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RESEARCH ARTICLE

Postoperative wound dehiscence in mandibular fractures

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ABSTRACT

Objective: To clarify the occurrence and causes of non-infection-related surgical wound dehiscence (SWD) in intraorally treated mandibular fractures.

Material and Methods: Patients with one or two fractures of the dentate part of the mandible treated surgically *via* an intraoral approach were included in this retrospective study. The primary outcome variable was SWD. Associations between patient-, fracture- and surgery-related variables and SWD were evaluated.

Results: Altogether 232 patients with 270 mandibular angle, body, symphysis and/or parasymphysis fractures were included in the analysis. In all, 22 SWDs were detected. These occurred in 9.5% of patients and in 8.1% of fractures. Surgery performed at night-time showed a significantly higher SWD rate than daytime surgeries ($p = .012$). Additionally, a significantly greater SWD rate was found among smokers ($p = .041$). Other studied variables remained statistically non-significant for SWD. In a multivariate analysis, night-time was the only significant independent variable with an odds ratio of 3.297 (95% CI 1.238 – 8.780, $p = .017$) for SWD.

Conclusion: The approach or closure technique used and the fracture type had only a minor effect on non-infection-related SWD in patients with mandibular fractures. To avoid SWDs, mandibular fracture surgeries should be conducted during the daytime with adequate support from an experienced surgeon.

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Introduction

Mandibular angle, body, symphysis and parasymphysis fractures are typically treated by open reduction using an intraoral approach [1,2]. Post-operative complication rates in studies on mandibular fracture surgeries vary between 25.0% and 61.1% depending on the fracture site and registered complication type [3–7]. Often reported complications in mandibular fracture surgery are infection (7.5–17.9%) [8–13], hardware failure (7.4–15.4%) [5,14], non-union (4.8–5.8%) [5,6] and malocclusion (2.9–8.0%) [5,6].

Additionally, surgical wound dehiscence (SWD) is a common post-operative complication in mandibular fracture surgery (3.0–13.4%) [5,6,15]. It can be described as a mechanical failure of the wound after surgery. Clinically, SWD is detected as bone and/or hardware exposure and the presence of granulation tissue. It is often associated with local infection [5] and especially with miniplate fixation techniques [6]. Substance abuse and smoking are examples of patient-related factors predisposing to SWD after mandibular fracture surgery [5,16]. SWD can contribute to the manifestation of other complications, such as hardware failure, and it may increase the need for control visits [5]. In practice, an intraoral surgical approach can be conducted by using a scalpel or electrosurgical instrument. In a previous study by Nagargoje et al. [17], oral mucosa wound healing was found to be better in the patient group incised with a scalpel than in the electrosurgery group.

Detailed surgery-related factors leading to SWD in mandibular fracture surgery are still unclear. In earlier studies [5,6,15], the definition of SWD has differed, as has the surgical approach and reduction used. Here we clarified the occurrence and causes of non-infection-related post-operative SWD in intraorally treated mandibular fractures. We hypothesized that previously undetected causes for SWD can be found in this patient population.

Materials and methods

Data collection

The electronic medical database of Helsinki University Hospital was utilized to retrospectively collect patient records of patients with mandibular fractures treated surgically at the hospital between January 2017 and December 2021.

Inclusion and exclusion criteria

Patients with one or two fractures of the dentate part of the mandible treated surgically *via* an intraoral approach were included in the study. Excluded were patients with infection at the time of primary surgery, patients without available

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dental panoramic radiographs and patients who had infection-associated SWD. Clinical symptoms and findings of infection included any of the following signs: pus formation, cellulitis, pain or re-increased swelling requiring antibiotic treatment. Additionally, a follow-up of at least 3 weeks was required for inclusion in the analyses.

Study variables

The primary outcome variable was SWD, defined as the opening of the wound either partially or completely with bone and/or hardware exposure. Patient-, fracture- and surgery-related variables for SWD occurrence were examined. Analyses were performed for both patient- and fracture-related variables separately.

Patient-related variables were age, sex, injury mechanism, substance abuse (including evident heavy alcohol use and/or abuse of other drugs), smoking, immunosuppressive condition (immunosuppressive drug therapy and/or disorder) and use of post-operative chlorhexidine mouthwash.

