Effects of Perioperative Systemic Corticosteroids on Clinically Significant Outcomes in Patients Undergoing Maxillofacial Trauma Surgery: A Systematic Review and Meta-Analysis

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Abstract

Background and aim: Maxillofacial injuries are frequent cause of presentations in an emergency department. The present study was performed to evaluate the effects of Perioperative Systemic Corticosteroids on Clinically Significant Outcomes in Patients Undergoing Maxillofacial Trauma Surgery.

Method: Databases of PubMed, Scopus, Web of Science, EBSCO and Embase were searched for systematic literature between 2010 to August 2021. For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included.95% confidence interval for odds ratio with fixed effect model and Mantel-Haenszel method were calculated. To deal with potential heterogeneity, random effects were used and I^2 showed heterogeneity. Meta-analysis was performed using Stata/MP v.16 software (The fastest version of Stata).

Result: In the initial review, duplicate studies were eliminated and abstracts of 134 studies were reviewed, the full text of 21 studies was reviewed by two authors, finally, eight studies were selected. Odds ratio ofpostoperative nausea and vomitingbetweencorticosteroid and control group was -0.76 (OR, -0.76 95% CI -1.54, 0.02; p=0.06).Odds ratio ofadverse effects betweencorticosteroid and control group was 1.22 (OR, 1.22 95% CI 0.36, 2.07; p=0.01).

Conclusion: Based on the findings of the present meta-analysis, significant differences were observed about adverse effects such asinfection, and wound healing complications between Perioperative Systemic Corticosteroids and not useCorticosteroids groups.

Key words: Systemic Corticosteroids, Maxillofacial Trauma Surgery, Oral and Maxillofacial Surgery

Introduction

Maxillofacial trauma is any injury to the face or jaws. Facial trauma may present with skin lacerations, burns, obstruction to the nasal cavity or sinuses, damage to the orbital sockets, fracture to the jawbone, and missing or broken teeth(1).Maxillofacial injuries are frequent cause of presentations in an emergency department(2).Treatment for facial trauma is complex

and often involves airway control, bleeding control, reduction of swelling, prevention of infection, repair of bone fractures, repair of lacerations or soft tissue injury, and reconstruction(3, 4).Maxillofacial trauma surgery is used worldwide to improve chewing function, broken facial bones, and facial beauty(5).After surgery, there may be risks to any person who may be readmitted to the hospital, including airway edema, potential for airway obstruction, trauma from surgery, loss of chewing function, and swelling of the face(6).To reduce the complications of surgery, high-dose, short-term corticosteroids have been used for several years to help reduce pain, trismus, and facial edema, as well as to shorten hospital stays(7). However use of steroids in maxillofacial trauma surgery is thus supported only by weak evidence and further research is advocated(8, 9).Therefore, due to the fact that there is not enough evidence for the use of corticosteroids in maxillofacial trauma surgery, but this method has become a standard of care in most centers over the years(10, 11).Studies have reported evidence that the use of systemic corticosteroids may be effective in orthognathic surgery(12, 13).It is noteworthy that in comparison of third molar surgeries, orthognathic surgeries and maxillofacial trauma surgery, the characteristics of pain, surgical consequences, pain mechanism and pain intensity, neurosensory disorder are different(14).As a result, the results of the use of systemic corticosteroids in third molar surgery or orthognathic surgeries cannot be attributed to maxillofacial trauma surgery.Accordingly, due to the necessity of conducting the study, the researcher decided to review previous studies in this field and review their results to provide sufficient evidence regarding steroids in maxillofacial trauma surgery; therefore, the present study was performed to evaluate the effects of Perioperative Systemic Corticosteroids on Clinically Significant Outcomes in Patients Undergoing Maxillofacial Trauma Surgery.

