

Complexity of Delayed Management of Facial Fractures

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Disclosure

Complexity of Delayed Management of Facial Fractures

Matthew Hamedani, DDS

The following potential conflict of interest relationships are germane to my presentation.

Equipment: None

Speakers Bureau: None

Stock Shareholder: None

Grant/Research Support: None

Consultant: None

Status of FDA devices used for the material being presented

NA/Non-Clinical

Status of off-label use of devices, drugs or other materials that constitute the subject of this presentation

NA/Non-Clinical





Why is this an important issue?

- ▶ On average in the United States, over 400,000 ED visits are concerned with facial fractures
- ▶ Mean charge per each ED visit is \$3,192 with the total United States ED charges close to \$1 billion
- ▶ Mean length of stay is 6.23 days
- ▶ Mean hospitalization charges (ED and inpatient charges) amounts to \$62,414
- ▶ Maintaining high-quality care and financial efficiency in the treatment of facial fractures remains a priority among surgeons, but cannot be effectively achieved without a unified treatment protocol



The Controversy

- ▶ Intuitively it is believed that treating facial fractures as early as possible will allow for the best results and minimize the risk of complications
- ▶ However, the ideal timing for treatment of facial fractures has not been well established in the literature



Factors that affect timing treatment

Delay between injury and presentation to a health care facility

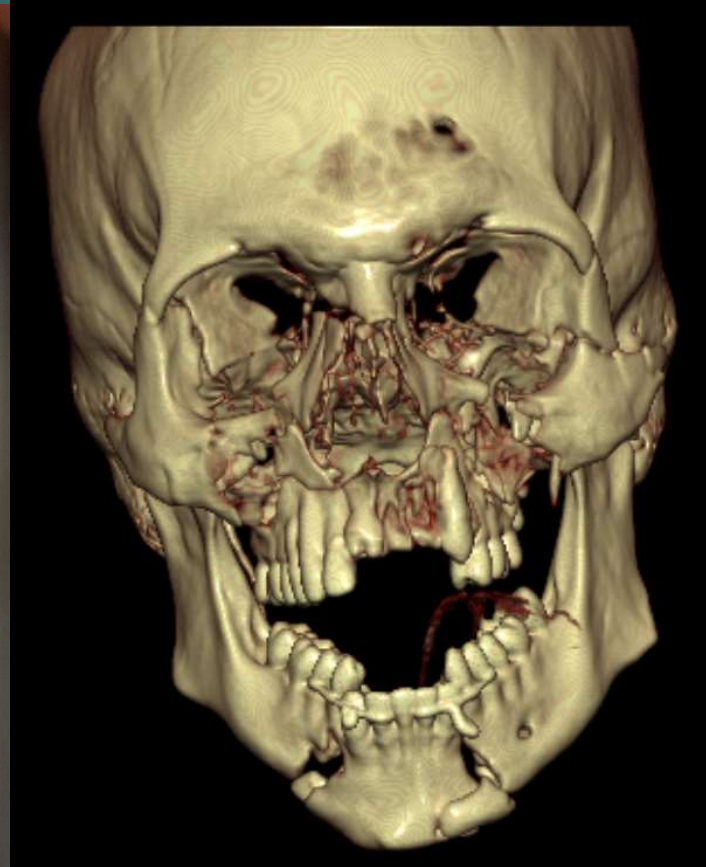
- ▶ Drug and alcohol intoxication
- ▶ Presentation outside working hours
- ▶ Access to care – physical, financial

Delay between diagnosis and treatment

- ▶ Polytrauma with prioritization of more life-threatening injuries
- ▶ Stability of the patient
- ▶ Soft tissue injuries
- ▶ Operating room time and availability
- ▶ Surgeon availability

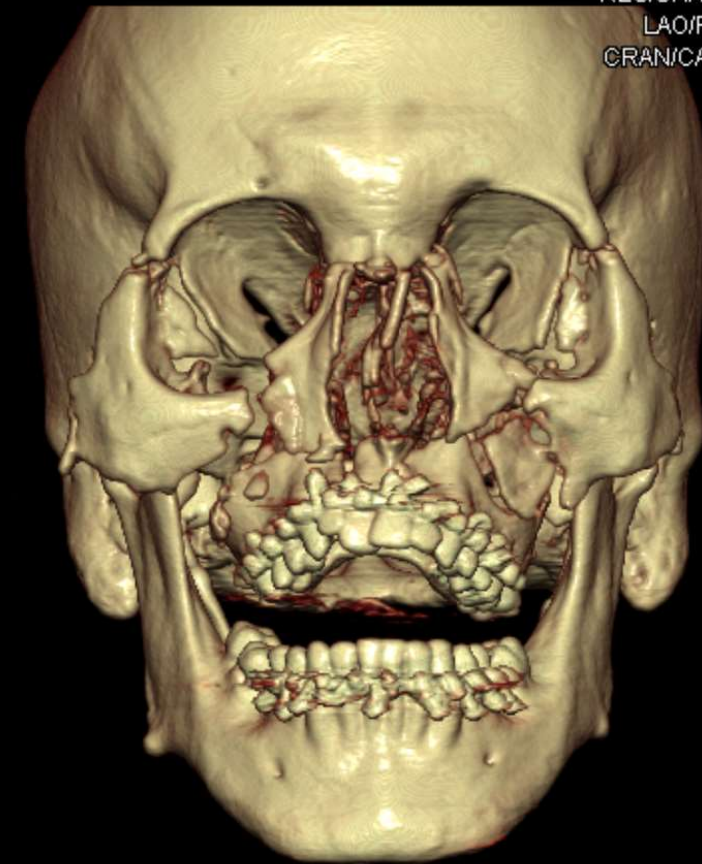
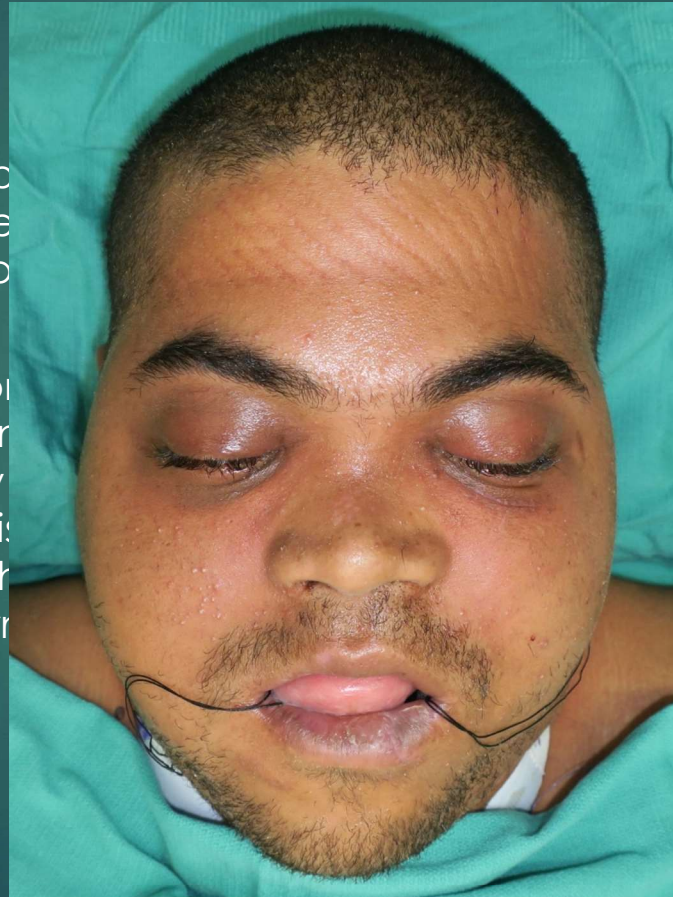


Benefits of Early Treatment



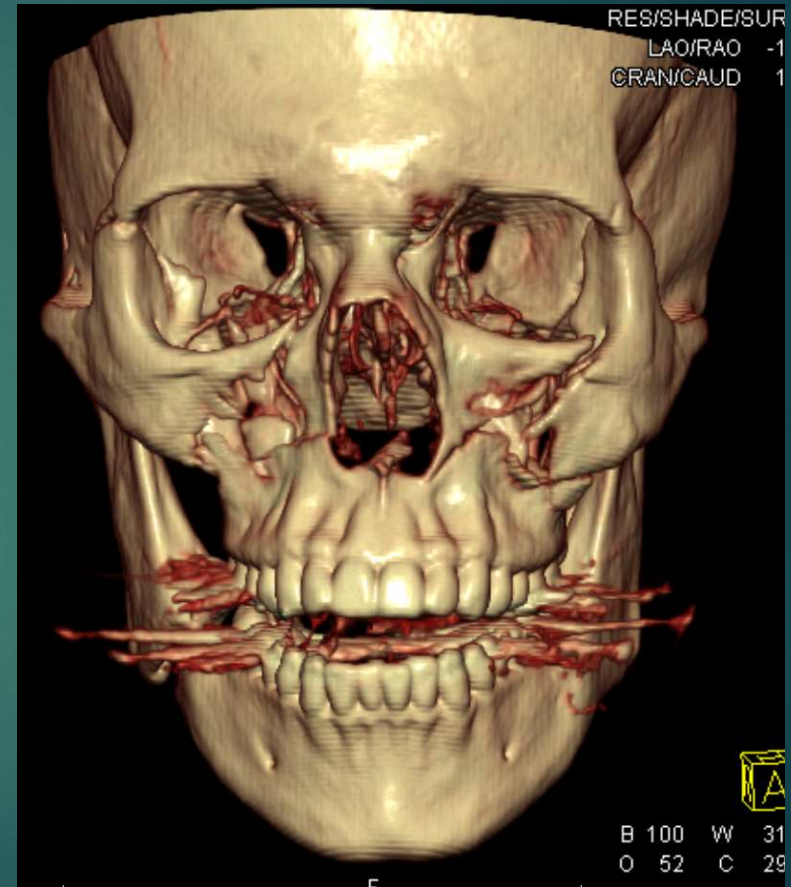
Benefits of Delayed Treatment

- ▶ Soft tissue edema resolution allows for greater pre- and intra-operative evaluation of fracture displacement and adequate reduction
- ▶ Soft tissue edema may compromise aesthetic incision placement; delaying surgery will allow placement of surgical incisions along existing skin creases and thereby avoid an unacceptable scar formation