Fracture-related predictor variables were fracture site (symphysis/parasymphysis, body or angle fracture) and comminution of the fracture.

Surgery-related predictor variables were surgical approach (scalpel approach or electrosurgery such as Colorado® microdissection needle), fracture fixation technique (miniplates, lag screws or combined), suturing technique (simple interrupted sutures, continuous sutures and a combination of previous sutures), treatment delay from injury to surgery, post-operative intermaxillary fixation, surgeon's experience (resident or consultant) and time of surgery (defined as night-time surgery if surgery began between 10 pm and 6 am).

Approach site and fixation methods

The vestibular approach was used in fractures of the symphysis, parasymphysis and mandibular body. In the angle region, the approach was executed over the external oblique ridge at approximately the level of the occlusion and then extended inferiorly and laterally to the teeth.

Mandibular body and angle fractures were fixed with one miniplate according to the technique described by Champy and Lodde [18]. Monocortical two miniplate fixation, two lag screws or a combination of a mini plate and a lag screw was used in the symphysis/para symphysis region. Thus, only load-sharing osteosynthesis methods were used.

Radiological evaluation

Pre- and post-operative dental panoramic radiographs and the initial radiologist reports were reviewed by two oral and maxillofacial surgeon consultants (JS and AH), and fracture comminution was assessed. Additionally, computed tomography images were reviewed when available.

Statistical analysis

Statistical analyses were executed with a statistical software package (SPSS for Macintosh, version 27, IBM). Differences between study groups in continuous variables were assessed with *t* test and Mann-Whitney *U* test. Cross-tabulated categorical variables were analyzed with Pearson Chi-squared test or Fisher's exact test if expected values were < 5. Smoking, fracture comminution, fracture site, incision technique, suturing technique and time of surgery were entered as independent variables in a binomial logistic regression model for SWD. Only residents were included in the logistic regression model because no SWDs were observed in fractures operated on by consultants. *p*-values < .05 were considered statistically significant throughout the analyses.

Ethical approval

The study protocol was approved by the internal board of the Head and Neck Centre, Helsinki University Hospital, Helsinki, Finland (HUS/356/2017) and complied with the Helsinki Declaration.

Results

A total of 232 patients with 270 mandibular angle, body, symphysis and/or parasymphysis fractures fulfilled the inclusion criteria and were included in the analysis (Figure 1). Most patients included were male ($n = 187$, 80.6%), and the most common injury mechanism was assault ($n = 106$, 45.7%). SWD occurred in 22 patients (9.5%), and each had only one SWD. Patient-related variables and the occurrence of SWD are shown in Table 1. A significantly greater SWD rate was found among smokers ($p = .041$). None of the patients had fracture-associated soft tissue deficiency.

SWD was detected in 8.1% of all fractures. Fracture- and surgery-related variables are presented in Table 2. Surgery performed at night time showed a significantly higher SWD rate than daytime surgery ($p = .012$). In all, 36.4% of SWDs were sustained after night-time surgery. Additional analyses showed that all night-time surgeries ($n = 43$) were conducted by residents with or without an assistant consultant. In a multivariate analysis (Table 3), night time was the only significant independent variable with an odds ratio of 3.297 (95% CI 1.238 – 8.780, $p = .017$) for SWD.

Properties of SWDs and the treatment given are shown in Table 4. The timing of SWD occurrence varied between 7 and 130 days (mean 21.6 days, median 12 days). Thirteen SWDs (59.1%) were detected within two weeks postoperatively. Of 22 SWDs, a dehisced wound was reclosed in five (22.7%). Plate removal was conducted for ten SWDs (45.5%), whereas the remaining 12 SWDs healed without plate removal.

Discussion

The aim of this study was to clarify the occurrence of post-operative SWD in non-infection-related intraorally operated mandibular fractures. According to our findings, several surgical techniques can be used successfully in simple mandibular fracture surgery when considering the risk of SWD. However, night-time surgery was found to predispose to SWD.