Method

Databases of PubMed, Scopus, Web of Science, EBSCO and Embase were searched for systematic literature between 2010 to February 2022.Use the MeSH Database, to build searches in PubMed:

(((((("Oral and Maxillofacial Surgeons"[Mesh] OR "Maxillofacial Injuries"[Mesh] OR "Maxillofacial Development"[Mesh] OR "Surgery, Oral"[Mesh] OR "Oral Surgical Procedures"[Mesh] OR "Orthognathic Surgery"[Mesh] OR "Maxilla"[Mesh]) OR ("Wounds and Injuries"[Mesh] OR "injuries" [Subheading])) AND "Adrenal Cortex Hormones"[Mesh]) OR "Steroids"[Mesh]) OR "Adrenal Glands"[Mesh]) OR "Dexamethasone"[Mesh].

Key considerations PRISMA was the basis of the present study(15) and PIECO strategy to answer theresearch questions showed in Table1.

Selection criteria

Inclusion criteria: criteria: Clinical controlled trials, randomized controlled trials, and cohort studies, English language. Case studies, case reports, and reviews were excluded from the study.

Table1. PICO strategy

PICO strategy	Description
P	Population: patients with any maxillofacial Trauma
I	interventions: corticosteroid
C	Comparison: placebo or no corticosteroid
O	Outcome: Clinically Significant Outcomes

Study selection, Data Extraction and method of analysis

Studies data were reported by study, years, study design, age, and number of patients.

Newcastle-Ottawa Scale (NOS) (16) used to assessed quality of the cohort studies and case-control studies, This scale measures three dimensions (selection, comparability of cohorts and outcome) with a total of 9 items. In the analysis, any studies with NOS scores of 1- 3, 4- 6 and 7- 9 were defined as low, medium and high quality, respectively. The quality of the randomized control trial studies included was assessed using the Cochrane Collaboration's tool(17). The scale scores for low risk was 1 and for High and unclear risk was 0. Scale scores range from 0 to 6. A higher score means higher quality.

For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included.Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

95% confidence interval for odds ratio with fixed effect model and Mantel-Haenszel method were calculated. To deal with potential heterogeneity, random effects were used and I^2 showed heterogeneity. I^2 values less than 50% indicate low heterogeneity and above 50% indicate moderate to high heterogeneity. Meta-analysis was performed using Stata/MP v.16 software (The fastest version of Stata).

Result

The review of the existing literature using the studied keywords, 134 studies were found. In the initial review, duplicate studies were eliminated and abstracts of 126 studies were reviewed. At this stage, 105 studies did not meet the inclusion criteria, so they were excluded, and in the second stage, the full text of 21 studies was reviewed by two authors. At this stage, 13 studies were excluded from the study due to incomplete data, inconsistency of results in a study, poor studies, lack of access to full text, inconsistent data with the purpose of the study. Finally, eight studies were selected (Figure1).