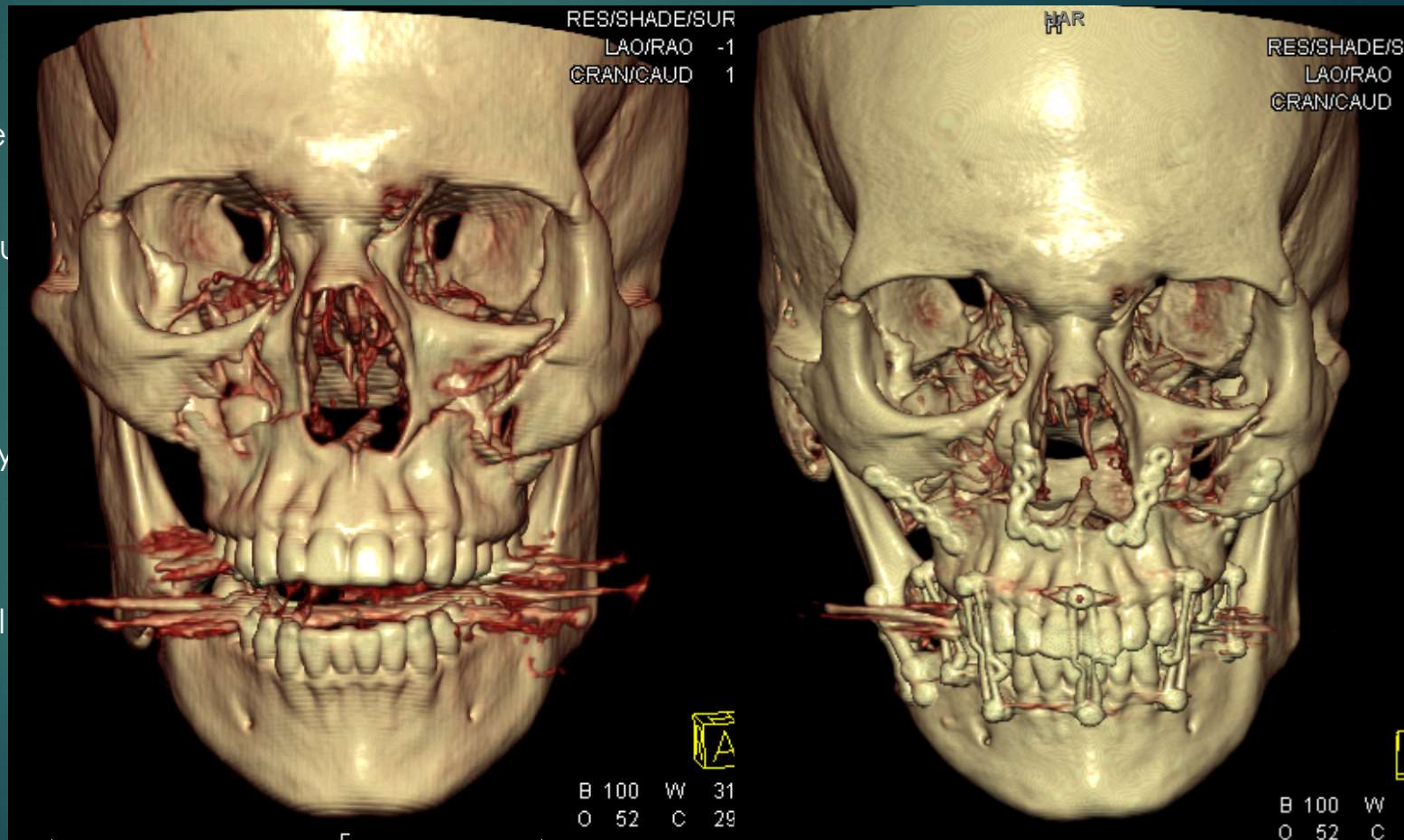
Disadvantages of Delayed Treatment

- ▶ Osseous callus formation, osteolysis at bone ends and soft tissue fibrosis can increase technical difficulty
- ▶ Treatment delay increase likelihood of infection by allowing for greater osseous devascularization and bacterial load (especially for mandible fractures)
- ▶ Esthetic or functional deficits
- ▶ Possible malnutrition due to inability to take in adequate PO
- ▶ Increased hospital stay
- ▶ Increased cost to patient and healthcare system



Assessment of Surgical Outcomes

- ▶ Infection
- ▶ Wound dehiscence
- ▶ Malocclusion
- ▶ Malunion/Delayed union
- ▶ Scar formation
- ▶ Nerve damage
- ▶ Permanent disability
- ▶ Esthetics
- ▶ Hospital stay
- ▶ Need for additional
- ▶ Cost
- ▶ Death





- ▶ Systematic Review
- ▶ 22 studies, none randomized.
- ▶ Statistical analysis of the influence of treatment delay upon healing complications was possible in only 6 studies.
- ▶ 4 studies showed no significant difference between immediate and delayed treatment.
- ▶ 1 study showed a preference for healing for cases treated within 3 days, whereas another study indicated that treatment time between 3 and 5 days were optimal with the lowest rate of complications.
- ▶ Finally, a few studies identified confounding factors such as alcohol, drug abuse and/or non-compliance, factors which have been shown strongly to influence the likelihood of complications.
- ▶ **Conclusion: No strong evidence for either acute or delayed treatment of mandibular fractures in order to minimize healing complications**

Dental Traumatology 2008; **24**: 22–26; doi: 10.1111/j.1600-9657.2006.00499.x

Effect of early or delayed treatment upon healing of mandibular fractures: a systematic literature review

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Accepted 1 March, 2006

Abstract – The possible relation between treatment delay and healing complications in mandibular fracture treatment (excluding condylar fractures) was reviewed systematically. Twenty-two studies were identified. No randomized studies focused on the effect of immediate or delayed treatment. The main focus of most studies was surgical repositioning and internal skeletal fixation. The healing complications analyzed in this study were infection in the fracture line and malocclusion. Statistical analysis of the influence of treatment delay upon healing complications was possible in six studies. Four studies showed no significant difference between immediate and delayed treatment. One study showed a preference for healing for cases treated within 3 days, whereas another study indicated that treatment time between 3 and 5 days were optimal with the lowest rate of complications. Finally, a few studies identified confounding factors such as alcohol, drug abuse and/or non-compliance, factors which have been shown strongly to influence the likelihood of complications. A significant problem in this analysis was that rather few patients were actually treated on an acute basis (i.e. within 12 or 24 hours after injury), a fact which together with the lack of control of confounding factors made this analysis problematic. In conclusion, there is presently no strong evidence for either acute or delayed treatment of mandibular fractures in order to minimize healing complications; new studies including a substantial number of cases treated on an acute basis are very much needed.

- ▶ Systematic Review
- ▶ 20 studies including 2,671 patients
- ▶ All studies were observational cohort or case-control studies
- ▶ 5 of 20 (25%) studies recommended earlier treatment
- ▶ **Conclusion: The majority of included studies do not make a recommendation for earlier treatment. The optimal treatment delay for minimizing complications in patients requiring mandible fracture ORIF remains unknown.**

OPEN



ORIGINAL ARTICLE

Pediatric/Craniofacial

Treatment Delay Impact on Open Reduction Internal Fixation of Mandibular Fractures: A Systematic Review

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 Alex Corneman, MD*
 Anthony R. Sandre, MSc, BSc†
 Forough Farrokhyar,
 PhD, MPhil‡§
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 Michael J. Cooper, MD, FRCS*

Background: The impact of mandible fracture treatment delay has been contested in the literature for decades, with conventional wisdom favoring earlier surgical treatment to prevent postoperative complications, primarily infection. Through a systematic review of all available evidence, this study aims to determine whether delay to open reduction and internal fixation of traumatic mandibular fractures influences outcomes.