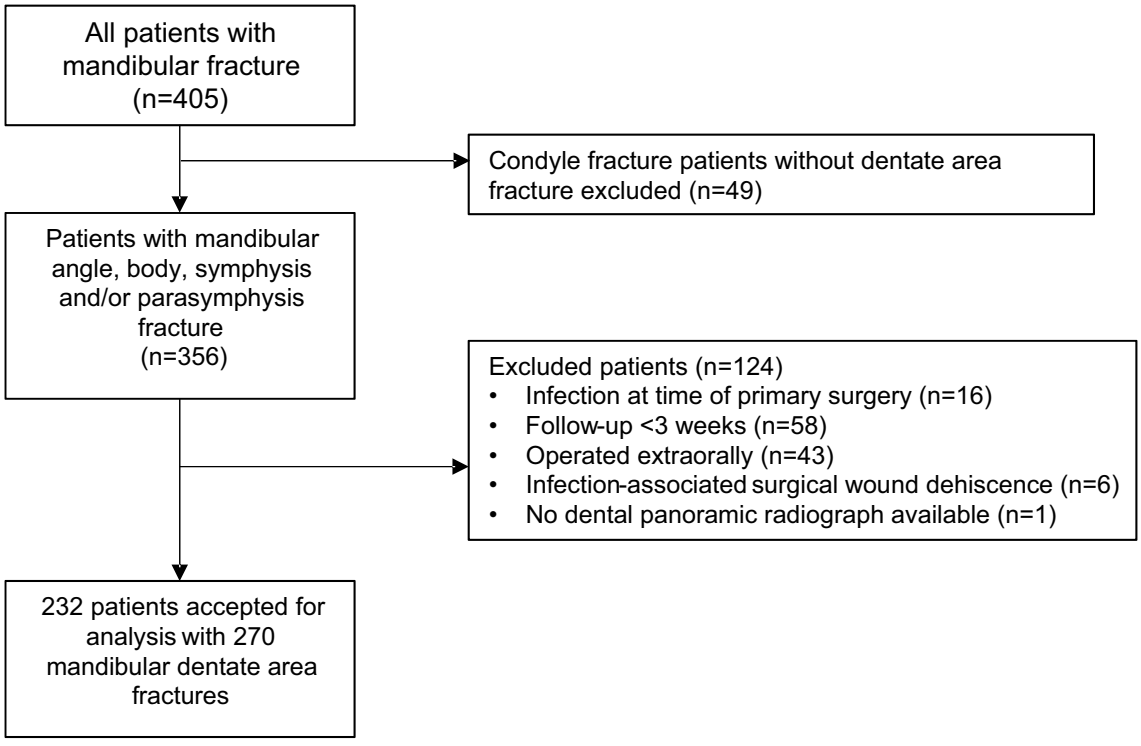

Figure 1. Flow chart of patient inclusion in the study.

Table 1. Explanatory variables and wound dehiscence in 232 mandibular fracture patients.

		Surgical wound dehiscence		No surgical wound dehiscence			
	All patients	*n*	%	*n*	%	*p*-value	Effect size if significant
All patients	232	22	9.5	210	90.5		
Age, years							
Range	5–89	16–77		5–89		.985	
Mean	34.6	33.8		34.7			
Median	31	32		31			
		n	% of *n*	*n*	% of *n*		
Sex							
Male	187	20	10.7	167	89.3	.264	
Female	45	2	4.4	43	95.6		
Immunosuppressive condition							
Yes	6	0	0	6	100.0	1	
No	226	22	9.7	204	90.3		
Smoking							
Yes	89	13	14.6	76	85.4	.041	.138
No	143	9	6.3	134	93.7		
Alcohol and/or drug abuse							
Yes	54	7	13.0	47	87.0	.302	
No	178	15	8.4	163	91.6		
Injury mechanism							
Assault	106	14	13.2	92	86.8	.371	
Traffic accident	45	2	4.4	43	95.6		
Falling on ground	61	6	9.8	55	90.2		
Falling ≥ 3 m	5	0	0	5	100.0		
Struck by an object	15	0	0	15	100.0		
Postoperative chlorhexidine mouthwash							
Yes	201	21	10.4	180	89.6	.324	
No	31	1	3	30	96.8		

Previously reported SWD rates in mandibular fracture surgery vary between 3% and 13.4% [5,6,15]; however, wound dehiscence definition, fracture type and surgical approach differ between these studies. In this study, we found SWD in 9.5% of patients and 8.1% of fractures. Regarding specific fracture types, Fox and Kellman [15] reported a non-infection-related SWD rate of 5.9% in patients with angle fracture, which corresponds to our results. SWD occurrence

Table 2. Fracture- and surgery-related explanatory variables in 270 mandibular fractures.