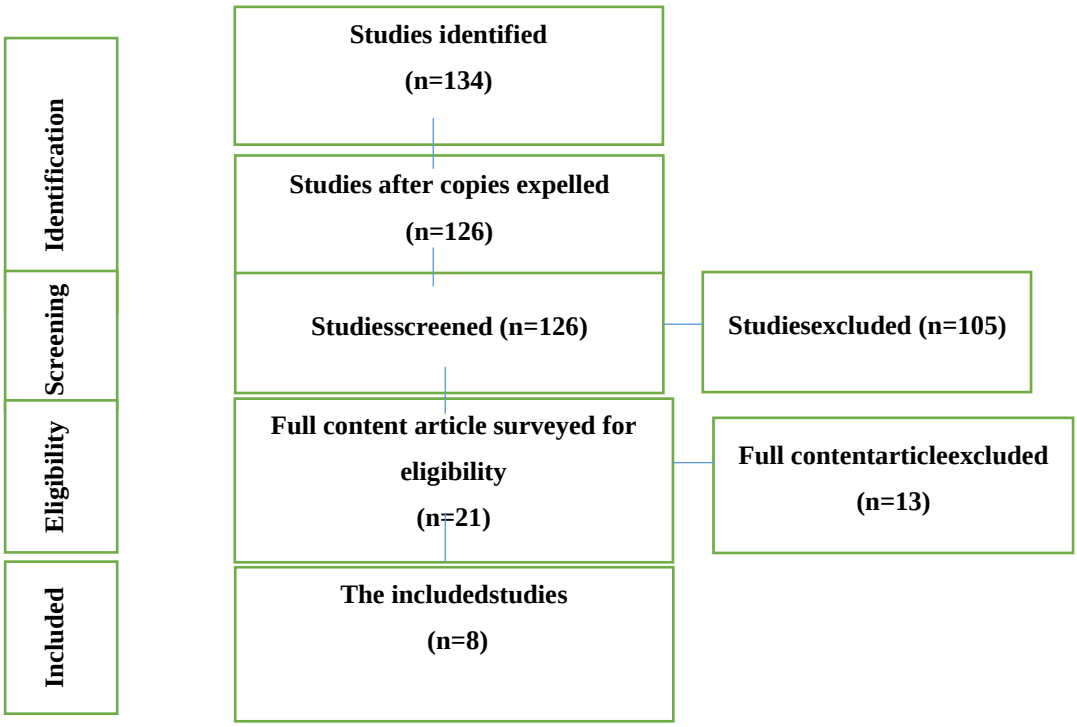

Figure 1. Study Attrition

Characteristics

Eight studies have been included in present article. The number of participants in Resorbable Platesgroup and titanium group were 302 with mean 33.87 years (male: 154; female: 148) and 411 with 34.75 years (male: 200; female: 211), respectively and a total was 713 (Table2).

Bias assessment

According to Cochrane Collaboration's tool, fourstudies had a total score of 3/6, two study had a total score of 5/6 and one study had a total score of 4/6 and 6/6. Five studies had medium qualityandthree studies that had high quality or low risk of bias(Table3).

Table2. Studies selected for systematic review and meta-analysis.

Study. years	Study Design	Number of patients		Corticosteroid group	Control group
		corticosteroid	control		
Snäll et al., 2018 (18)	P-RCT	37	36	DXM 10 mg IV/ 10 mg IM every 8 hours upto 16 hours to a total of 30 mg.	None
Haapanen et al., 2018 (19)	P-RCT	10	8	DXM 10 mg/ gluteal muscle every 8 hours over 16 hours	None
Haapanen et al., 2017 (20)	P-RCT	35	29	10 mg of DXM/ 10 mg intramuscularly every 8 hours over	None

				16 hours/ 30 mg of DXM or 10 mg of DXM	
Snäll et al., 2015 (21)	P-RCT	18	17	DXM 10 mg IV and 10 mg IM every 8 hours upto 16 hours to a total of 30 mg.	
Dongol et al., 2015 (22)	P-RCT	20	20	8 mg DXM and	None
Snäll et al., 2014 (23)	P-RCT	33	31	DXM 10 mg IV	None
Snäll et al., 2013 (24)	P-RCT	20	21	DXM 10 mg IV and 10 mg IM every 8 hours up to 16 hours to a total of 30 mg.	None
Jahromi et al., 2013 (25)	P-RCT	30	30	DXM (5 mg orally) 1 hour before anesthesia induction.	Placebo

P-RCT: Prospective randomized control trial

Postoperative Nausea and Vomiting

Odds ratio ofpostoperative nausea and vomitingbetweencorticosteroid and control group was -0.76 (OR, -0.76 95% CI -1.54, 0.02; p=0.06)with low heterogeneity (I^2<0.00%; P =0.78); there was no statistically significant difference between two groups (P=0.06) (Figure2).

Neurosensory Effects

Odds ratio ofneurosensory effects betweencorticosteroid and control group was -0.10 (OR, -0.10 95% CI -1.11, 0.91; p=0.85)with low heterogeneity (I^2<0.00%; P =0.45); there was no statistically significant difference between two groups (P=0.06) (Figure3).

Adverse Effects (Infection, and Wound Healing Complications)

Odds ratio ofadverse effects betweencorticosteroid and control group was 1.22 (OR, 1.22 95% CI 0.36, 2.07; p=0.01)with low heterogeneity (I^2=2.13%; P =0.38); there was statistically significant difference between two groups (P=0.01) (Figure4).

