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Impacted wisdom tooth and mandibular fracture complications

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Impacted lower third molar relationship with mandibular angle fracture complications

Abstract

Introduction: Mandibular angle fractures are very common and are associated with the highest risk of complications. The aim of this study is to evaluate the correlation between impacted lower third molar and mandibular angle fracture complications.

Material and methods: All patients presenting with a mandibular angle fracture and at least 2 months follow up were retrospectively included. The following complications were recorded: post-traumatic malocclusion, mouth opening limitation, inferior alveolar nerve hypoesthesia, infection, delayed union, hardware loosening. The patients were divided in two groups: impacted lower third molar or erupted/absent lower third molar.

Results: A total of 68 patients were included, lower third molar was impacted in 36 cases and erupted/absent in 32 cases. 40 complications were recorded in 27 patients at 2 months. No statistically significant difference could be found about malocclusion, mouth opening limitation and inferior alveolar nerve hypoesthesia. A lower rate of persistent inferior alveolar nerve hypoesthesia (p=0.0557) in patients with impacted lower third molar (19.4%) was observed compared to patients without impacted lower third molar (40.6%). There was no occurrence of delayed union and hardware loosening in impacted lower third molar group, whereas 5 delayed unions and 4 hardware loosening were recorded in erupted/absent lower third molar group. Finally, the rate of patients with at least one of the 6 complications is significantly higher in the erupted/absent lower third molar group (17/32, 53.1%) than in the impacted lower third molar group (10/36, 27.8%), p=0.033.

Discussion: The risk of overall complication is decreased when lower third molar is impacted in mandibular angle fracture. This supports the idea of a role of the impacted lower third molar in fracture reduction and stability.

Keywords: mandibular fracture; mandibular angle fracture; lower third molar; impacted tooth; facial traumatology

Introduction

Mandibular fractures are very common, accounting for 36% to 76% of facial fractures, amongst them, mandibular angle fractures account for 16 to 37% of mandibular fractures [1,2]. Mandibular fractures etiologies consist mainly of assault, traffic accidents, falls, and sports accidents. The mechanism of the trauma influences the location of the fracture, especially angular or condylar fractures. Angular fractures are predominant following assaults or falls, while they are less associated with high kinetic traumas such as traffic accidents [3]. However, the presence and the position of the lower third molar (LTM) is the predominant risk factor [1]. LTM are found in 60-85% of mandibular angle fractures [2,4]. The mandibular angle is delimited in proximally by the distal face of the second molar and distally by the horizontal line extending the retromolar triangle. When the LTM is present, it decreases bone quality and density, resulting in an area of bone fragility at the mandibular angle, which will be prone to fracture. Several studies have shown that the presence of LTM increases the risk of mandibular angle fractures [1,2,5–8]. This risk of fracture is directly linked with the position of the LTM. Class B and class II of the Pell & Gregory classification [9] are the main risk factors for mandibular angle fracture, whereas classes A and I are protective factors and class C is not associated with a risk modification according to Armond *et al.* [1]. This can be explained by the fact that the upper bony layer of the mandibular angle is a zone of tension while the lower bony layer is a zone of compression as shown by Champy *et al.* [10]. When LTM are rated C, the upper bony layer remains intact, inducing less weakness. On the other hand, we know that the presence of LTM protects against the occurrence of condylar fractures, which are at risk of functional limitation [11]. The value of preventive extraction of asymptomatic impacted LTM is therefore controversial [4,5,7].

The treatment of mandibular angle fractures is also still controversial and is related with the risk of complications. The treatment strategy depends mostly on the displacement of the fracture: non-displaced fractures can be treated conservatively, while displaced fractures require open reduction and internal fixation (ORIF). Nowadays, even non-displaced fractures are often treated with ORIF to avoid maxillomandibular fixation (MMF) [12]. Various techniques of rigid or non-rigid ORIF have been described with controversy regarding the stability of the fracture site, however, it seems to have no significant difference in late complications occurrence [10,12–17].

Mandibular angle fractures are the mandibular fractures associated with the highest risk of complications, up to 33% according to several studies [12,14,15,18–21]. The most frequent complications of mandibular angle fractures are healing disorders (15.3%) and infections (9.9%) (12). Their occurrence seems to correlate mostly with tobacco and alcohol use and plate fracture [22] although the main difference between angular fracture and other mandibular fracture is the frequent presence of LTM.

The management of LTM in cases of mandibular angle fracture remains debated, some historic studies advocate LTM removal [23,24], while more recent studies advocate LTM preservation [4,12,25–28]. LTM preservation could help in fracture reduction and fixation. No statistically significant difference in postoperative complications between LTM preservation and LTM removal was found in several studies [4,12,25,26,29]. Nevertheless, they advocate LTM removal in cases of tooth infection, mobility or fracture [25,26].