	Surgical wound dehiscence		No surgical wound dehiscence			
	n	%	*n*	%	*p*-value	Effect size if significant
All fractures	22	8.1	248	91.9		
Treatment delay from accident to surgery, days						
Range	0–14		0–19			
Mean	2.0		1.8		.629	
Median	1		1		.936	
	n	% of *n*	*n*	% of *n*		
Fracture site						
Symphysis/parasymphysis	13	7.7	156	92.3	.262	
Body	5	15.2	28	84.8		
Angle	4	5.9	64	94.1		
Incision technique						
Scalpel	7	9.9	64	90.1	.539	
Electrosurgery	15	7.5	184	92.5		
Fixation method						
Plate(s)	22	8.6	234	91.4	.519	
Lag screw(s)	0	0	10	100.0		
Combined	0	0	4	100.0		
Suturing technique						
Simple interrupted sutures	14	8.7	147	91.3	.494	
Continuous sutures	8	8.5	86	91.5		
Combined	0	0	15	100.0		
Additional mentalis muscle suturing in (para) symphysis fractures						
Yes	5	5.7	83	94.3	.307	
No	8	9.9	73	90.1		
Comminution of fracture						
Non-comminuted	19	7.6	230	92.4	.394	
Comminuted	3	14.3	18	85.7		
Minor comminution	3	17.6	14	82.4	1	
Major comminution	0	0	4	100.0		
Postoperative intermaxillary fixation						
Yes	5	8.9	51	91.1	.787	
No	17	7.9	197	92.1		
Surgeon						
Resident with/without assistant consultant	22	8.6	234	91.4	.613	
Resident	17	9.3	165	90.7	.504	
Resident with assistant consultant	5	6.8	69	93.2		
Consultant	0	0	14	100.0		
Time of surgery						
Night-time	8	18.6	35	81.4	.0120	.166
Daytime	14	6.2	213	93.8		

Table 3. Logistic regression analysis with 95% confidence intervals for occurrence of surgical wound dehiscence after mandibular fracture surgery.

Variable	Coefficient	SE	VIF	OR	95% CI	*p*-value
Smoker	0.905	0.470	1.018	2.472	0.983–6.214	.054
ref. non-smoker						
Body fracture	1.027	0.598	1.037	2.793	0.864–9.025	.086
ref. angulus and symphysis fracture						
Electrosurgery	−0.243	0.512	1.015	0.785	0.287–2.141	.636
ref. scalpel incision						
Simple interrupted sutures	0.268	0.486	1.020	1.307	0.504–3.386	.582
ref. continuous and combined sutures						
Comminuted fracture	0.689	0.703	1.023	1.992	0.502–7.906	.327
ref. non-comminuted fracture						
Night-time surgery	1.193	0.500	1.008	3.297	1.238–8.780	.017
ref. daytime surgery						

Abbreviations: SE: standard error; VIF: variance inflation factor; OR: odds ratio; CI: confidence interval.

with other fracture types was, however, higher in our study. SWD was found in 7.7% of symphysis/parasymphysis fractures and in up to 15.2% of fractures in the mandibular body. In the latter, intraorally placed plate fixation typically covers only the mucosa and thin submucosa, thus exposing it to a greater risk of SWD compared with other mandibular regions. The role of infection in SWD as the original reason can also be discussed. For this study, six patients were excluded due to clinical infection-associated SWD. Thus, the majority of SWDs were not related to infection.

Time of day has been shown to affect the result of surgery. Wu et al. [19] found in their retrospective review of 1140 patients that night-time cholecystectomy is associated with an increased conversion to open surgery. Additionally, Kelz et al. [20] noted the elevated risk of morbidity in surgical procedures ($n = 144\,740$) performed later than 4 pm. However,

Table 4. Properties and treatment given in surgical wound dehiscence cases.