Methods: MEDLINE, EMBASE, CINAHL, and Web of Science were systematically searched for English language literature pertaining to the above research question and screened in duplicate. Methodological quality scoring was performed using MINORS criteria. Qualitative and quantitative findings from relevant studies are presented.

Results: Twenty eligible studies including 2,671 patients had open reduction internal fixation, with or without adjunct mandibulomaxillary fixation. All studies were observational cohort or case-control studies of low methodological quality with a mean MINORS score of 6.5 of 16 (40.6%) for noncomparative studies and 11.2 of 24 (46.7%) for comparative studies. Only 5 of 20 (25%) studies recommended earlier treatment. Due to insufficient reporting of data and study heterogeneity, the impact of treatment delay on complications could not be quantitatively analyzed.

Conclusions: There is substantial heterogeneity and no consensus on the definition of “early” versus “delayed” surgical treatment for patients with traumatic mandibular fractures. The majority of included studies do not make a recommendation for earlier treatment. Future, well-designed prospective studies are essential to determine if there is an optimal surgical treatment delay of mandibular fractures that mitigates the risk of infectious and noninfectious complications. (*Plast Reconstr Surg Glob Open* 2018;6:e1829; doi: 10.1097/GOX.0000000000001829; Published online 18 June 2018.)

Patient factors increasing complication rates:

- ▶ Age was a significant predictor of infection for tooth bearing mandible fractures treated with open or closed reduction
 - ▶ Patients < 20 years old - infection rate of 9.4%
 - ▶ Patients > 60 years - infection rate of 55%
- ▶ Periodontal disease has been linked to delayed healing of mandibular body fractures.
- ▶ One of the most significant contributors for developing complications in patients with traumatic mandible fractures is substance use, including alcohol abuse.
 - ▶ As many as 53.6% of drug users with mandible fractures developed surgical-site infection
 - ▶ Smoking has also been reported to increase post-ORIF complication rates 4-fold and infection rates 6-fold, as compared with nonsmokers receiving ORIF.

Table 10. Factors Implicated to be Associated with Postoperative Complications following Surgical Treatment of Mandible Fractures

Patient factors
Advanced age ^{22,28}
Poor dental status ^{28,45}
Noncompliance ^{8,30,45}
Substance/alcohol abuse ^{4,5,19-21,23,28,32,45}
Tobacco use ^{5,26,27}
Fracture factors
Angle/body fractures ^{22,28,34}
Multifocal/comminuted fractures ^{21,22,26,28}
Open/tooth-bearing fractures ^{5,8,28,31}
Fractures requiring tooth extraction ³⁴
Surgical factors
Improper ORIF technique ³¹
Intraoral incision approach ²⁶

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<http://dx.doi.org/10.1016/j.ijom.2014.03.003>, available online at <http://www.sciencedirect.com>

The effect of treatment timing on the management of facial fractures: a systematic review

M. J. L. Hurrell, M. D. Batstone: *The effect of treatment timing on the management of facial fractures: a systematic review.* *Int. J. Oral Maxillofac. Surg.* 2014; 43: 944–950. © 2014 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Abstract. The ideal timing for treatment of facial fractures has not been well established. The objective of this systematic review was to examine the effects of treatment delay on outcome in the management of facial fractures. The PubMed database was used to search for relevant English-language articles published between 1979 and 2013. Cross-referencing identified additional studies. There were no selection restrictions for study type. The first author, using pre-defined data fields, extracted information independently. Studies were assessed by study type, evidence level, sample size, data collected, outcome variables, control of confounding variables, and findings. Thirty studies were identified. Inconsistency was identified with data collected, outcome variables, and findings. Of the 30 studies identified, 28 were case series, thereby providing a low level of evidence overall. The majority of case series were retrospective and sample sizes were predominantly small. Control of confounding variables was poor. Eighteen studies found no statistically significant relationship between treatment delay and treatment outcome. Nine studies found a statistically significant relationship between treatment delay and worse treatment outcomes. There were three studies with conflicting results. With the current body of evidence, definitive conclusions cannot be drawn on the timing of treatment for facial fractures.

Key words: delay; timing; facial; fracture; outcome; treatment.

Accepted for publication 4 March 2014
Available online 2 April 2014

- ▶ Systematic Review
- ▶ 30 studies were identified
 - ▶ 28 were case series
- ▶ 18 studies found no statistically significant relationship between treatment delay and treatment outcome
- ▶ 9 studies found a statistically significant relationship between treatment delay and worse treatment outcomes
- ▶ 3 studies with conflicting results
- ▶ **Conclusion: Definitive conclusions cannot be drawn on the timing of treatment for facial fractures.**

- ▶ Retrospective Case Study
- ▶ Four outcome measures were analyzed: facial symmetry, facial scarring, trismus, and radiographic outcome.
- ▶ Five additional variables were subsequently analyzed: operation, diagnosis, primary operator, regular alcohol use, and regular cigarette use.
- ▶ Treatment delay was found not to significantly alter the incidence of trismus or facial asymmetry

Conclusions:

- ▶ **Treatment delay was found to significantly alter the incidence of facial scarring. For each additional delay of a day, the odds of facial scarring being present compared to absent decreased by 13%**
- ▶ **With increasing treatment delay, the risk of a major inadequacy in anatomical fracture reduction increases for both cigarette users and non-cigarette users, but that this is much greater for regular cigarette users**

A multi-outcome analysis of the effects of treatment timing in the management of zygomatic fractures

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M. J. L. Hurrell, S. C. Borgna, M. C. David, M. D. Batstone: A multi-outcome analysis of the effects of treatment timing in the management of zygomatic fractures. *Int. J. Oral Maxillofac. Surg.* 2016; 45: 51–56. © 2015 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Abstract. The aim of this study was to analyze the effects of surgical treatment delay in the management of zygomatic fractures. A retrospective case series of 99 patients was undertaken. Four outcome measures were analyzed in relation to delay: facial symmetry, facial scarring, trismus, and radiographic outcome. Five additional variables were subsequently analyzed: operation, diagnosis, primary operator, regular alcohol use, and regular cigarette use. Statistically significant associations were found between delay and facial scarring, and delay and radiographic outcome. For each additional delay of a day, the odds of facial scarring being present, compared to absent, decreased by 13% (odds ratio (OR) 0.87, 95% confidence interval (CI) 0.76–0.98). For regular cigarette users, for each additional day of delay there was a 306-fold increased risk of having a radiographic outcome of major deviation from pre-morbid compared to equivalent to pre-morbid (OR 306.38, 95% CI 2.08–45,161.49). For non-regular cigarette users/non-users, for each additional day of delay there was a 1.5-fold increased risk of having a radiographic outcome of major deviation from pre-morbid compared to equivalent to pre-morbid (OR 1.50, 95% CI 1.08–2.09). These findings correlate with commonly held beliefs and anecdotal evidence. Despite the limitations, this study allows for an evidence-based approach to the timing of treatment of zygomatic fractures.

Key words: delay; timing; zygoma; zygomatic; fracture; outcome; treatment.

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Available online 14 September 2015

- ▶ Prospective study
- ▶ 215 patients with a total of 359 mandible fractures
- ▶ 9 outcome variables were analyzed in relation to treatment delay: wound dehiscence, hardware exposure, local postoperative infection, malocclusion, trismus, nerve damage, fracture non-union, return to OR and radiographic outcome.
- ▶ Delay was measured in days and ranged from 0 to 41 days, with a mean delay of 4.6 days.
- ▶ The incidence of wound dehiscence, hardware exposure, local postoperative infection, trismus, nerve damage, fracture non-union and return to OR was 6%, 4%, 11%, 8.5%, 47%, 2% and 8%, respectively.
- ▶ Objective malocclusion evident in 13% of cases and poor radiographic outcomes was evident in 4.5% of cases
- ▶ **Conclusion: The findings of this study suggest it may be safe to delay the definitive treatment of mandible fractures.**

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<https://doi.org/10.1016/j.ijom.2018.03.017>, available online at <https://www.sciencedirect.com>

A prospective study examining the effects of treatment timing in the management of mandible fractures

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M. J. L. Hurrell, M. C. David, M. D. Batstone: A prospective study examining the effects of treatment timing in the management of mandible fractures. *Int. J. Oral Maxillofac. Surg.* 2018; 47: 1126–1131. © 2018 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Abstract. The ideal timing for treatment of mandible fractures has not been well established. The objective of this study was to analyse the effects of treatment timing in the surgical management of mandible fractures. A prospective evaluation of 215 continuous patients with a total of 359 mandible fractures was undertaken. Nine outcome variables were analysed in relation to treatment delay by logistic regression modelling: wound dehiscence, hardware exposure, local postoperative infection, malocclusion, trismus, nerve damage, fracture non-union, return to theatre, and radiographic outcome. Nineteen additional variables were included in the analysis to adjust for potential confounding. Delay was measured in days and ranged from 0 to 41 days, with a mean delay of 4.6 days. The incidence of wound dehiscence, hardware exposure, local postoperative infection, trismus, nerve damage, fracture non-union and return to theatre was 6%, 4%, 11%, 8.5%, 47%, 2% and 8%, respectively. Objective malocclusion and poor radiographic outcomes were evident in 13% and 4.5% of cases, respectively.