On the other hand, Fernandes et al. [2] found that the absence of LTM in the mandibular angle fracture line, following peroperative LTM removal or LTM absence prior to trauma, is associated with a lower rate of post-operative infection when compared to mandibular angle fractures with LTM in the fracture line. However, their detailed results are contradictory and their conclusion is only about post-operative infection and not about complications at large.

In our clinical practice, there seems to be a link between impacted LTM and the occurrence of complications, notably infection and healing issues, in mandibular angle fracture. Bearing in mind that mandibular angle fractures account for a significant proportion of mandibular fractures and are prone to complications, the lack of results about this question in the literature makes our subject relevant to improve the management of mandibular angle fractures. The aim of this study is therefore to evaluate the association between impacted LTM and mandibular angle fracture complications.

Materials and Methods

All patients presenting with a mandibular angle fracture, isolated or associated with other fractures, in Lille University Hospital from November 2018 to May 2020, were eligible. Patients were included if at least 2 months follow up was observed. Patients under 15-year-old were excluded (Figure 1). Demographics of patients were collected retrospectively. Mandibular angle treatment was decided collegially based on several parameters: fracture displacement, orientation of the fracture, dentition and dental occlusion, patient medical background. It included observational treatment, maxillomandibular fixation (MMF) and open reduction and internal fixation (ORIF). Observational treatment and MMF were grouped as conservative treatment. The following complications were recorded 2 months postoperatively or following trauma in observational cases: post-traumatic malocclusion, mouth opening limitation, inferior alveolar nerve (IAN) hypoesthesia, infection, delayed union, hardware loosening or fracture.

LTM presence or absence, and position (impacted or not) was evaluated on initial orthopantomogram or CT-scan if no orthopantomogram could be performed, such as in polytrauma cases. The patients were divided in two groups: impacted LTM or erupted/absent LTM. Patients were followed-up at least 2 months.

Statistical analysis

Categorical variables were expressed as numbers (percentage). Continuous variables were expressed as means (standard deviation, SD) in the case of normal distribution or medians [range] otherwise. Normality of distribution was assessed using histograms and the Shapiro-Wilk test.

Comparison of the risks factors and the comparisons of the complication rates between the two groups of approaches (patients with impacted LTM versus with erupted/absent LTM) were studied using Chi-square tests (or Fisher's exact tests when expected cell frequency was <5) for categorical variables and Mann-Whitney U or Student t tests (regarding the normality of distributions) for continuous variables.

Statistical testing were done at the two-tailed α level of 0.05.

Data were analyzed using SAS software package, release 9.4 (SAS Institute, Cary, NC, USA).

Results

A total of 68 patients with at least one mandibular angle fracture were included. Main characteristics of our population study were listed in Table 1. 12 of them (17.7%) were females and 56 (82.4%) were males. The median age was 27 (range 16 to 76). The most frequent etiology was assault in 48 patients (70.6%). The median time from injury to treatment was 2 days (range 0 to 24). LTM was impacted in the line of fracture in 36 cases (52.9%), it was erupted in 16 cases (23.55%) and absent in 16 cases (23.55%). Hence, there were 32 patients (47.1%) with erupted/absent LTM. Four patients underwent LTM extraction during surgery, which was erupted in 3 cases and impacted in 1 case. ORIF was performed in 48 cases (70.6 %), and conservative treatment in the remaining 20 cases (29.4%), including 13 MMF (19.1%) and 7 observational treatments (10.3%). Forty patients (58.8%) had another mandibular fracture. The most frequent association was with a parasymphysis fracture (23/68, 33.8%). The only statistical difference between the impacted LTM and erupted/absent LTM groups concerned the treatment performed: ORIF was more frequently performed in the erupted/absent LTM group (27/32, 84.4% vs 21/36, 58.3%, p=0.0187).

Forty complications were recorded at 2 months (Figure 2): 1 malocclusion (1.5%), 8 mouth opening limitation (11.8%), 20 IAN hypoesthesia (29.4%), 5 delayed unions (7.4%), 2 infections (2.9%), and 4 hardware loosening or fracture (8.5%). These complications affected 27 patients (39.7%). The complication rate between impacted LTM group and erupted/absent LTM group was compared. No statistically significant difference could be found about malocclusion (0% in impacted LTM group versus 3.1% in erupted/absent LTM group), mouth opening limitation (5.6% in impacted LTM group versus 18.8% in erupted/absent LTM group). A lower rate of persistent IAN hypoesthesia (p=0.0557) in patients with impacted LTM (19.4%) was observed compared to patients without impacted LTM (40.6%). The low rate of patients with delayed unions, infections or hardware loosening made

statistical analyses comparing the two groups impossible. Among these 3 complications, 1 patient in each group (impacted LTM and erupted/absent LTM) presented an infection. There was no occurrence of delayed union and hardware loosening in impacted LTM group, whereas 5 delayed unions (15.6%) and 4 hardware loosening (14.8%) were recorded in erupted/absent LTM group. Finally, the rate of patients with at least one of the 6 complications is significantly higher in the erupted/absent LTM group (17/32, 53.1%) than in the impacted LTM group (10/36, 27.8%), p=0.033.

