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

Nyoman Ayu Anggayanti*, Endang Sjamsudin2, Tantry Maulina2, Aulia Iskandarsyah3

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 (T1) and 14 (T2) and 60 days (T3) after surgery.
Results: Male (3.92±1.89) and younger patients (3.89±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±5.94), 14 days post-intervention (17.93±4.68), and 60 days post-intervention (14.67±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

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. Suboptimal outcome resulting from a multitude of complications in both early and late settings is more likely to occur with inadequate management.

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. 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.

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. 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.

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.\textsuperscript{7} Quality of life assessment served as objectification of recovery endpoint in this regard.\textsuperscript{8}

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.\textsuperscript{9} 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.\textsuperscript{10} 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 comittee 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 amandments.

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);\textsuperscript{5} open reduction as a mean of maxillofacial management is done by the reduction of fracture fragment through intra- or extraoral surgical intervention\textsuperscript{11}; 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\textsubscript{0}) and 14 (T\textsubscript{1}) and 60 days (T\textsubscript{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.\textsuperscript{12} 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.\textsuperscript{13} 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.\textsuperscript{14}

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±1.89) compared to females (2.50±0.71) and also in patients aged 17-30 years (3.89±1.69) as opposed to older patients aged 31-50 years (3.50±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   |       |
| 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     |

Assessment timing was divided into before and after surgical intervention.

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

| Domain                  | Age range | Before | After | Before | After |
|-------------------------|-----------|--------|-------|--------|-------|
|                         | 17-30 years | 31-50 years |        |        |       |
| 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     |       |

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. 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 as reported in studies carried out in Korea, supports the assumption that early productive aged males are more vulnerable due to their more active trait. 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 no not 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).

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

| Quality of life | T₀ | T₁ | T₂ |
|-----------------|----|----|----|
| 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) |

T₀, before surgical intervention; T₁, 14 days post-surgical intervention; T₂, 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   |
|----------|-----------|--------|-----|
| T₀         | 2.87 (1.99) | 1.76-3.98 | <0.001 |
| T₁         | 6.13 (4.69) | 3.54-8.72 | <0.001 |
| T₂         | 3.27 (3.43) | 1.37-5.17 | 0.002 |

Cl, confidence interval; SD, standard deviation; T₀, before surgical intervention; T₁, 14 days post-surgical intervention; T₂, 60 days post-surgical intervention.
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.19,20

The average FISS score found in this study was lower than the past research in a level I trauma center in Oregon (4.4±2.7), although it was higher than the average in Cipto Mangunkusumo Hospital in Jakarta (3.37±1.9).12,21 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.22 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 1.44.23

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.24,25 A pilot study of collaborative medical and psychological care for maxillofacial injury patients successfully screened 80% patients for psychological morbidity despite the multifaceted challenges.26

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 quality life in a cohort study by Lupi-Ferandin et al. However, the mean difference in quality of life after follow up period was not investigated.25 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.28 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.

FUNDING
These authors have no support or funding to report.

ETHICAL CLEARANCE
Ethical approval was obtained by the health research ethics committee in Medical Faculty of Universitas Padjadajaran (No. 1040/UN6.10/PN/2017) before study commencement.

REFERENCES
1. Jose A, Nagori SA, Agarwal B, Bhatia O, Roychoudhury A. Management of maxillofacial trauma in emergency: An update of challenges and controversies. J Emergencies, Trauma and Shock. 2016;9(2):73–80.
2. Parashar A, Sharma RK. Unfavourable outcomes in maxillofacial injuries: How to avoid and manage. Indian J Plast Surg. 2013;46(2):221–34.
3. Arslan ED, Solaoglu AG, Komut E, Kavalcı C, Yılmaz F, Karakılıc E, et al. Assessment of maxillofacial trauma in emergency department. World J Emerg Surg. 2014;9(1):13.
4. Lalloo R, Lucchesi LR, Bisignano C, Castle CD, Dingels ZV, Fox JT, et al. Epidemiology of facial fractures: Incidence, prevalence and years lived with disability estimates from the Global Burden of Disease 2017 study. *Inj Prev*. 2019;25(Suppl 1):i27.

5. Ochs MW, Tucker MR. Management of facial fractures. In: Peterson JL, editor. Contemporary oral and maxillofacial surgery. 6th ed. Mosby; 2014. p. 491–517.

6. Zoghbi Y, Gerth DJ, Tashiro J, Lee A, Thaller SR. Open versus closed reduction of maxillary fractures: Complications and resource utilization. *J Craniofac Surg*. 2017;28(7):1797–802. Available from: https://pubmed.ncbi.nlm.nih.gov/28834837/.

7. Sahni V. Psychological impact of facial trauma. *Craniomaxillofac Trauma Reconstr*. 2018;11(1):015–20.

8. Sikora M, Chlubek M, Grochans E, Jurczak A, Safranow K, Chlubek D. Analysis of factors affecting quality of life in patients treated for maxillofacial fractures. *Int J Environ Res Public Health*. 2020;17(1).

9. Setia MS. Methodology series module 3: Cross-sectional studies. *Indian J Dermatol*. 2016;61(3):261–4.

10. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian J Psychol Med*. 2013;35(2):121–6.

11. Hupp JR, Ellis E, Tucker MR. Contemporary oral and maxillofacial surgery. 6th ed. Philadelphia: Elsevier; 2014. p. 491–517.

12. Bagheri SC, Dierks EJ, Kademani D, Holmgren E, Bell RB, Hommer L, et al. Application of a facial injury severity score in craniomaxillofacial trauma. *J Oral Maxillofac Surg*. 2006;64(3):408–14. Available from: https://pubmed.ncbi.nlm.nih.gov/16487802/.

13. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*. 1997;25(4):284–90. Available from: https://pubmed.ncbi.nlm.nih.gov/9332805/.

14. Conforte JJ, Alves CP, Sánchez M del PR, Ponzoni D. Impact of trauma and surgical treatment on the quality of life of patients with facial fractures. *Int J Oral Maxillofac Surg*. 2016;45(5):575–81. Available from: https://pubmed.ncbi.nlm.nih.gov/26296597/.

15. Boffano P, Roccia F, Zavattero E, Dediol E, Uglesić V, Kovacić Ž, et al. European Maxillofacial Trauma (EURMAT) project: A multicentre and prospective study. *J Cranio-Maxillofac Surg*. 2015;43(1):62–70. Available from: https://pubmed.ncbi.nlm.nih.gov/25457465/.

16. Park K-P, Lim S-U, Kim J-H, Chun W-B, Shin D-W, Kim J-Y, et al. Fracture patterns in the maxillofacial region: a four-year retrospective study. *J Korean Assoc Oral Maxillofac Surg*. 2015;41(6):306.