No statistically significant association was found between treatment delay and treatment outcomes.

The findings of this study suggest it may be safe to delay the definitive treatment of mandible fractures. Treatment delay may allow for improved resource distribution and prioritization of more time-dependent interventions.

Key words: trauma; assault; mandible; fracture; timing; delay; surgery.

Accepted for publication 19 March 2018
 Available online 10 April 2018

- ▶ Retrospective study
- ▶ Sample size of 505 patients
- ▶ Time span from injury to repair ranged from 0 to 90 days.
- ▶ The total number of patients from the sample with reported complications was 124.
- ▶ No statistical significance correlating the time spans and complication rates ($P=.796$).
- ▶ Body fractures resulted in the highest rate of complications (33%). Of the noncompliant patients ($n = 144$), 28.5% presented with complications.
- ▶ No significance was seen in unfavorable fractures ($n = 283$), with a rate of complications of 28.6%.
- ▶ No significance could be correlated with substance abuse ($n = 107$, 29.9% with complications).
- ▶ **Conclusion: The results of this study suggest that time from injury to repair does not affect the rate of complications**

Immediate Versus Delayed Treatment of Mandibular Fractures: A Stratified Analysis of Complications



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and Jayini S. Thakker, DDS, MD§

Purpose: To analyze the rate of complication outcomes of mandibular fracture repairs across different injury-to-repair time spans.

Patients and Methods: We conducted a retrospective cohort study of patients with repaired mandibular fractures. The independent variable was the time span from injury to surgical repair. The primary outcome variable was the rate of complications measured postoperatively during the follow-up appointments. Other variables were grouped for performance of a stratified analysis: favorability of the fracture, patient compliance, substance abuse, and fracture location. Descriptive and bivariate statistics were computed.

Results: The final sample was composed of 505 patients, and the time span from injury to repair ranged from 0 to 90 days. The total number of patients from the sample with reported complications was 124. There was no statistical significance correlating the time spans and complication rates ($P = .796$). The variables for the stratified analysis also showed no significant correlations except for fracture location. Body fractures resulted in the highest rate of complications (33%; $P = .041$). Of the noncompliant patients ($n = 144$), 28.5% presented with complications ($P = .352$). No significance was seen in unfavorable fractures ($n = 283$), with a rate of complications of 28.6%. No significance could be correlated with substance abuse ($n = 107$, 29.9% with complications; $P = .262$).

Conclusions: The results of this study suggest that although time from injury to repair does not affect the rate of complications, the global standard of care for the management of non-emergent mandibular fractures should consider the cost-effectiveness of delaying treatment while exercising a reasonable length of delay for the comfort of the patient.

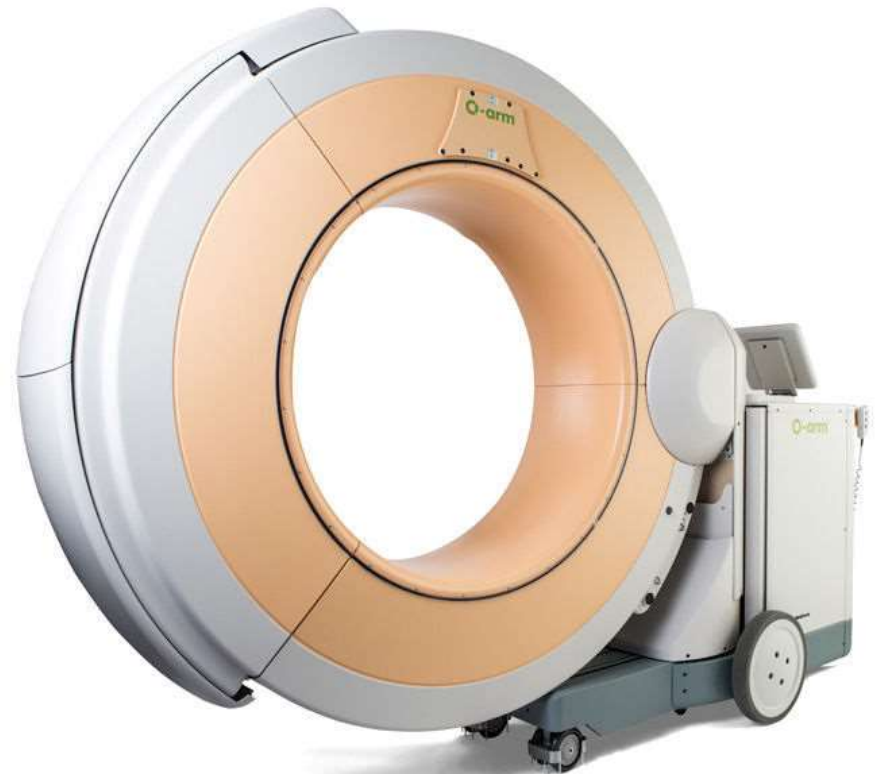
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J Oral Maxillofac Surg 74:1186-1196, 2016

Our Experience in Miami



Maxillofacial Trauma Experience in Miami

- ▶ Average treatment delay between isolated facial fracture admission and treatment is approximately 5 days
- ▶ Average treatment delay between pan-facial injuries and treatment is approximately 13 days
- ▶ Overcoming the complications of delayed treatment:
 - ▶ Diligent wound care by residents
 - ▶ Placement of patient's into maxillomandibular fixation upon arrival for mandible fractures
 - ▶ Virtual surgical planning
 - ▶ 3D printer utilization
 - ▶ Intra-operative CT scan



Case Report

CC: "I have double vision and sunken eyes. My right and left cheek bones look different and my bite is way off."

HPI: 33 year old man referred by ophthalmologist, for evaluation of facial deformity. He fell from a four story building in June of 2015 and underwent ORIF of bilateral mandible and bilateral ZMC fractures and reconstruction of bilateral orbital floors in Orlando.

Dx: Bilateral lagophthalmos , OS enophthalmos, facial deformity/asymmetry, malocclusion

Tx: 1/28/16

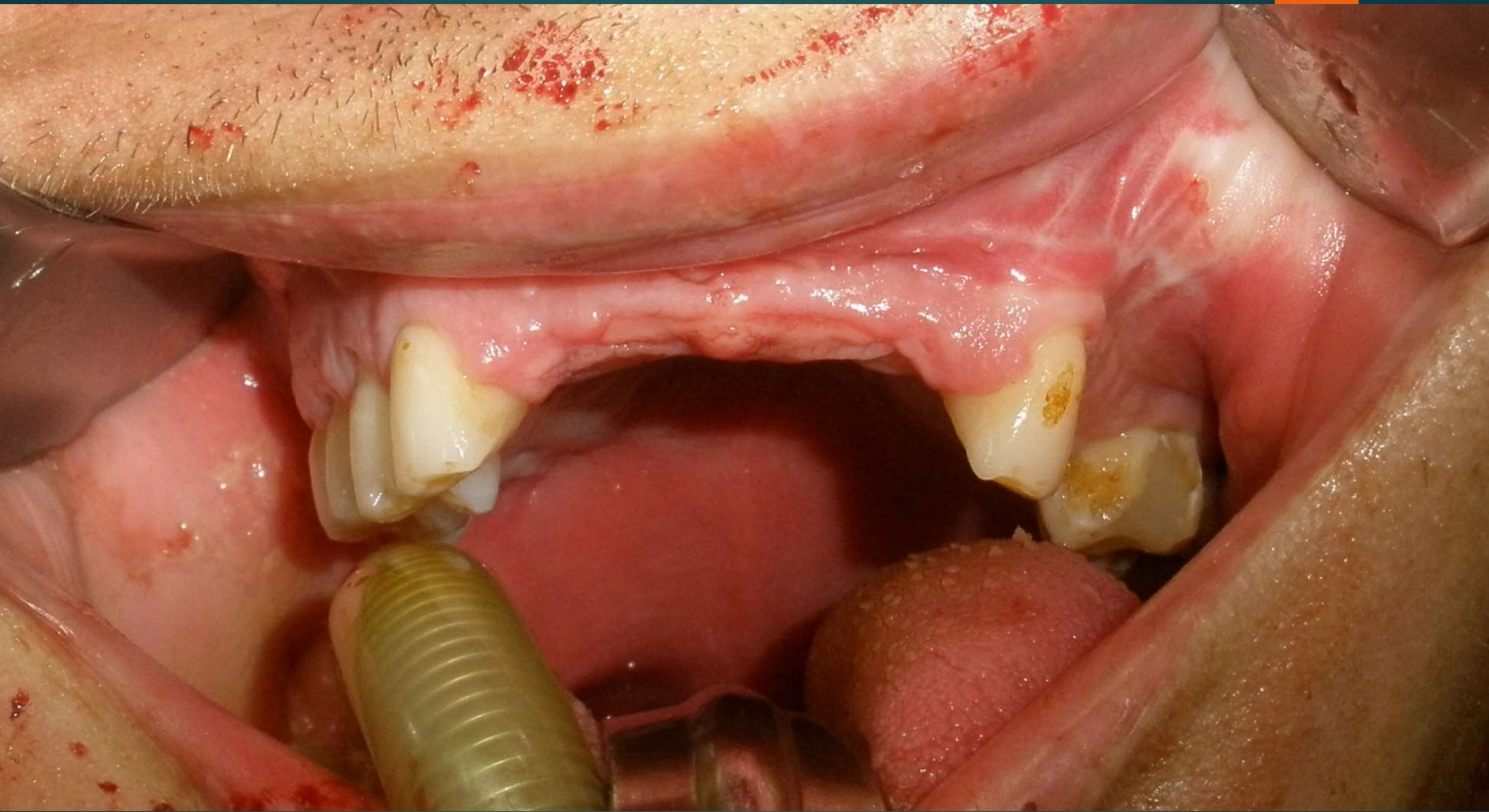
1st stage: Removal all foreign bodies, osteotomy of B/L ZMC's and then ORIF in appropriate orientation, reconstruction of the orbital floors by oculoplastic team

