Time Recommendation and Alternative Parameters for Severe Maxillofacial Trauma Reconstruction

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Abstracts

Background: Severe maxillofacial trauma often associated with other injuries, therefore the delay of reconstruction often occur until the patients are stable. Early reconstruction results a better facial function and appearances.

Aim: The aim of this study to give the recommendation and alternative parameters for severe maxillofacial trauma reconstruction.

Methods: The method of this study is adult patients with bimaxillary and bilateral maxillofacial trauma were eligible for this study, while pregnant women were excluded. Nine patients with maxillofacial trauma were involved in this study and we measured 15 facial anthropometric and 41 lateral cephalometricon 7, 14, 21 days compared to 3 months post-reconstruction.

Results: The result of this study showed reconstruction can be planned 14 days after trauma for lower jaw fracture and 21 days after bimaxillary fracture. Lateral cephalometry was a reliable method to measure facial edema following surgery which combined facial anthropometry with lateral cephalometry using parameters that are not affected by edema. This can be applied as an additional guiding tool in surgical planning for maxillofacial trauma patients especially those with bimaxillary and bilateral fractures.

Conclusion: Combination of anthropometric and cephalometric parameters which are not affected by edema can be applied as an additional guiding tool in surgical planning for maxillofacial trauma patients.

Keywords*: Facial Anthropometric, Lateral Cephalometry, Facial Edema, Severe Maxillofacial Trauma.*

Introduction

Maxillofacial trauma patients, especially with panfacial fracture, often requires of following surgery that associated with the facial deformity whichis often indicated repairing natural architecture of facial bone and leaving minimal traces as possible[1]. In developing countries, almost 50-70% of traffic accidents remain the leading cause of facial trauma[1].

Anthropometry is the measurement of living subjects[2]. Head and facial anthropometry measurements can be used together with cephalometry, Computed Tomography (CT), and Magnetic Resonance (MR) in preparation for a patient undergoing plastic and reconstructive surgery[3]. The lateral cephalometry may help evaluate the loss of vertical dimension and skeletal relations between the arches. Easy to access the equipment and low cost could provide a correct surgical planning when analysed appropriately[4].

Modified techniques using anthropometric combined with cephalometric examination are easy and inexpensive. Facial edema can be assessed using cephalometric measurements, Moreover a combination between anthropometric and cephalometric for surgical planning could be used as an alternative for surgeons. Therefore, we aimed to assess the time recommendation and alternative parameters for severe maxillofacial trauma reconstruction[5].

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Method

This research uses experimental study design, posted test only group design. In other side, this study used adult patients with bimaxillary and bilateral maxillofacial trauma were eligible for this study, while pregnant women were excluded. After obtaining the informed consent of the patients underwent surgery. All of them were operated following the same procedure in the same hospital by three different surgeons at the same level of experience. Facial anthropometric and lateral cephalometric measurements were taken ON day 7, 14, 21 and 3rd month postoperatively. Facial anthropometry was measured using a standardized anthropometric tool such as spreading and sliding caliper, its showed on Figure 1 and lateral cephalometry using Vistadent software (GAC Techno Center, Birmingham, United Kingdom) on Figure 2.

Figure 1. Anthropometric measurement using spreading caliper and sliding

Figure 2. Cephalometric analysis using vistadent software, the dots which are refer to landmarks on cephalometry are being filled, and computer will calculate it.

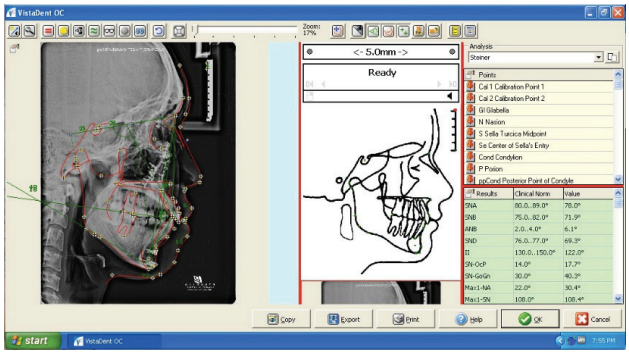


Figure above it's the figure that used by researcher in this study. In other side, researcher used some data. *First,* data from 15 facial anthropometric and 41 lateral cephalometric which measured on day 7, 14, 21 were compared to those taken within 3 months after post-operatively. It was to assess whether facial anthropometric and lateral cephalometric measurements following the surgery were affected by edema. *Second*, the measurements of lateral cephalometric on day 7, 14, 21 were compared to third (3) month post-operatively to assess the time resolution of facial edema after the operation. The paired samples T-test was used to compare anthropometric and cephalometric variables on day 7, 14, 21 with third (3) month postoperatively. Data were analyzed using SPSS version 11.0 for windows.