All (*n*)		22		
Days between surgery and surgical wound dehiscence				
Range		7 – 130		
Mean		21.6		
Median		12		
	Yes *n*	**%**	**No *n***	%
Dehiscence properties				
Hardware exposure	14	63.6	8	36.4
Wound completely dehisced	9	40.9	13	59.1
Treatment of dehiscence				
Resuturing of wound	5	22.7	17	7.30
Chlorhexidine mouthwash recommended after dehiscence	19	86.4	3	13.6
Plate(s) removed	10	45.5	12	54.5

Figure 2. A 20-year-old male smoker had clinically asymptomatic wound dehiscence after surgery for mandibular parasymphysis fracture. Continuous sutures were used in the fracture surgery. Dehiscence was detected 8 days post-operatively and an attempt was made to repair the wound by suturing again. Clinically asymptomatic dehiscence persisted, and fixation material was removed 5 months post-operatively. The figure shows the exposed upper fixation plate immediately underneath the mucosal approach. The more optimal approach site is presented in Figure 3(A,B).

some previous studies [21,22] indicated that trauma surgery at night time was not associated with higher complication rates. In our study, night-time surgery was associated significantly with SWDs ($p = .012$). The experience of the surgeon diminished SWD occurrence (Table 2), nevertheless, residents were always involved in night-time surgeries. The surgeon's fatigue at night time may increase the risk of complications. Working overtime, sleep deprivation and both mentally and physically demanding work may lead to fatigue that possibly impairs concentration. It is noteworthy that only simple dentate mandibular fractures were included in the study and differences between fracture types regarding the occurrence of SWD were minor. As shown previously, a short delay after injury before repairing mandible fractures is not associated with higher complication rates [11,23,24]. Thus, these simple mandibular fracture surgeries can be recommended to be postponed to the daytime.

Previous studies have compared scalpel and electrosurgery instruments. According to Nagargoje et al. [17], diathermy is faster to use than a scalpel in mucosal approaches in mandibular anterior fracture surgery. However, in the same study, wound healing was found to be better post-operatively in patients with a scalpel approach at 24 h and 48 h. In our study, no difference was found between SWD occurrence and the technique chosen. Thus, both approaches can be used, but it is important to consider heating power when an electrosurgical instrument is applied.

Among several surgery-related technical aspects in fracture reduction and fixation methods, special attention should be paid to the optimal site and approach level. According to the AO principles, the preferred site for approach in the angle region is approximately 5 mm away from the attached gingiva [25]. Between the canines, the preferred distance is 10–15 mm [26]. Surprisingly, separate closure of the mentalis muscle did not prevent SWD in symphysis region. This refers to a situation-specific assessment of the closure technique by surgeons, which appears optimal considering the results. The local circumstances at the fracture site, such as tissue type and level of approach, should thus be considered.

Intraoral mandibular fracture surgery appears to be prone to early SWD and to occur 7–10 days after surgery as previously presented [15]. This highlights the consequence of surgical technique on wound healing. However, in the present study, timing of SWD occurrence ranged from one week up to 130 days, with a median of 12 days. Our finding emphasizes the importance of post-operative follow-up and clinical examination even if the patient has no symptoms of infection. In addition, the variation in timing suggests different reasons behind SWD. Close location of the fixation material to the approach may increase the risk of SWD (Figure 2). Thus, the location of the surgical approach should be planned carefully to reduce the risk for SWD (Figure 3). However, for good fracture repositioning, fixation may require to be placed higher than optimal for surgical wound healing. Additionally, the proximity of the roots of the teeth and the mental nerve affect fixation placement. In the angle region, one miniplate is found to cause significantly less SWD when compared to two miniplates [27], however, local factors such as the presence and location of the wisdom tooth in the fracture area certainly influence on SWDs. Since optimal osteosynthesis is the main purpose of fracture surgery, and presumably, all SWDs cannot be avoided, patients should be informed of this typical complication in intraoral fracture surgery.

In addition to local factors, such patient-related factors as poor oral hygiene, immunocompromised status and smoking predispose to post-operative complications [5,16]. In this study, SWD occurrence was associated significantly with smoking ($p = .041$), and SWD was common in patients with