Discussion

The epidemiology and the management of mandibular angle fracture have been extensively researched. However, LTM relationship with mandibular angle fracture prognosis is still controversial [2,12,25,26]. Mandibular angle fractures are the mandibular fractures associated with the highest risk of complications and it seems difficult to rule out LTM influence in their occurrence. No statistically significant association could be found individually between each of the searched complications and LTM position. However, there is significatively less complications in the impacted LTM group, as more patients presented at least one complication in the erupted/absent LTM group (17/32, 53.1% vs 10/36, 27.8%). Hence, there seems to be less complications when LTM is impacted.

Delayed union, infection, and hardware loosening could be considered as the most serious complications as they mostly require a secondary surgery. The study population was typical of facial traumatology epidemiology with a majority of young adult males suffering from fractures following an assault [3,16]. This population is associated with a high rate of follow-up failures in our common clinical practice. Non-compliance is one of the main risk factors for major complications of mandibular fractures [30]. It can be inferred that patients presenting with such severe complications are not lost to follow-up conversely to less severe complications such as mouth opening limitation or IAN hypoesthesia. However, our rate of delayed union (7.35%) and infection (2.9%) is lower than expected from the literature (15.3% and 9.9% respectively) [13]. This low rate of occurrence did not allow statistical analysis. However, it can be noted that no delayed union or hardware loosening were found in the impacted LTM group. When LTM is impacted, there is less bone tissue in the mandibular angle, which is responsible of mandibular angle fracture following trauma and a protection against mandibular condyle fracture [5–7]. Contrarily, erupted/absent LTM favors

mandibular condyle fracture versus mandibular angle fracture [31]. However, this lack of bone tissue seems to have no adverse effect on bone healing as delayed union cases occurred only in erupted/absent LTM. The impacted LTM may help in fracture reduction and enhance reduction stability, thus helping to achieve better bone healing. On the other hand, if LTM is be fractured or infected (active pericoronitis), it should be removed intra-operatively [25,26]. In our series, only one impacted LTM was removed intra-operatively. Indeed, impacted LTM removal is usually associated with alveolar bone loss, leaving few bones left on the upper part of the mandible to judge the correct reduction of the fracture intra-operatively through the classical intraoral approach. LTM management in cases of mandibular angle fracture is currently trending toward preservation [4,12,25–30,32], as it seems to be a significant factor in fracture reduction and stability.

One case of infection was found in each group. Impacted LTM was not associated with a decrease or an increase of infection occurrence. This is in accordance with several other studies [4,12,25,26,29]. However, the systematic review of Fernandes et al. [2] found that the absence of LTM, whether missing preoperatively or removed during fracture treatment, is associated with a lower rate of infection.

The two groups (impacted LTM and erupted/absent LTM) were comparable except on age and type of treatment performed. Patients were younger in the impacted LTM group, which may be expected as LTM extraction is mostly performed before 30 years old [33]. Age impact nerve [34] and bone healing [35]. The capabilities for axonal regeneration and reinnervation are maintained throughout life, but tend to be delayed and less effective with aging in a non-linear fashion [34]. Only 1 patient had more than 65 years old in the erupted/absent LTM group. The median age of patients with IAN hypoesthesia in our study was 29 in both groups, and the mean age was 34 in the impacted LTM group and 33 in the erupted/absent LTM group. The mean age of patients showing delayed union was 42 years

old. Hence, age should not have impacted IAN hypoesthesia persistence or delayed union. Furthermore, studies have shown that age does not increase the risk of delayed union [36,37]. The decision between conservative treatment and ORIF was made collegially based on several patient-specific characteristics. 50% (24/48) of the patients undergoing ORIF presented one of the complications (excluding hardware loosening and fracture), whereas 15% (3/20) of the patients undergoing conservative treatment presented a complication (Figure 3).This may be explained by the fact that surgical treatment was indicated for unstable or displaced fractures, which are more at risk of complications [38,39]. Since the proportion of surgical treatment with ORIF was significantly higher in erupted/absent LTM group than in impacted LTM group (27/32, 84.4% vs 21/36, 58.3%, p=0.0187), the complication rate may have been overestimated in erupted/absent LTM and therefore underestimated in impacted LTM group. Indeed, this could constitute a bias and part of the complications in erupted/absent LTM group could be due to surgical treatment. However, the fact that there is more surgical treatment in this group can be explained by more displaced or unstable fractures. The impacted LTM may therefore not only help fracture reduction but decrease fracture displacement. Furthermore, IAN hypoesthesia were more frequent in the erupted/absent LTM group than in the impacted LTM group (13/32, 40.6% vs 7/36, 19.4%, p=0.0557). Persistant hypoesthesia is the result of a severe IAN injury, which is more severe in displaced cases [40,41].