Table3. Risk of bias assessment (Cochrane Collaboration's tool(17))

study	Random sequence generation	allocation concealment	blinding of participants and personnel	blinding of outcome assessment	incomplete outcome data	selective reporting	Total score
Snäll et al., 2018 (18)	+	+	?	+	?	+	4
Haapanen et al., 2018 (19)	+	?	-	+	?	+	3
Haapanen et al., 2017	+	+	+	+	+	+	6

(20)							
Snäll et al., 2015 (21)	+	?	-	+	?	+	3
Dongol et al., 2015 (22)	+	?	+	+	+	+	5
Snäll et al., 2014 (23)	+	?	-	+	?	+	3
Snäll et al., 2013 (24)	+	?	-	+	?	+	3
Jahromi et al., 2013 (25)	+	?	+	+	+	+	5

Low (+), unclear (?), high (-)

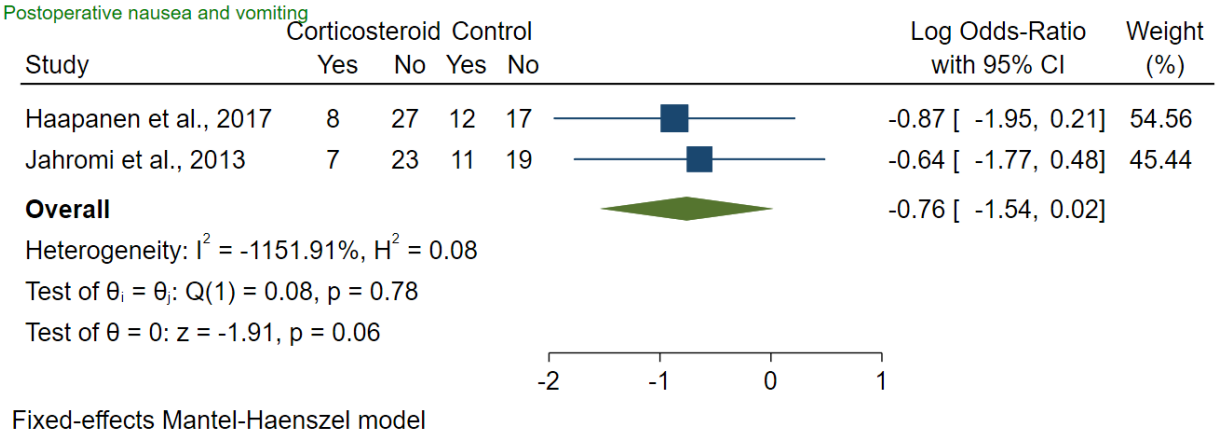

Figure2. Forest plot showed Postoperative Nausea and Vomiting

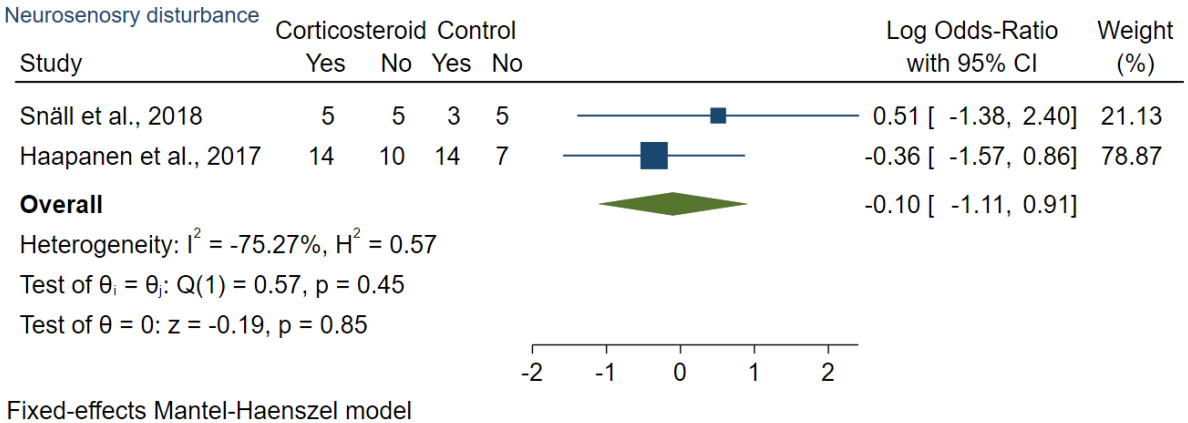

Figure3. Forest plot showed neurosensory effects between corticosteroid and control group