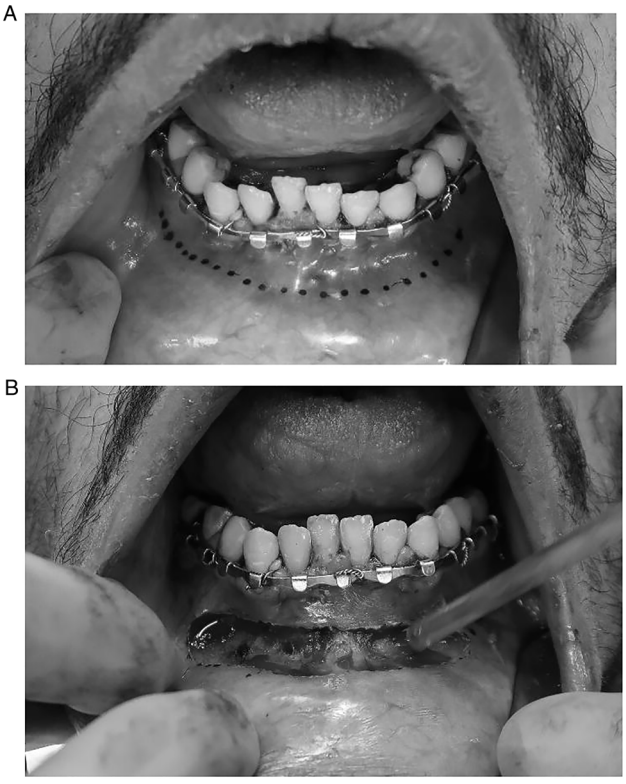

Figure 3. (A) The approach is placed to the labial sulcus in patient with mandibular fracture. (B) The incision is made through the mucosa. Submucosal dissection is performed, and the mentalis muscle is bisected to exposure the fracture site. Mucosal approach has been made adequately considering the location of the fixation materials.

alcohol/substance abuse history, although this result did not reach statistical significance. Immunosuppressive condition was rare in the study population (2.6%). Patients with an increased risk of post-operative problems require special precision in treatment both perioperatively and post-operatively. Clinicians should encourage patients for smoking cessation, motivate them to maintain good oral hygiene and briefly intervene in their alcohol use [28]. Although post-operative chlorhexidine mouthwash was not shown to be beneficial or detrimental to SWD in this study, it should be recommended in post-operative care, as it has proven to improve the level of oral hygiene by reducing plaque levels [29].

The retrospective design and the variation between patients, fracture types and surgical methods can be considered the main limitations of this study. With standardized surgical techniques, more differences might have emerged between groups. In addition, patients' subjective experience, such as pain and discomfort, was not elucidated in this study. We also did not evaluate the occurrence of other complications or whether night-time surgery increases the risk for these complications.

In conclusion, SWD is a common post-operative complication after intraoral surgery of simple dentate mandibular fractures. Surgery performed at night time predisposes to SWDs. Additionally, smokers were found to have a greater SWD rate. Electrosurgery or the scalpel approach and different closure methods are equally good in intraoral mandibular fracture surgery when evaluating SWD. These findings emphasize the role of education and experience to reach an optimal approach site and location of fixation material as well as day-time surgery in SWD prevention.

Disclosure statement

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References

[1] Ellis E, Miles BA. Fractures of the mandible: a technical perspective. Plast Reconstr Surg. 2007;120(Supplement 2):76S–89S.
[2] de Matos FP, Arnez MFM, Sverzut CE, et al. A retrospective study of mandibular fracture in a 40-month period. Int J Oral Maxillofac Surg. 2010;39(1):10–15.
[3] Biller JA, Pletcher SD, Goldberg AN, et al. Complications and the time to repair of mandible fractures. Laryngoscope. 2005;115(5):769–772.
[4] Siddiqui A, Markose G, Moos KF, et al. One miniplate versus two in the management of mandibular angle fractures: a prospective randomised study. Br J Oral Maxillofac Surg. 2007;45(3):223–225.
[5] Gutta R, Tracy K, Johnson C, et al. Outcomes of mandible fracture treatment at an academic tertiary hospital: a 5-Year analysis. J Oral Maxillofac Surg. 2014;72(3):550–558.
[6] Lamphier J, Ziccardi V, Ruvo A, et al. Complications of mandibular fractures in an urban teaching center. J Oral Maxillofac Surg. 2003;61(7):745–749.
[7] Beret M, Nicot R, Roland-Billecart T, et al. Impacted lower third molar relationship with mandibular angle fracture complications. J Stomatol Oral Maxillofac Surg. 2022;123(2):149–154.
[8] Lee CC, Hajibandeh JT, Tannyhill RJ, et al. Is outpatient management of mandibular fractures associated with inflammatory complications? An ACS-NSQIP study. J Oral Maxillofac Surg. 2021;79(12):2507–2518.
[9] Odom EB, Snyder-Warwick AK. Mandible fracture complications and infection: the influence of demographics and modifiable factors. Plast Reconstr Surg. 2016;138(2):282e–289e.
[10] Gaal A, Bailey B, Patel Y, et al. Limiting antibiotics when managing mandible fractures may not increase infection risk. J Oral Maxillofac Surg. 2016;74(10):2008–2018.
[11] Czerwinski M, Parker WL, Correa JA, et al. Effect of treatment delay on mandibular fracture infection rate. Plast Reconstr Surg. 2008;122(3):881–885.
[12] Oksa M, Haapanen A, Marttila E, et al. Simple dentate area fractures of the mandible – can we prevent postoperative infections? Acta Odontol Scand. 2022;80(7):494–500.
[13] Dodson TB, Perrott DH, Kaban LB, et al. Fixation of mandibular fractures: a comparative analysis of rigid internal fixation and standard fixation techniques. J Oral Maxillofac Surg. 1990;48(4):362–366.
[14] Shurley CD, Abramowicz S, Manhan AJ, et al. Comprehensive analysis of patients with failure of mandibular hardware. Oral Surg Oral Med Oral Pathol Oral Radiol. 2022;134(1):15–19.
[15] Fox AJ, Kellman RM. Mandibular angle fractures: two-miniplate fixation and complications. Arch Facial Plast Surg. 2003;5(6):464–469.