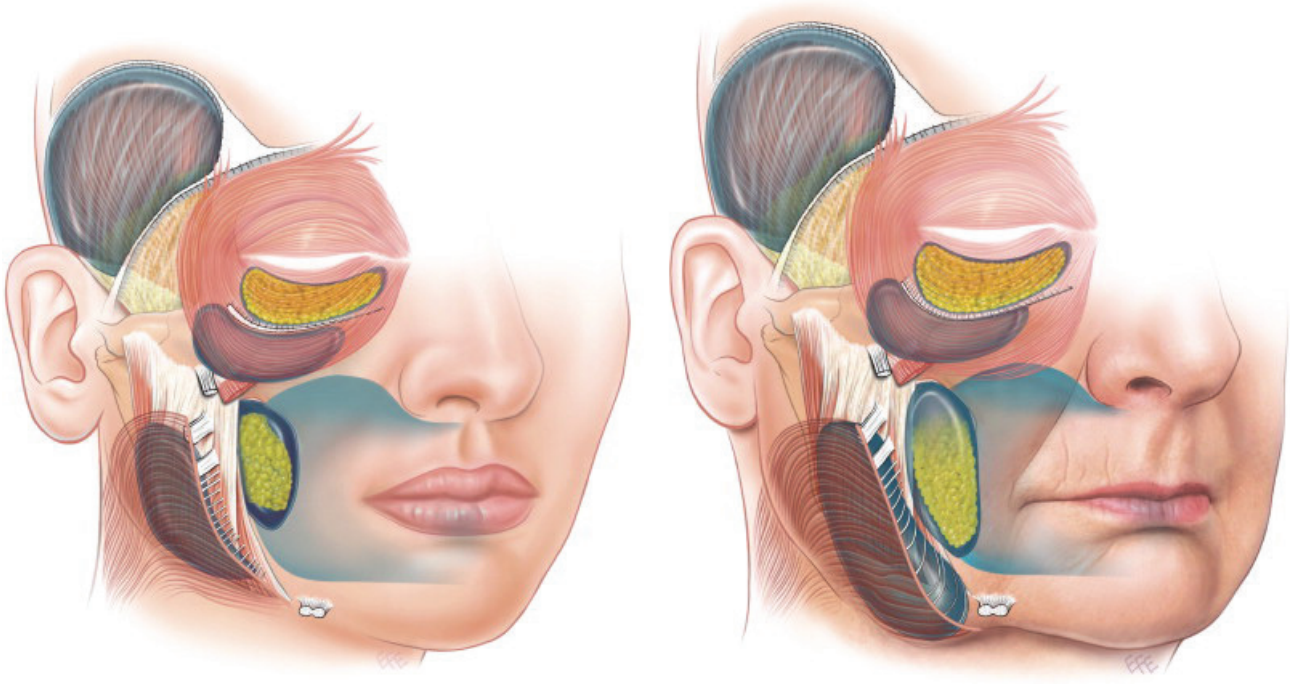
Result

Between September 2012 and March 2013, the data were collected from nine patients consisted of seven males and two females between 17 and 31 years old (median 24 years). Seven out fifthteen (7/15) anthropometric parameters (zy-zy, go-go, ex-ex, sn-c, go-cdl1, go-cdl2, gn-go1) were affected by edema (p <0,05), while the remaining eight parameters remained constant throughout day 7, 14, 21 and 3rd month postoperatively. All cephalometric parameters remained constant throughout day 7, 14, 21 and 3rd month postoperatively except 4 parameters (Ls-NsPog'; A'-SS; Ls1u-Ls; Pog-Pog'). The cephalometric parameters are able to assess the time resolution of facial edema, such asbasic upper lip thickness (A'-SS), thickness of vermillion of the upper lip (Ls1u-Ls), and soft tissue thickness of chin (Pog-Pog'). Basic upper lip thickness (A'-SS) and soft tissue thickness of chin (Pog-Pog') on day 7 were significantly different compared to 3rd monthpostoperatively (p <0,05) whilebasic upper lip thickness on days 14 was significantly different compared to 3 months postoperatively (p <0,05). There was no further reduction of facial edema in the lower jaw after day 14 and in both upper and lower jaw after day 21.

This study showed that the edema of the lower jaw disappeared within two weeks after the reconstruction of maxillofacial trauma and edema of the face within three weeks. The faster resolution of edema on the lower jaw could be explained by the presence of the largest space in the fourth layer of the face, the premasseteric space, allowing greater movement leading to greater of edema reduction[6] (Figure 3).