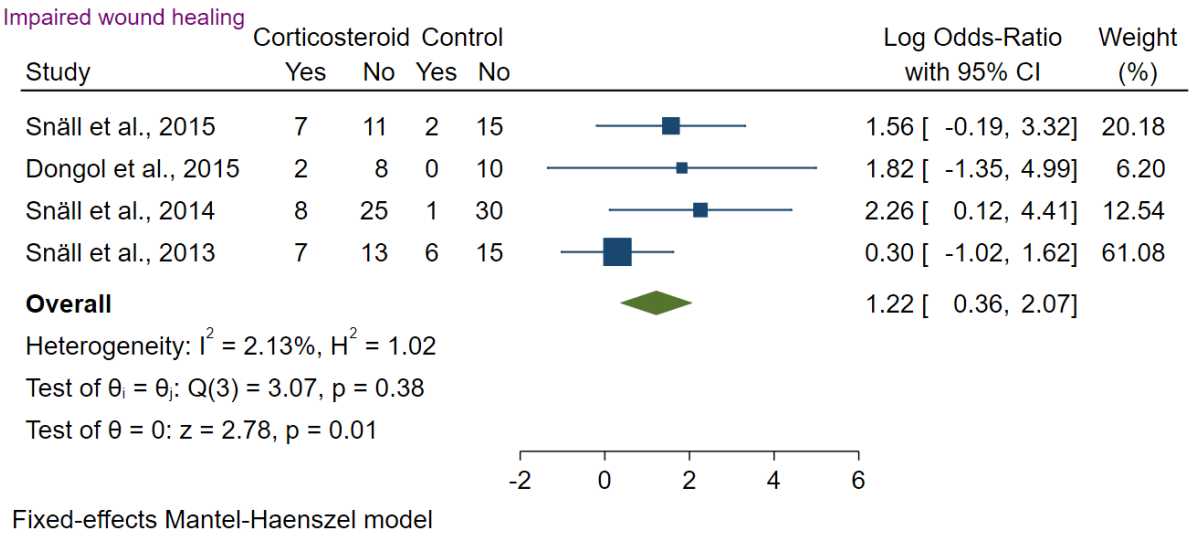

Figure4. Forest plot showed adverse effects between corticosteroid and control group

Discussion

One of the most common surgeries performed worldwide is Maxillofacial trauma surgery, which is usually performed to improve chewing function, facial beauty, and align broken facial bones(26).The aim of present study was evaluate the effects of perioperative systemic corticosteroids on clinically significant outcomes in patients undergoing maxillofacial trauma surgery. In the present study, 8 articles were reviewed; 713 patients were evaluated.According to the results of single preoperative dexamethasone results, it can reduce edema in the first two days after surgery.Based on the meta-analysis, no significant differences were observed in terms of Postoperative Nausea and Vomiting and Neurosensory Effects between the two groups. On the other hand, meta-analysis showed that there is a significant difference in terms of Infection, and Wound HealingComplications. No findings were available on the quality of life of patients after surgery and patient satisfaction with surgery.Some studies did not report side effects during the postoperative period(27, 28). Kormi et al., 2016 reported 100% of oral and maxillofacial surgeon respondents use intraoperative corticosteroids for orthognathic surgery to reduce swelling(29).Silva et al.,2014 Reported beneficial effects of corticosteroids after surgery and their effect on facial edema(30).Studies examining corticosteroids during orthognathic surgery have shown different findings; some have reported significant differences between groups with or without steroids, and some studies have shown no differences(31-33).Few RCT studies have been performed on the efficacy and safety of corticosteroids in maxillofacial trauma surgery, and more RCT studies are needed to provide stronger evidence.It is also suggested that future studies examine the quality of life of patients after surgery and patient satisfaction.The present study had limitations such as sample size of studies was low, follow-up period was not studied, patient satisfaction, quality of life was not studied, few studies were focused on study variables, clinical outcomes were not well reported and fracture classification was No studies were reported, so further studies were needed to confirm the findings of the present study to provide sufficient and stronger evidence, as the conclusions of the present study were very limited.