2nd stage: Maxillary LeFort I osteotomy and repositioning



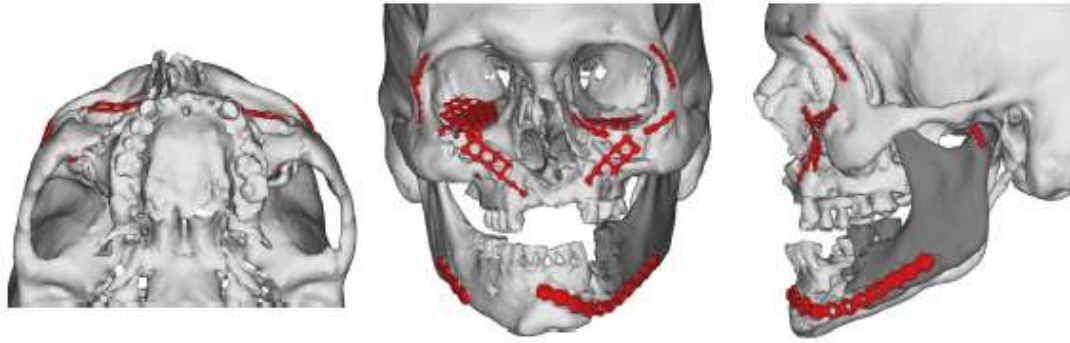




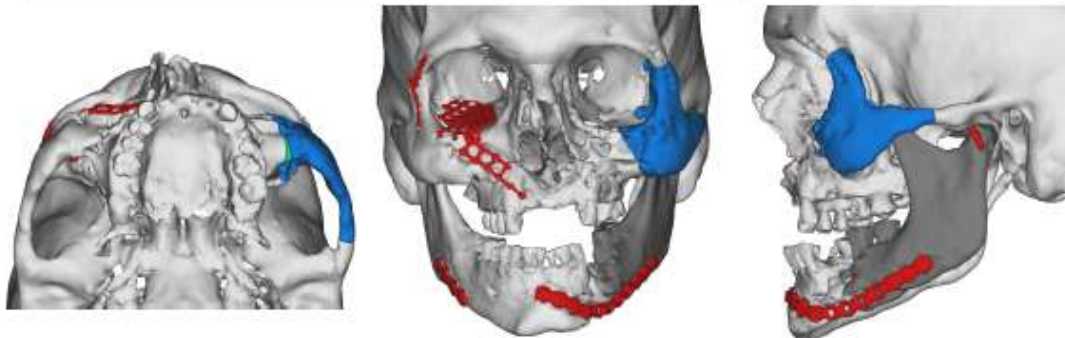




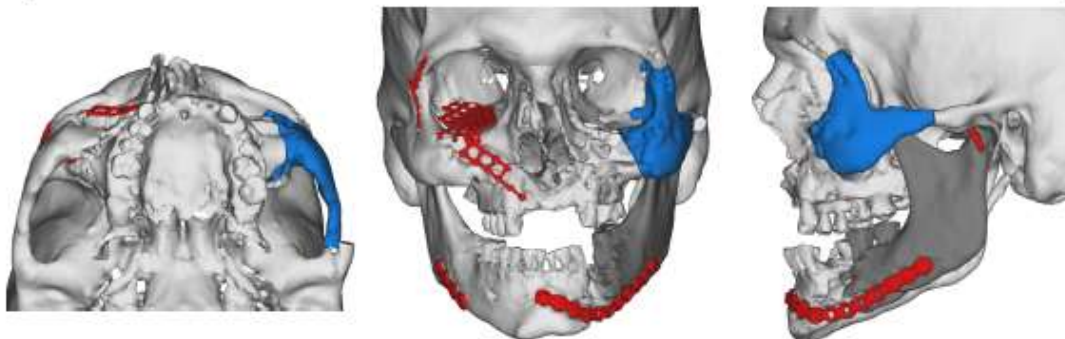
Preoperative Anatomy



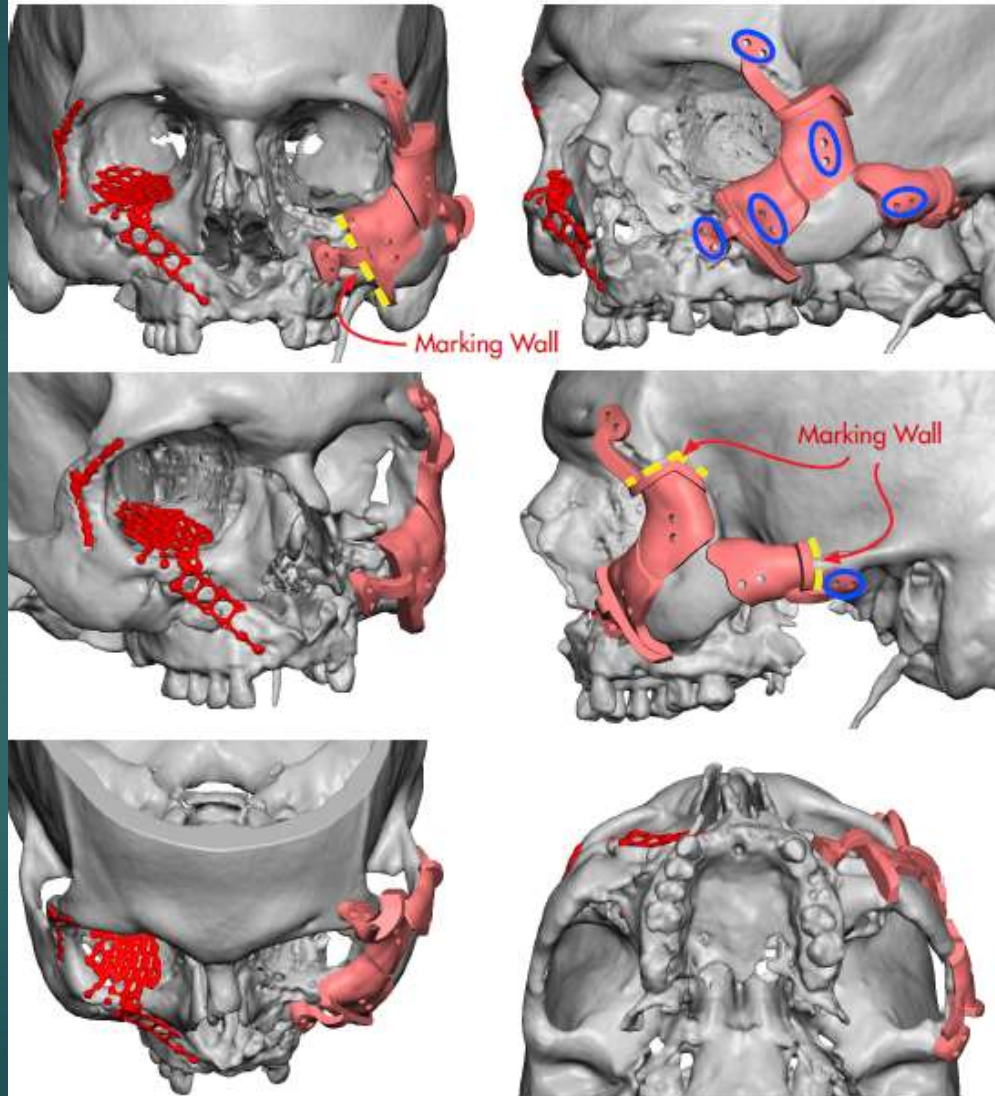
Osteotomized Unrepositioned Anatomy



Simulated Postoperative Anatomy

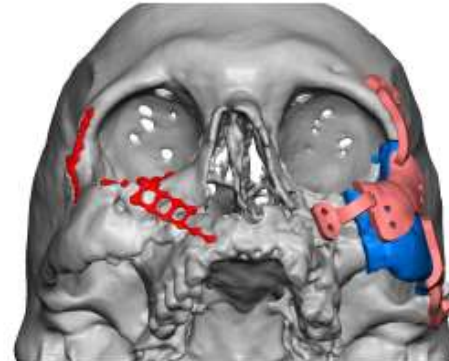
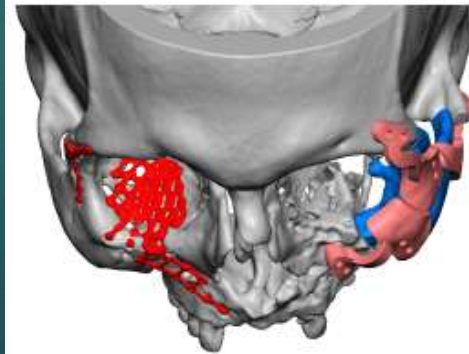
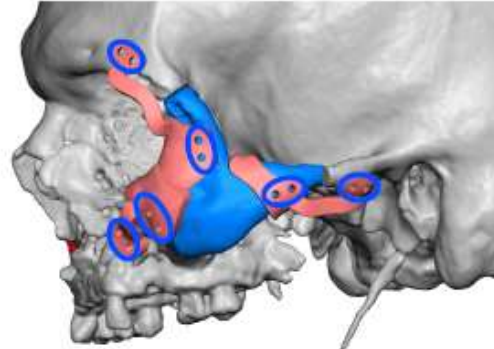
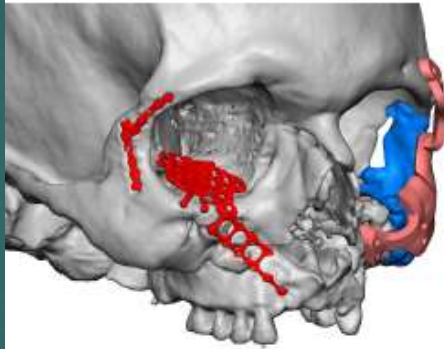