Figure 3**.** Soft tissue spaces of the face: upper temporal, prezygomatic, masticator and premasseter space. Adapted from Mendelson, B. 'Facelift anatomy,

SMAS, retaining ligaments and facial spaces', Aesthetic Plastic Surgery, Saunders Elsevier. 2009.



On the figure 3, we considered the surgery as the moment of trauma because the surgical trauma itself is proportional to the actual trauma that causes the fractures. The morphology of the face returned close to 90% of the baseline facial scan at 3rd month while, scanning after sixth months was used as the baseline[7]. In our study, facial morphology returned to the baseline at week 3, while the scans recorded on the third month was used as the baseline.

The fracture of facial bone remodeling process beginsin responding to an interrupted blood supply. At the end of the first week after trauma, non-perfused bone is substituted by a new bone that could be visible 2 to 3 weeks after trauma[8]. Facial bone remodeling is faster than in long bones, because of the outstanding circulations allowsfaster recovery[9]. Normally, facial bone healing takes around 4 to 6 weeks in midface region and 10 to 12 weeks in mandible region[10]. Callus could be seen at 2 to 3 weeks after trauma, while performing reconstruction after 4-6 weeks in the midface and after 10-12 weeks in mandible probably will need osteotomy because of the bone is reunion.

The optimal results of surgery for repail of panfacial fracture can be obtained two weeks after the trauma[11]. In some circumstances, even early surgical intervention should be avoided, such as cervical spine injury. Primary repair can be successfully completed up to 3 weeks after injury[12]. The results of this study indicate that reconstructive surgery should be planned 14 days after trauma for lower jaw fracture and 21 days after bimaxillary fracture. The surgeonshave analternative option to immediately operate on a maxillofacial trauma patient with subsequent surgery risk if postoperative deformity occurs or wait until facial edema resolves.

Eight anthropometric parameters were not affected by edema, they remain constant for postreconstruction. This can be explained by the presence of facial ligaments cause the area to become more fixed, therefore,it is more resistant to edema (Figure 4).

Figure 4. Facial Ligaments (red line). Adapted from Mendelson, B. 'Facelift anatomy, SMAS, retaining ligaments and facial spaces', Aesthetic Plastic Surgery, Saunders Elsevier. 2009.

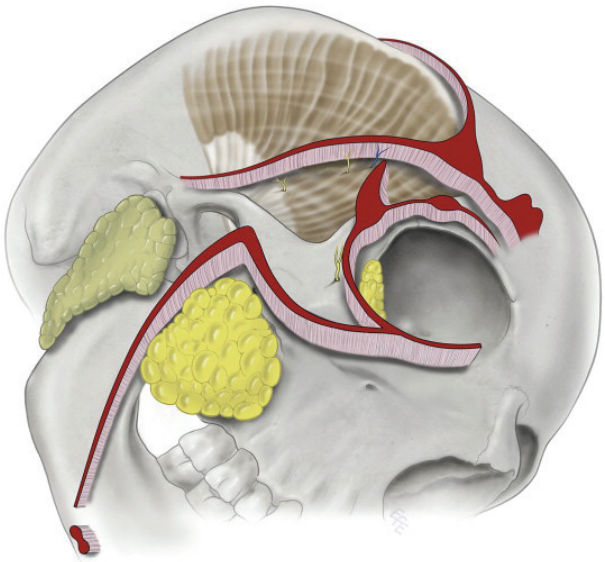


Figure 4 showed that forty-one cephalometric parameters were not affected by edema. We also found that upper and lower facial height (tr-gn, n-gn, UFH, LFH) were not affected by edema. We suggest these parameters can be used when edema appears on the face.

From this study I can be showed that maxillofacial trauma caused by severe ballistic or avulsion injuries. Some of that injuries can be creates complex composite defects for the human[13].

Conclusion

Swelling due to edema of the lower jaw disappeared within two weeks after the reconstruction while, swelling of the face disappeared within three weeks for maxillofacial trauma. Reconstruction can be planned 14 days after trauma for lower jaw fracture and 21 days after bimaxillary fracture. Lateral cephalometry was a reliable method to measure facial edema following surgery which combined facial anthropometry with lateral cephalometry using parameters that are not affected by edema. This can be applied as an additional guiding tool in surgical planning for maxillofacial trauma patients especially those with bimaxillary and bilateral fractures. This approach has the advantage of accuracy, convenience and inexpensive than other scan-based techniques.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: This study was approved by Ethical Commission of Health Research Faculty of Medicine University of Airlangga.

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