Conclusion

Based on the findings of the present meta-analysis, no significant differences were observed about postoperative nausea and vomiting and neurosensory effects between Perioperative Systemic Corticosteroids and not useCorticosteroids groups. However significant differences were observed about adverse effects such asinfection, and wound healing complications between Perioperative Systemic Corticosteroids and not useCorticosteroids groups. Due to the small number of RCT studies in line with the objectives of the present study, meta-analysis shows poor evidence for the effectiveness of Perioperative Systemic Corticosteroids on Clinically Significant Outcomes in Patients Undergoing Maxillofacial Trauma Surgery;further studies are needed.

References

1. Abhinav RP, Selvarasu K, Maheswari GU, Taltia AA. The patterns and etiology of maxillofacial trauma in South India. Annals of maxillofacial surgery. 2019;9(1):114.
2. Loutroukis T, Loutrouki E, Klukowska-Rötzler J, Koba S, Schlittler F, Schaller B, et al. Violence as the Most Frequent Cause of Oral and Maxillofacial Injuries among the Patients from Low-and Middle-Income Countries—A Retrospective Study at a Level I Trauma University Emergency Department in Switzerland. International journal of environmental research and public health. 2020;17(13):4906.
3. Braun TL, Maricevich RS, editors. Soft tissue management in facial trauma. Seminars in Plastic Surgery; 2017: Thieme Medical Publishers.
4. Singh V, Jain D, Kanna S. Soft Tissue Injuries. Maxillofacial Trauma: Springer; 2021. p. 145-57.
5. de Caxias FP, Dos Santos DM, Bannwart LC, de Moraes Melo Neto CL, Goiato MC. Classification, history, and future prospects of maxillofacial prosthesis. International journal of dentistry. 2019;2019.
6. Nastri AL, Gurney B. Current concepts in midface fracture management. Current opinion in otolaryngology & head and neck surgery. 2016;24(4):368-75.
7. Turan A, Sessler DI. Steroids to ameliorate postoperative pain. The Journal of the American Society of Anesthesiologists. 2011;115(3):457-9.
8. Singh AK, Dhungel S, Bhattarai K, Roychoudhury A. Do the benefits of systemic corticosteroids outweigh adverse effects during maxillofacial trauma surgery? A systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery. 2021;79(7):1530. e1-. e21.
9. Maeng MM, De Moraes CG, Winn BJ, Glass LRD. Effect of topical periocular steroid use on intraocular pressure: a retrospective analysis. Ophthalmic Plastic & Reconstructive Surgery. 2019;35(5):465-8.
10. Munro IR, Boyd JB, Wainwright DJ. Effect of steroids in maxillofacial surgery. Annals of plastic surgery. 1986;17(5):440-4.
11. Zhang W, Zhao G, Li L, Zhao P. Prophylactic administration of corticosteroids for preventing postoperative complications related to tracheal intubation: a systematic review and meta-analysis of 18 randomized controlled trials. Clinical drug investigation. 2016;36(4):255-65.