Several studies have shown that LTM increases the risk of mandibular angle fracture [1,2,5–8]. On the other hand, impacted LTM decrease the risk of overall complication in mandibular angle fracture compared to erupted/absent LTM. Indeed, there was significatively less complications in the impacted LTM group, as more patients in the erupted/absent LTM group presented at least one of the following complications: malocclusion, mouth opening

limitation, IAN hypoesthesia, delayed unions, infection, and hardware loosening or fracture. Furthermore, delayed unions and hardware loosening or fracture occurred only in the erupted/absent LTM group. This supports the idea of a role of the impacted LTM in fracture reduction and stability. Hence, the impacted LTM should be preserved in mandibular angle fractures, unless it is fractured or infected.

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References

[1] Armond ACV, Martins CC, Glória JCR, Galvão EL, dos Santos CRR, Falci SGM. Influence of third molars in mandibular fractures. Part 1: mandibular angle—a meta-analysis. Int J Oral Maxillofac Surg 2017;46:716–29. https://doi.org/10.1016/j.ijom.2017.02.1264.

[2] Fernandes IA, Souza GM, Silva de Rezende V, Al-Sharani HM, Douglas-de-Oliveira DW, Galvão EL, et al. Effect of third molars in the line of mandibular angle fractures on postoperative complications: systematic review and meta-analysis. Int J Oral Maxillofac Surg 2020;49:471–82. https://doi.org/10.1016/j.ijom.2019.09.017.

[3] Fridrich KL, Pena-Velasco G, Olson RAJ. Changing trends with mandibular fractures: A review of 1,067 cases. J Oral Maxillofac Surg 1992;50:586–9. https://doi.org/10.1016/0278-2391(92)90438-6.

[4] Ellis E. Outcomes of patients with teeth in the line of mandibular angle fractures treated with stable internal fixation. J Oral Maxillofac Surg 2002;60:863–5. https://doi.org/10.1053/joms.2002.33852.

[5] Iida S, Nomura K, Okura M, Kogo M. Influence of the Incompletely Erupted Lower Third Molar on Mandibular Angle and Condylar Fractures: J Trauma Inj Infect Crit Care 2004;57:613–7. https://doi.org/10.1097/01.TA.0000096647.36992.83.

[6] Duan DH, Zhang Y. Does the presence of mandibular third molars increase the risk of angle fracture and simultaneously decrease the risk of condylar fracture? Int J Oral Maxillofac Surg 2008;37:25–8. https://doi.org/10.1016/j.ijom.2007.07.010.

[7] Samieirad S, Eshghpour M, Dashti R, Tohidi E, Javan AR, Mianbandi V. Correlation Between Lower Third Molar Impaction Types and Mandibular Angle and Condylar Fractures: A Retrospective Study. J Oral Maxillofac Surg 2019;77:556–64. https://doi.org/10.1016/j.joms.2018.09.028.

[8] Giovacchini F, Paradiso D, Bensi C, Belli S, Lomurno G, Tullio A. Association between third molar and mandibular angle fracture: A systematic review and meta-analysis. J Cranio-Maxillofac Surg 2018;46:558–65. https://doi.org/10.1016/j.jcms.2017.12.011.

[9] Pell GJ, Gregory GT. Impacted mandibular third molars: Classification and modified techniques for removal. Dent Dig 1933;39:330–8.

[10] Champy M, Loddé JP, Schmitt R, Jaeger JH, Muster D. Mandibular osteosynthesis by miniature screwed plates via a buccal approach. J Maxillofac Surg 1978;6:14–21. https://doi.org/10.1016/S0301-0503(78)80062-9.

[11] Thangavelu A, Yoganandha R, Vaidhyanathan A. Impact of impacted mandibular third molars in mandibular angle and condylar fractures. Int J Oral Maxillofac Surg 2010;39:136–9. https://doi.org/10.1016/j.ijom.2009.12.005.

[12] Ellis E. Management of Fractures Through the Angle of the Mandible. Oral Maxillofac Surg Clin N Am 2009;21:163–74. https://doi.org/10.1016/j.coms.2008.12.004.

[13] Patel N, Kim B, Zaid W. A Detailed Analysis of Mandibular Angle Fractures: Epidemiology, Patterns, Treatments, and Outcomes. J Oral Maxillofac Surg 2016;74:1792–9. https://doi.org/10.1016/j.joms.2016.05.002.

[14] Seemann R, Schicho K, Wutzl A, Koinig G, Poeschl WP, Krennmair G, et al. Complication Rates in the Operative Treatment of Mandibular Angle Fractures: A 10-Year Retrospective. J Oral Maxillofac Surg 2010;68:647–50. https://doi.org/10.1016/j.joms.2009.07.109.

[15] Al-Moraissi EA, Ellis E. What Method for Management of Unilateral Mandibular Angle Fractures Has the Lowest Rate of Postoperative Complications? A Systematic Review and Meta-Analysis. J Oral Maxillofac Surg 2014;72:2197–211. https://doi.org/10.1016/j.joms.2014.05.023.