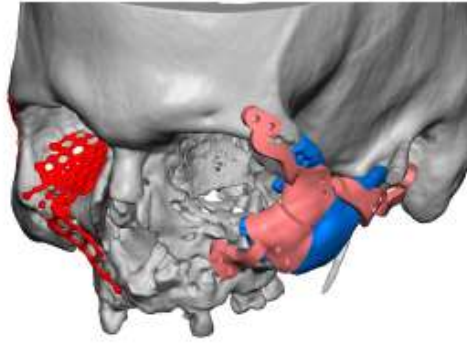
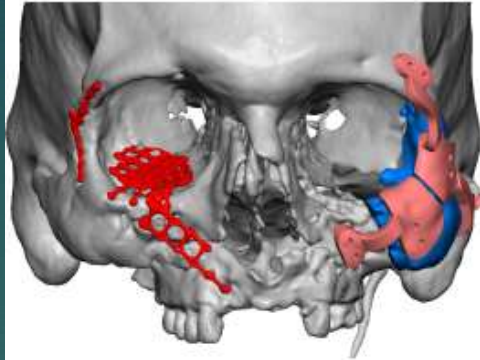


Maxillofacial Marking Guides

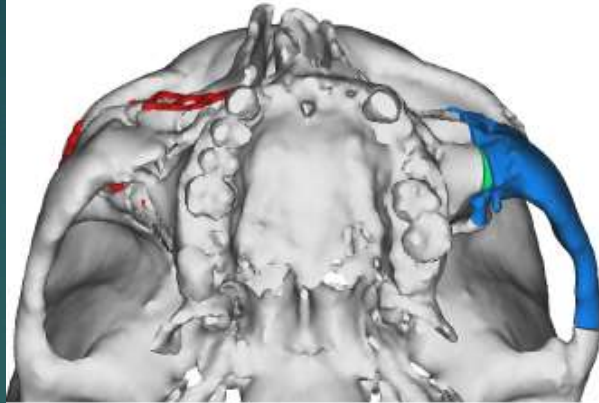


Maxillofacial Positioning Guides

Virtual Surgical Planning

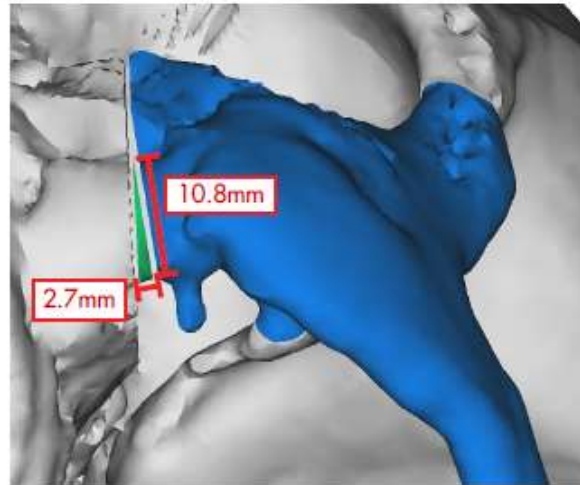
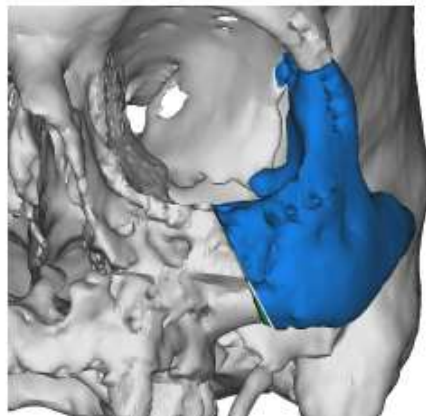


Interference Detail

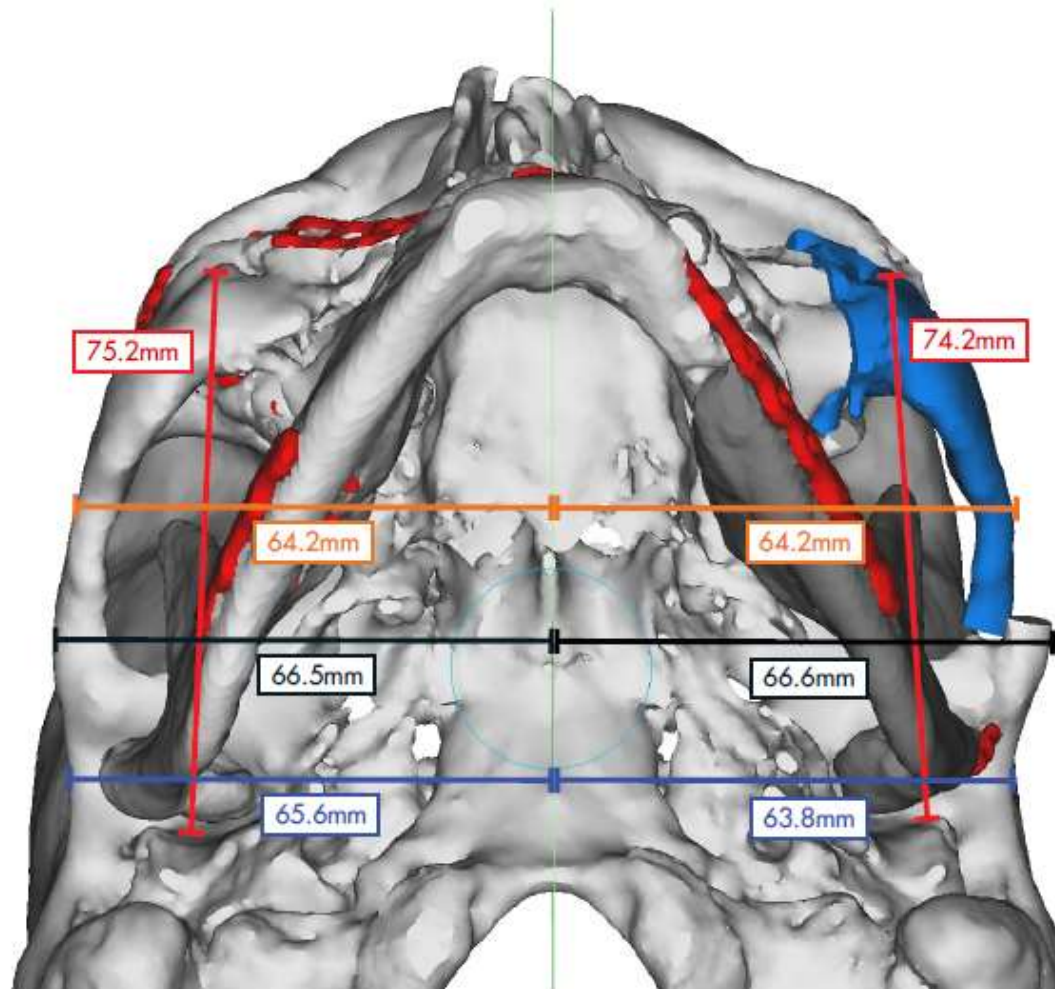


Once in the final position, the bone shown in green will need to be removed to avoid interference with the native maxilla.

Measurements are approximate.