[16] Hsieh TY, Funamura JL, Dedhia R, et al. Risk factors associated with complications after treatment of mandible fractures. JAMA Facial Plast Surg. 2019;21(3):213–220.
[17] Nagargoje GL, Badal S, Mohiuddin SA, et al. Evaluation of electrocautery and stainless steel scalpel in oral mucoperiosteal incision for mandibular anterior fracture. Ann Maxillofac Surg. 2019;9(2):230–234.
[18] Champy M, Lodde JP. Mandibular synthesis. Placement of the synthesis as a function of mandibular stress (in french). Rev Stomatol Chir Maxillofac. 1976;77(8):971–976.
[19] Wu JX, Nguyen AT, de Virgilio C, et al. Can it wait until morning? A comparison of nighttime versus daytime cholecystectomy for acute cholecystitis. Am J Surg. 2014;208(6):911–918.
[20] Kelz RR, Freeman KM, Hosokawa PW, et al. Time of day is associated with postoperative morbidity. Ann Surg. 2008;247(3):544–552.
[21] Busse J, Bhandari M, Devereaux PJ. The impact of time of admission on major complications and mortality in patients undergoing emergency trauma surgery. Acta Orthop Scand. 2004;75(3):333–338.
[22] Yaghoubian A, Kaji AH, Putnam B, et al. Trauma surgery performed By "sleep deprived" residents: are outcomes affected? J Surg Educ. 2010;67(6):449–451.
[23] Hurrell MJL, David MC, Batstone MD. A prospective study examining the effects of treatment timing in the management of mandible fractures. Int J Oral Maxillofac Surg. 2018;47(9):1126–1131.
[24] Barker DA, Oo KK, Allak A, et al. Timing for repair of mandible fractures. Laryngoscope. 2011;121(6):1160–1163.
[25] Ellis E, Schubert W. Transoral approach to the angle. Available from: https://surgeryreference.aofoundation.org/cmf/trauma/mandible/approach/transoral-approach-to-the-angle. Cited 2022. Feb 25.
[26] Ellis E, Schubert W. Transoral approach to the symphysis and body. Available from:https://surgeryreference.aofoundation.org/cmf/trauma/mandible/approach/transoral-approach-to-the-symphysis-and-body. Cited 2022. Feb 25.
[27] Al-Moraissi EA. One miniplate compared with two in the fixation of isolated fractures of the mandibular angle. Br J Oral Maxillofac Surg. 2015;53(8):690–698.
[28] Hirvikangas R, Bertell J, Marttila E, et al. Patient injury-related alcohol use – underestimated in patients with facial fractures? Oral Surg Oral Med Oral Pathol Oral Radiol. 2020;130(3):236–240.
[29] James P, Worthington H, Parnell C, et al. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health. Cochrane Database Syst Rev. 2017;3(3):CD008676.