[16] Ferrari R, Lanzer M, Wiedemeier D, Rücker M, Bredell M. Complication rate in mandibular angle fractures—one vs. two plates: a 12-year retrospective analysis. Oral Maxillofac Surg 2018;22:435–41. https://doi.org/10.1007/s10006-018-0728-4.

[17] Chen CL, Zenga J, Patel R, Branham G. Complications and Reoperations in Mandibular Angle Fractures. JAMA Facial Plast Surg 2018;20:238. https://doi.org/10.1001/jamafacial.2017.2227.

[18] Feller K-U, Schneider M, Hlawitschka M, Pfeifer G, Lauer G, Eckelt U. Analysis of complications in fractures of the mandibular angle—a study with finite element computation and evaluation of data of 277 patients. J Cranio-Maxillofac Surg 2003;31:290–5. https://doi.org/10.1016/S1010-5182(03)00015-5.

[19] Biller JA, Pletcher SD, Goldberg AN, Murr AH. Complications and the Time to Repair of Mandible Fractures: The Laryngoscope 2005;115:769–72. https://doi.org/10.1097/01.MLG.0000157328.10583.A7.

[20] Fox AJ, Kellman RM. Mandibular Angle Fractures: Two-Miniplate Fixation and Complications. Arch Facial Plast Surg 2003;5:464. https://doi.org/10.1001/archfaci.5.6.464.

[21] Soriano E, Kankou V, Morand B, Sadek H, Raphaël B, Bettega G. [Fractures of the mandibular angle: factors predictive of infectious complications]. Rev Stomatol Chir Maxillofac 2005;106:146–8. https://doi.org/10.1016/s0035-1768(05)85834-6.

[22] Furr AM, Schweinfurth JM, May WL. Factors Associated with Long-Term Complications after Repair of Mandibular Fractures. The Laryngoscope 2006;116:427–30. https://doi.org/10.1097/01.MLG.0000194844.87268.ED.

[23] Bradley RL. Treatment of fractured mandible. Am Surg 1965;31:289–90.

[24] Rowe NL, Killey HC. Fractures of the facial skeleton. Churchill Livingstone; 1968.

[25] Lim H-Y, Jung T-Y, Park S-J. Evaluation of postoperative complications according to treatment of third molars in mandibular angle fracture. J Korean Assoc Oral Maxillofac Surg 2017;43:37. https://doi.org/10.5125/jkaoms.2017.43.1.37.

[26] Ulbrich N, Ettl T, Waiss W, Gosau M, Moralis A, Reichert TE, et al. The influence of third molars in the line of mandibular angle fractures on wound and bone healing. Clin Oral Investig 2016;20:1297–302. https://doi.org/10.1007/s00784-015-1612-3.

[27] Khavanin N, Jazayeri H, Xu T, Pedreira R, Lopez J, Reddy S, et al. Management of Teeth in the Line of Mandibular Angle Fractures Treated with Open Reduction and Internal Fixation: A Systematic Review and Meta-Analysis. Plast Reconstr Surg 2019;144:1393–402. https://doi.org/10.1097/PRS.0000000000006255.

[28] McNamara Z, Findlay G, O'Rourke P, Batstone M. Removal versus retention of asymptomatic third molars in mandibular angle fractures: a randomized controlled trial. Int J Oral Maxillofac Surg 2016;45:571–4. https://doi.org/10.1016/j.ijom.2016.01.007.

[29] Bobrowski AN, Sonego CL, Chagas OL. Postoperative infection associated with mandibular angle fracture treatment in the presence of teeth on the fracture line: a systematic review and meta-analysis. Int J Oral Maxillofac Surg 2013;42:1041–8. https://doi.org/10.1016/j.ijom.2013.02.021.

[30] Christensen BJ, Mercante DE, Neary JP, King BJ. Risk Factors for Severe Complications of Operative Mandibular Fractures. J Oral Maxillofac Surg 2017;75:787.e1-787.e8. https://doi.org/10.1016/j.joms.2016.12.003.

[31] Armond ACV, Martins CC, Glória JCR, Galvão EL, dos Santos CRR, Falci SGM. Influence of third molars in mandibular fractures. Part 2: mandibular condyle—a meta-analysis. Int J Oral Maxillofac Surg 2017;46:730–9. https://doi.org/10.1016/j.ijom.2017.02.1265.

[32] Lee J-H. Treatment of Mandibular Angle Fractures. Arch Craniofacial Surg 2017;18:73–5. https://doi.org/10.7181/acfs.2017.18.2.73.

[33] Patel S, Mansuri S, Shaikh F, Shah T. Impacted Mandibular Third Molars: A Retrospective Study of 1198 Cases to Assess Indications for Surgical Removal, and Correlation with Age, Sex and Type of Impaction—A Single Institutional Experience. J Maxillofac Oral Surg 2017;16:79–84. https://doi.org/10.1007/s12663-016-0929-z.