12. de AC Almeida R, Lemos C, De Moraes S, Pellizzer E, Vasconcelos B. Efficacy of corticosteroids versus placebo in impacted third molar surgery: systematic review and meta-analysis of randomized controlled trials. International Journal of Oral and Maxillofacial Surgery. 2019;48(1):118-31.
13. Larsen MK, Kofod T, Christiansen A-E, Starch-Jensen T. Different dosages of corticosteroid and routes of administration in mandibular third molar surgery: a systematic review. Journal of oral & maxillofacial research. 2018;9(2).
14. Hargreaves KM. Congress orofacial pain. Pain. 2011;152(3 Suppl):S25.
15. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement (Chinese edition). Journal of Chinese Integrative Medicine. 2009;7(9):889-96.
16. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. European journal of epidemiology. 2010;25(9):603-5.
17. Higgins J, Altman D, Gøtzsche P, Jüni P, Moher D, Oxman A, et al. Cochrane bias methods group; cochrane statistical methods group. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials BMJ. 2011;343(7829):d5928.
18. Snäll J, Törnwall J, Suominen AL, Thorén H. Behavior of C-reactive protein in association with surgery of facial fracture and the influence of dexamethasone. Oral and Maxillofacial Surgery. 2018;22(2):129-34.
19. Haapanen A, Thorén H, Apajalahti S, Suominen A, Snäll J. Neurosensory recovery after trauma to the orbital floor: a prospective trial with dexamethasone. British Journal of Oral and Maxillofacial Surgery. 2018;56(9):810-3.
20. Haapanen A, Thorén H, Apajalahti S, Suominen AL, Snäll J. Does dexamethasone facilitate neurosensory function regeneration after zygomatic fracture? A randomized controlled trial. Journal of Oral and Maxillofacial Surgery. 2017;75(12):2607-12.
21. Snäll J, Apajalahti S, Suominen A-L, Törnwall J, Thorén H. Influence of perioperative dexamethasone on delayed union in mandibular fractures: a clinical and radiological study. Medicina Oral, Patología Oral y Cirugía Bucal. 2015;20(5):e621.
22. Dongol A, Jaisani MR, Pradhan L, Dulal S, Sagtani A. A randomized clinical trial of the effects of submucosal dexamethasone after surgery for mandibular fractures. Journal of Oral and Maxillofacial Surgery. 2015;73(6):1124-32.
23. Snäll J, Kormi E, Koivusalo A-M, Lindqvist C, Suominen AL, Törnwall J, et al. Effects of perioperatively administered dexamethasone on surgical wound healing in patients undergoing surgery for zygomatic fracture: a prospective study. Oral surgery, oral medicine, oral pathology and oral radiology. 2014;117(6):685-9.
24. Snäll J, Kormi E, Lindqvist C, Suominen AL, Mesimäki K, Törnwall J, et al. Impairment of wound healing after operative treatment of mandibular fractures, and the influence of dexamethasone. British Journal of Oral and Maxillofacial Surgery. 2013;51(8):808-12.
25. Jahromi HE, Gholami M, Rezaei F. A randomized double-blinded placebo controlled study of four interventions for the prevention of postoperative nausea and vomiting in maxillofacial trauma surgery. Journal of Craniofacial Surgery. 2013;24(6):e623-e7.
26. Givony S. Mandibular fractures, diagnostics, postoperative complications. Medical Sciences. 2020;8(13):45-52.

27. Brignardello-Petersen R. High uncertainty regarding the effectiveness of dexamethasone in reducing postoperative pain in patients with zygomatic fractures. The Journal of the American Dental Association. 2019;150(9):e127.
28. Lin HH, Kim S-G, Kim H-Y, Niu L-S, Lo L-J. Higher dose of dexamethasone does not further reduce facial swelling after orthognathic surgery: A randomized controlled trial using 3-dimensional photogrammetry. Annals of Plastic Surgery. 2017;78(3):S61-S9.
29. Kormi E, Snäll J, Törnwall J, Thorén H. A survey of the use of perioperative glucocorticoids in oral and maxillofacial surgery. Journal of Oral and Maxillofacial Surgery. 2016;74(8):1548-51.
30. da Silva EM, Hochman B, Ferreira LM. Perioperative corticosteroids for preventing complications following facial plastic surgery. Cochrane Database of Systematic Reviews. 2014(6).
31. Jean S, Dionne P-L, Bouchard C, Giasson L, Turgeon AF. Perioperative systemic corticosteroids in orthognathic surgery: a systematic review and meta-analysis. Journal of Oral and Maxillofacial Surgery. 2017;75(12):2638-49.
32. Jean S, Dionne P, Bouchard C, Giasson L, Turgeon A. Perioperative systemic corticosteroids in orthognathic surgery: a systematic review and meta-analysis. International Journal of Oral and Maxillofacial Surgery. 2019;48:122.
33. Dan AE, Thygesen TH, Pinholt EM. Corticosteroid administration in oral and orthognathic surgery: a systematic review of the literature and meta-analysis. Journal of Oral and Maxillofacial surgery. 2010;68(9):2207-20.