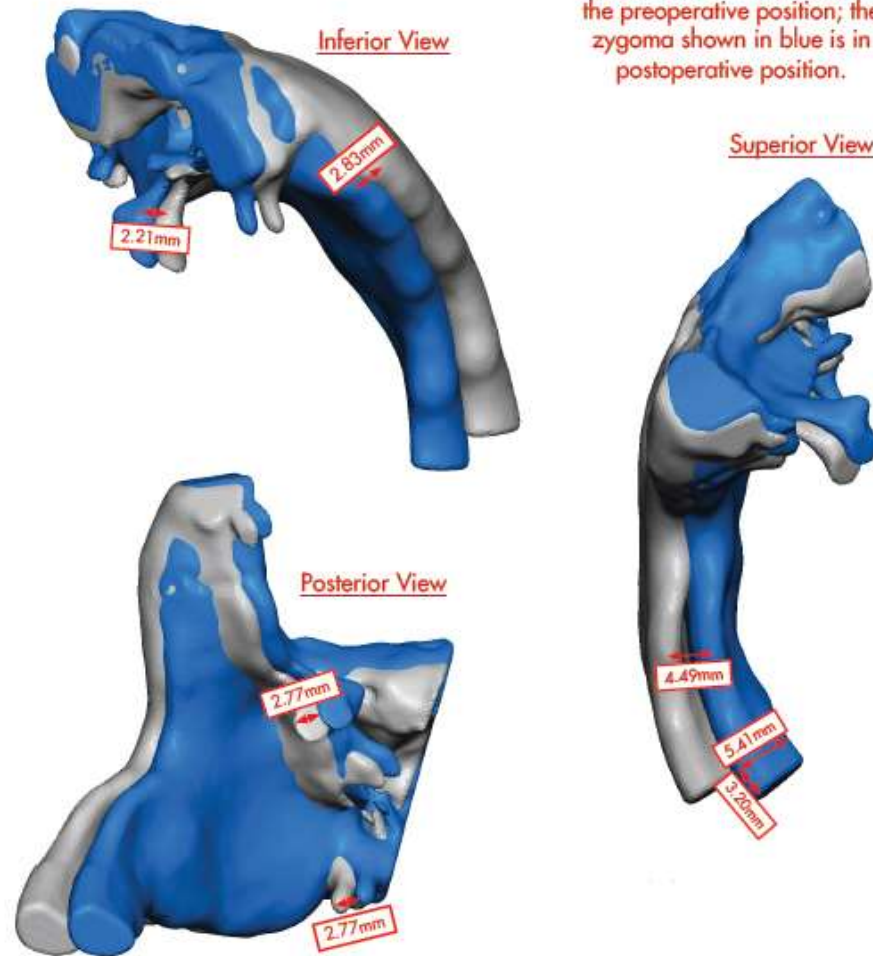


Requested Measurements



Measurements are approximate.

Requested Measurements



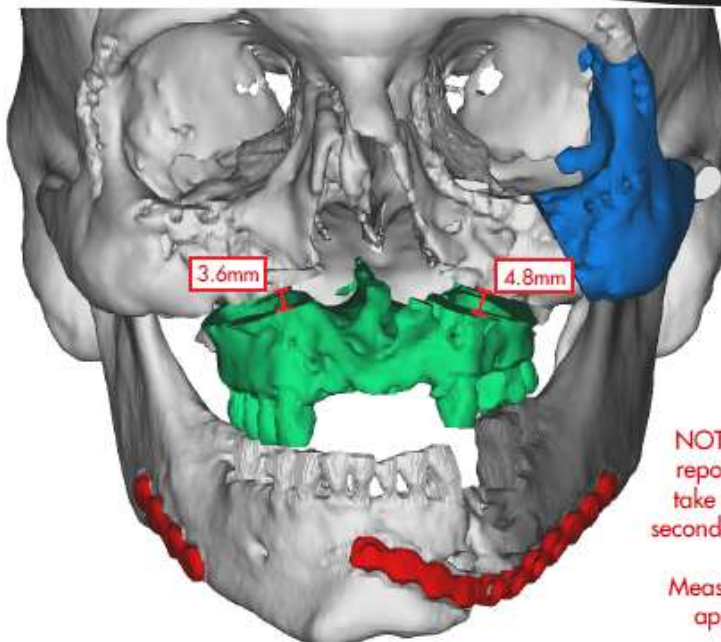
Zygoma shown in white is in the preoperative position; the zygoma shown in blue is in postoperative position.

Measurements are approximate.