[34] Verdú E, Ceballos D, Vilches JJ, Navarro X. Influence of aging on peripheral nerve function and regeneration. J Peripher Nerv Syst JPNS 2000;5:191–208. https://doi.org/10.1046/j.1529-8027.2000.00026.x.

[35] Clark D, Nakamura M, Miclau T, Marcucio R. Effects of Aging on Fracture Healing. Curr Osteoporos Rep 2017;15:601–8. https://doi.org/10.1007/s11914-017-0413-9.

[36] Foulke BA, Kendal AR, Murray DW, Pandit H. Fracture healing in the elderly: A review. Maturitas 2016;92:49–55. https://doi.org/10.1016/j.maturitas.2016.07.014.

[37] Li Z, Zhang W, Li Z-B, Li J-R. Abnormal Union of Mandibular Fractures: A Review of 84 Cases. J Oral Maxillofac Surg 2006;64:1225–31. https://doi.org/10.1016/j.joms.2006.04.018.

[38] Gordon PE, Lawler ME, Kaban LB, Dodson TB. Mandibular Fracture Severity and Patient Health Status Are Associated With Postoperative Inflammatory Complications. J Oral Maxillofac Surg 2011;69:2191–7. https://doi.org/10.1016/j.joms.2011.03.071.

[39] Moreno JC, Fernández A, Ortiz JA, Montalvo JJ. Complication rates associated with different treatments for mandibular fractures. J Oral Maxillofac Surg 2000;58:273–80. https://doi.org/10.1016/S0278-2391(00)90051-X.

[40] Yadav S, Mittal HC, Malik S, Dhupar V, Sachdeva A, Malhotra V, et al. Post-traumatic and postoperative neurosensory deficits of the inferior alveolar nerve in mandibular fracture: a prospective study. J Korean Assoc Oral Maxillofac Surg 2016;42:259. https://doi.org/10.5125/jkaoms.2016.42.5.259.

[41] Schenkel JS, Jacobsen C, Rostetter C, Grätz KW, Rücker M, Gander T. Inferior alveolar nerve function after open reduction and internal fixation of mandibular fractures. J Cranio-Maxillofac Surg 2016;44:743–8. https://doi.org/10.1016/j.jcms.2016.03.001.

Table Legend

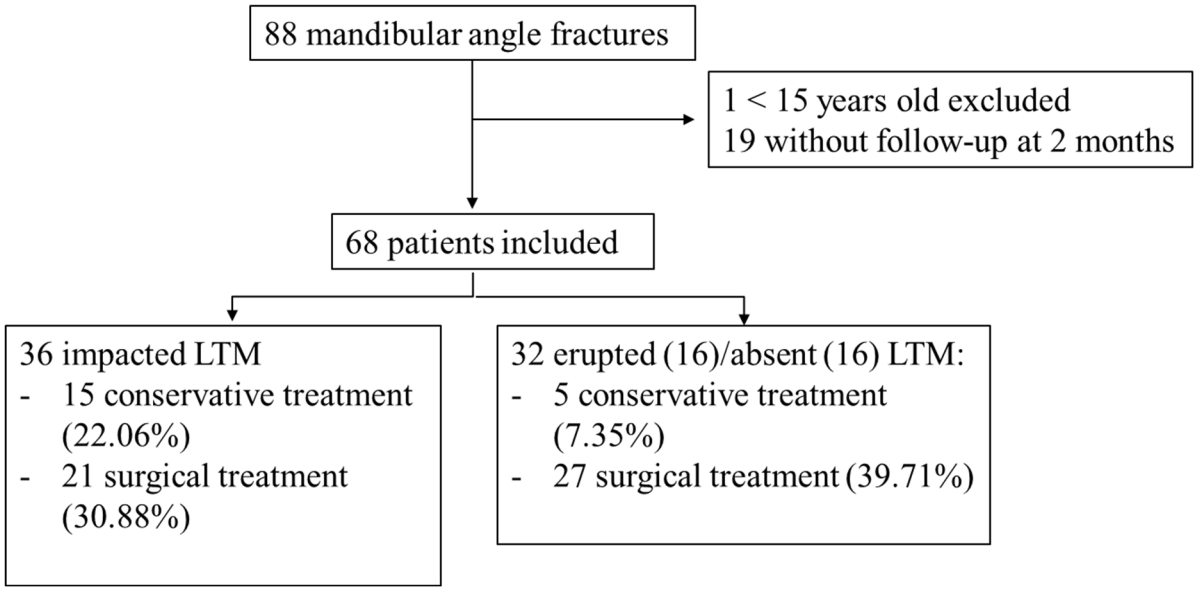
Table 1: Description of the population (LTM = Lower Third Molar)

