6.C10/PN/2017) before study commencement.

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