2nd Stage

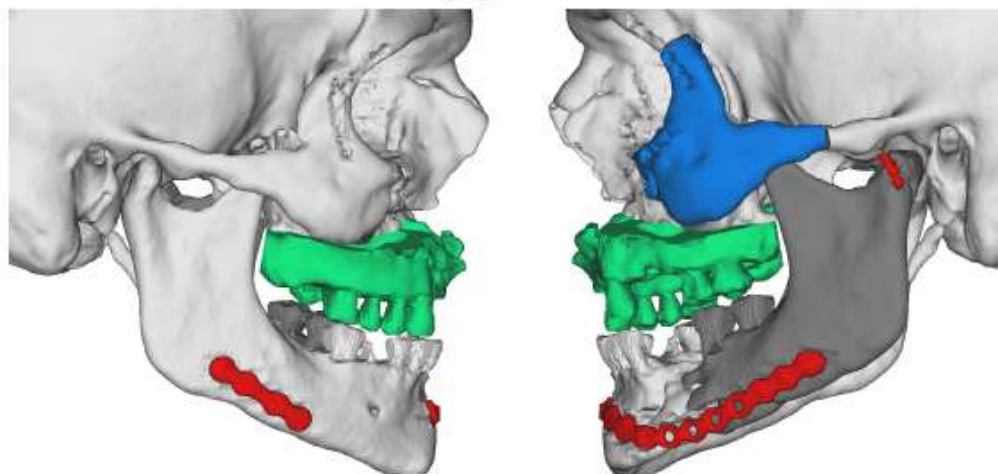
Repositioned Maxilla Detail

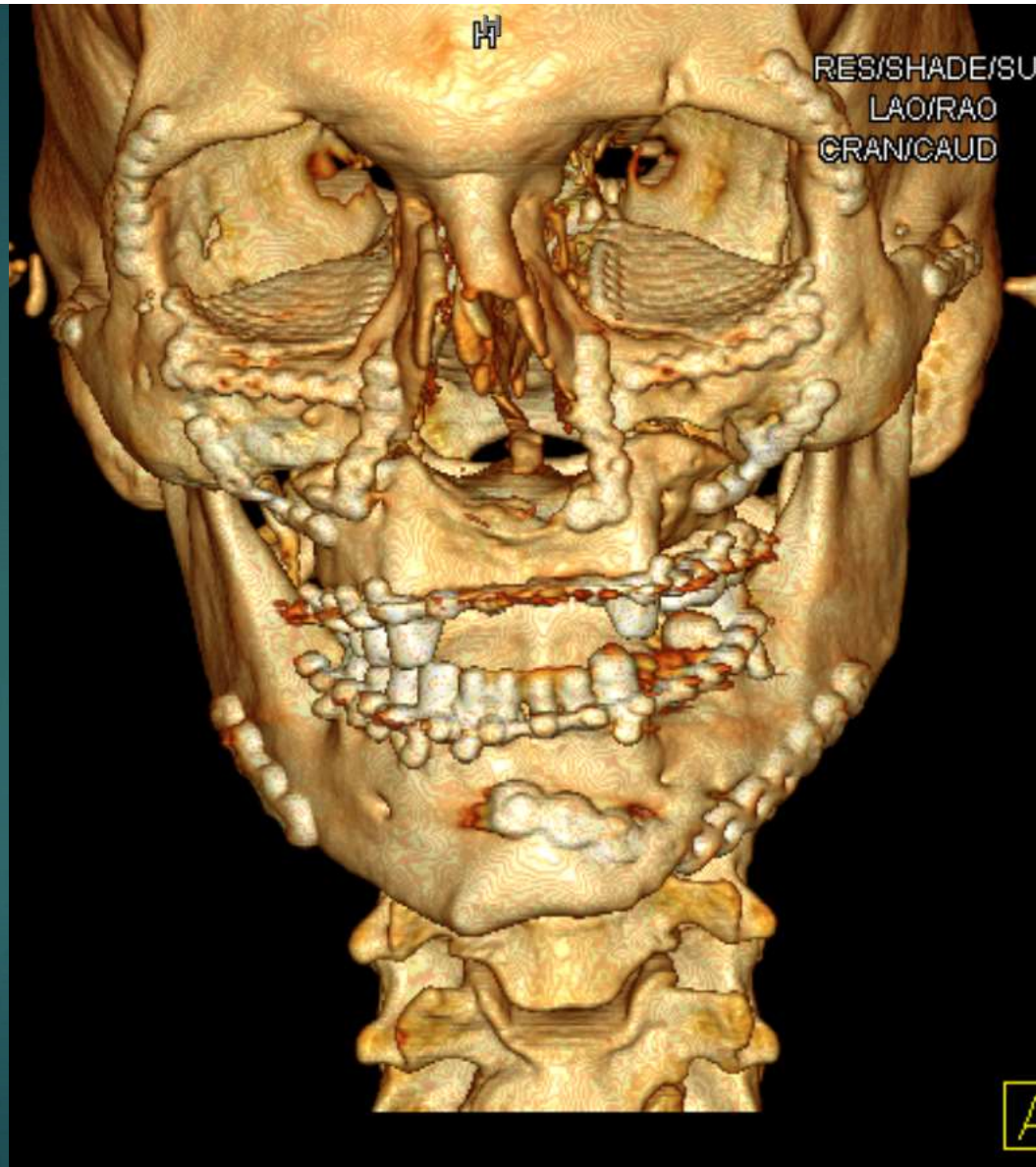
Virtual Surgical Planning

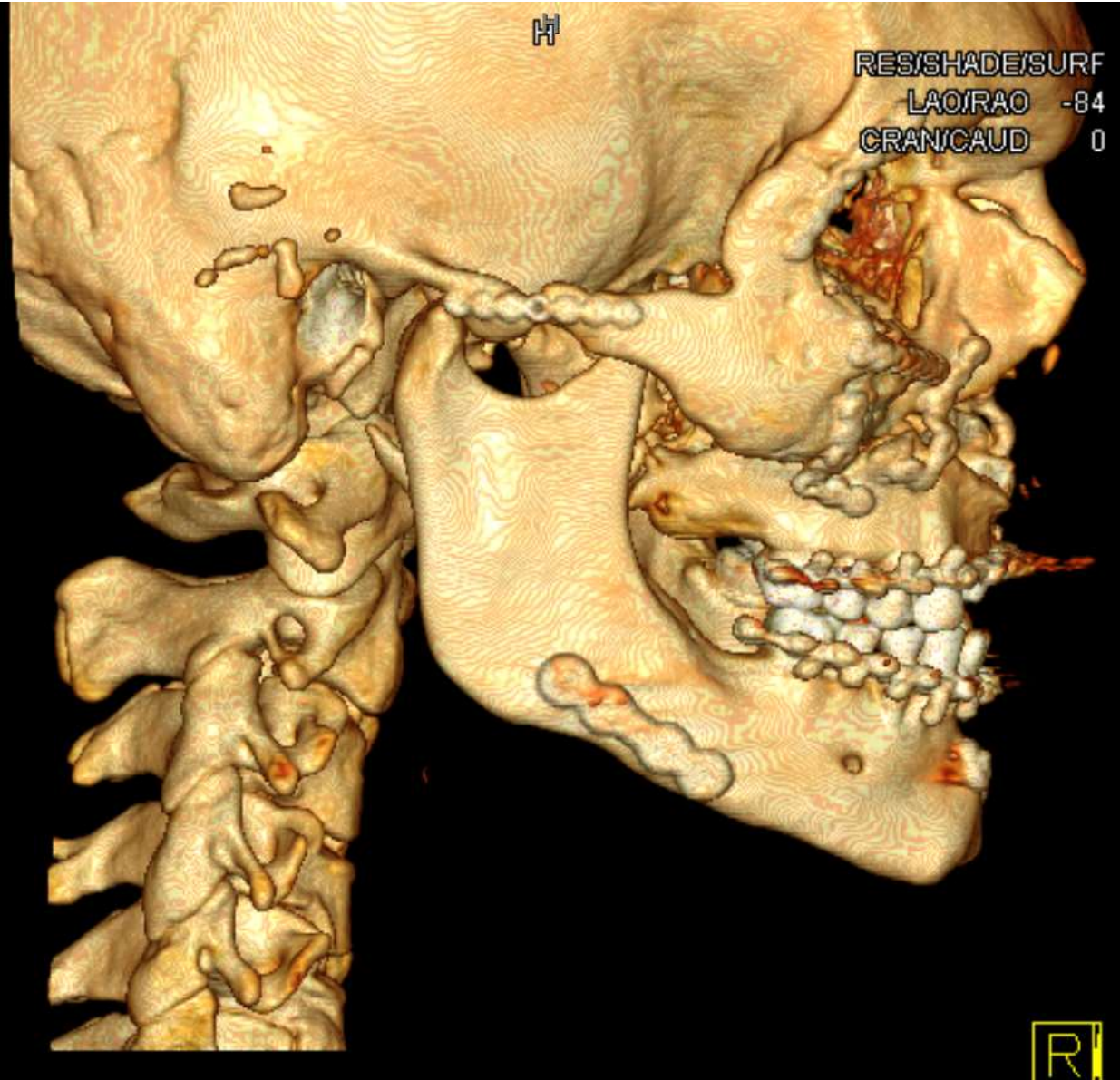


NOTE: Maxillary repositioning will take place during secondary procedure.

Measurements are approximate.

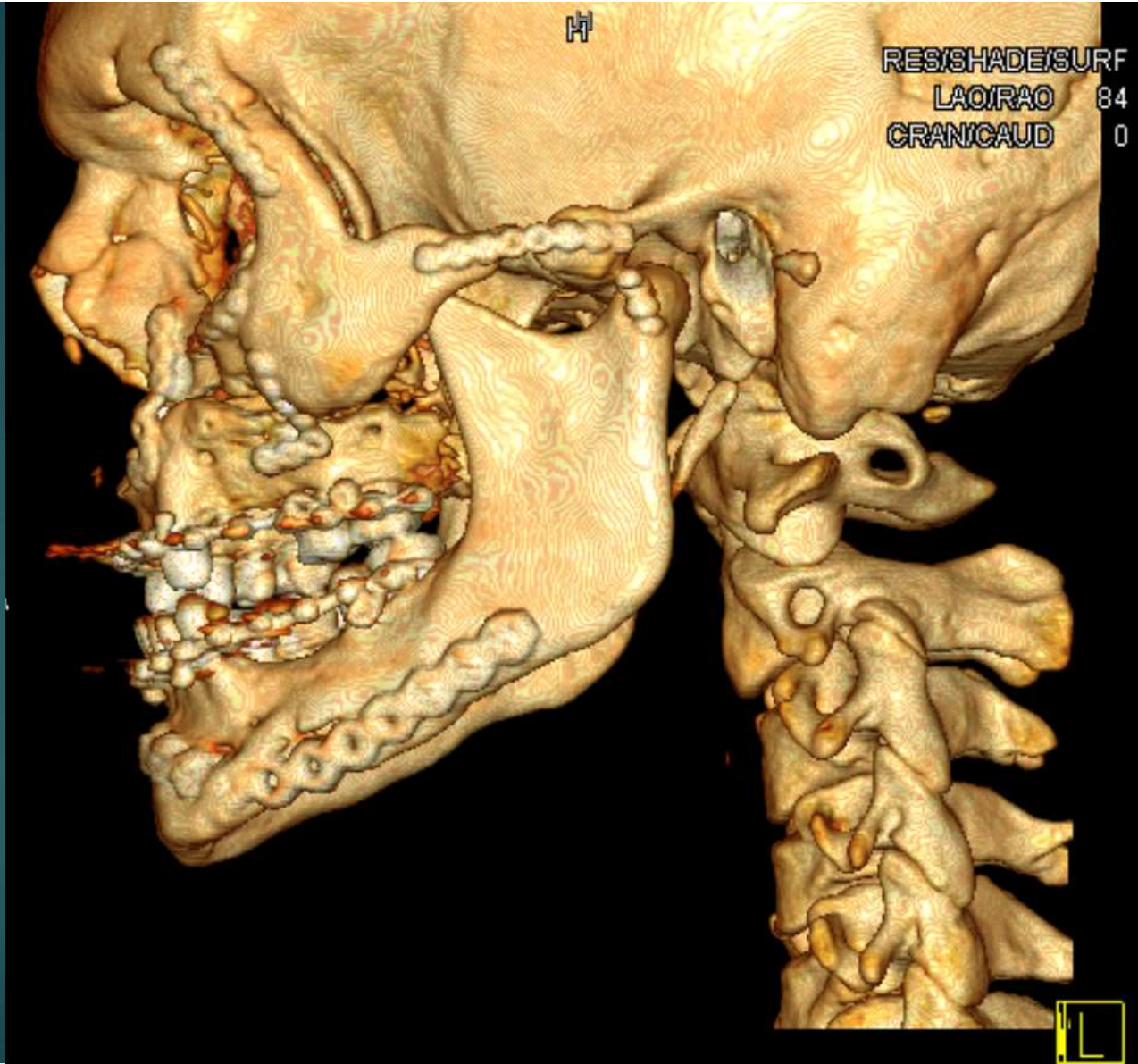






RES/SHADE/SURF
LAO/RAO -84
CRANICAUD 0

R



Conclusion

- ▶ Multiple issues are associated with delays in repair of maxillofacial trauma but most of these are associated with delays inherent to poly-trauma patients.
- ▶ The current evidence does not show a significant difference in reduction of complications between early and late treatment.
- ▶ Multiple cofounding factors besides delay in treatment influence treatment outcome.
- ▶ Delayed treatment of facial fractures may have greater difficulty in fracture reduction but that may be offset by reduction in soft tissue edema and scarring particularly in multiple facial fractures.
- ▶ The use of virtual surgical planning and intra-operative CT can help overcome many of the challenges associated with delayed surgery.

How do you want to remove the tooth?



Thank you
for your
attention!