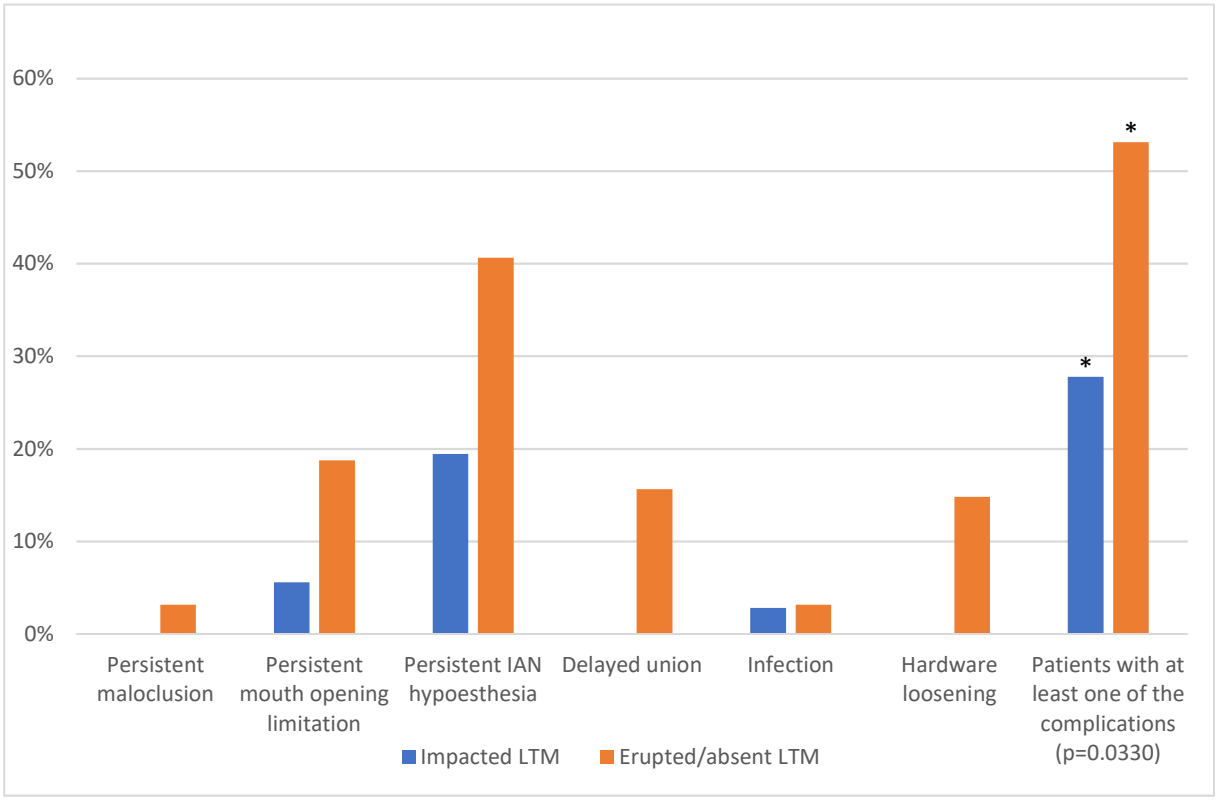
Figure Legends

Figure 1: Flow chart of the study

Figure 2: Comparison of the complication rate in patients with impacted lower third molar (LTM) versus with erupted/absent LTM. * = statistically significant result ($p < 0.05$).

Figure 3: Mandibular angle fracture complication rates according to the treatment


88 mandibular angle fractures
1 < 15 years old excluded
19 without follow-up at 2 months
68 patients included
36 impacted LTM
- 15 conservative treatment (22.06%)
- 21 surgical treatment (30.88%)
32 erupted (16)/absent (16) LTM:
- 5 conservative treatment (7.35%)
- 27 surgical treatment (39.71%)


60%
50%
40%
30%
20%
10%
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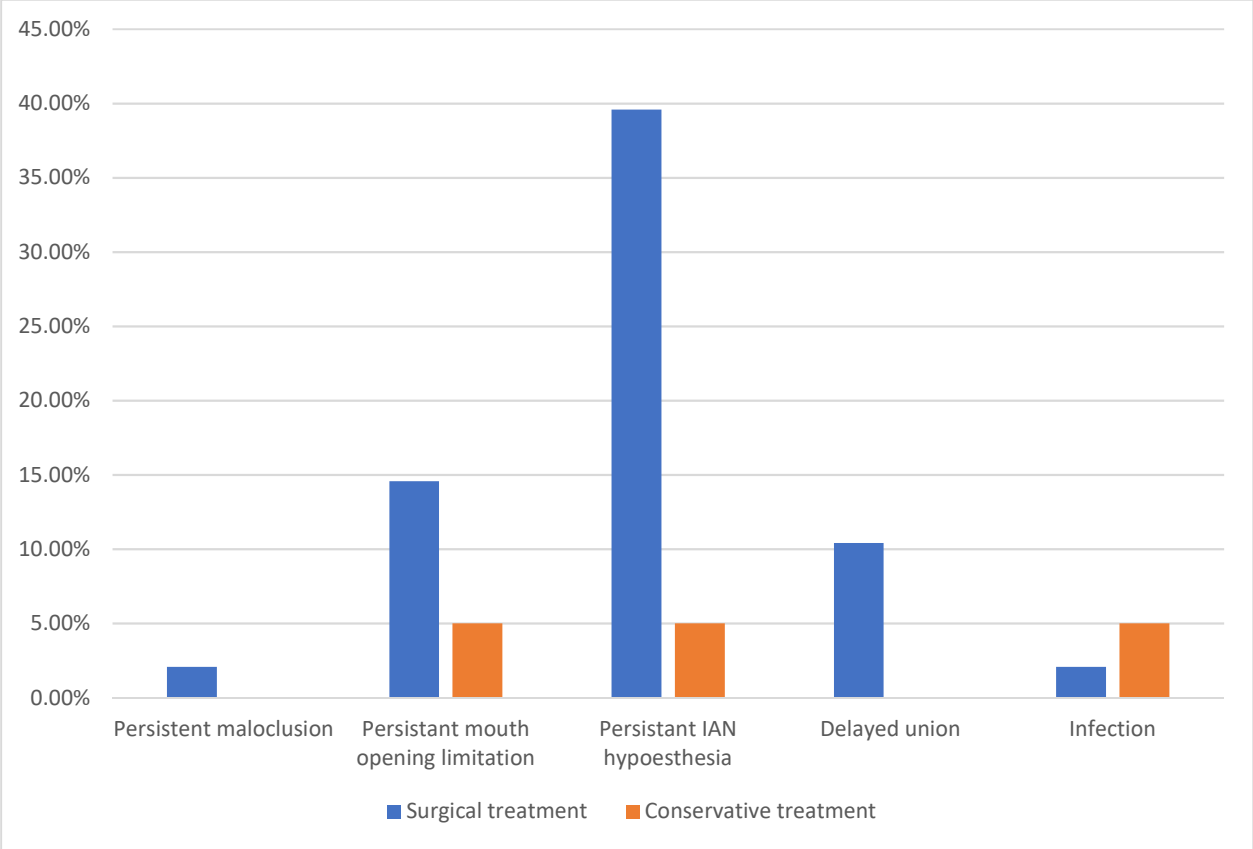
Persistent maloclusion
Persistent mouth opening limitation
Persistent IAN hypoesthesia
Delayed union
Infection
Hardware loosening
Patients with at least one of the complications (p=0.0330)
Impacted LTM
Erupted/absent LTM


45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Persistent maloclusion
Persistant mouth opening limitation
Persistant IAN hypoesthesia
Delayed union
Infection
Surgical treatment
Conservative treatment

	All (N=68)	Impacted LTM (n=36)	Erupted/absent LTM (n=32)	p-value
Sex				0.1337
Female	12 (17.65%)	4 (11.11%)	8 (25%)	
Male	56 (82.35%)	32 (88.89%)	24 (75%)	
Age, median (range)	27 (16-76)	23.5 (16-46)	31 (19-76)	< 0.0001
Time from injury to treatment in days, median (range)	2 (0-24)	2 (0-24)	2 (0-12)	0.7926
Smoking				0.5368
No	26 (38.24%)	15 (41.67%)	11 (34.38%)	
Yes	42 (61.76%)	21 (58.33%)	21 (65.63%)	
Mechanism of injury				0.3971
Assault	48 (70.59%)	27 (75%)	21 (65.63%)	
Other (sport injury, traffic accident, fall)	20 (29.41%)	9 (25%)	11 (34.38%)	
Prior orthodontic treatment				0.4842
No	59 (86.76%)	30 (83.33%)	29 (90.63%)	
Yes	9 (13.24%)	6 (16.67%)	3 (9.38%)	
Angle's classification				0.5229
I	47 (69.12%)	26 (72.22%)	21 (65.63%)	
II	8 (11.76%)	5 (13.89%)	3 (9.37%)	
III	13 (19.12%)	5 (13.89%)	8 (25%)	
Dentition				
Complete	39 (57.35%)			
> 6 teeth	13 (19.12%)			
< 6 teeth	14 (20.59%)			
Edentulous	2 (2.94%)			
LTM Extraction during surgery				
None	64 (94.11%)			
Yes	4 (5.88%)	1 (2.78%)	3 (9.38%)	
Other mandible fractures				0.8357
No	28 (41.18%)	15 (41.67%)	13 (40.63%)	
Parasymphysis	23 (33.82%)	13 (36.11%)	10 (31.25%)	
Other localisation	17 (25%)	8 (22.22%)	9 (28.13%)	
Treatment				0.0187
Conservative	20 (29.41%)	15 (41.67%)	5 (15.63%)	
- Observational	7 (10.3%)			
- Maxillomandibular Fixation	13 (19.1%)			
Surgery	48 (70.59%)	21 (58.33%)	27 (84.38%)	