



ISSN: 2230-9926

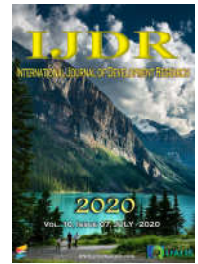
Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 10, Issue, 07, pp. 38452-38457, July, 2020

<https://doi.org/10.37118/ijdr.19430.07.2020>



RESEARCH ARTICLE

OPEN ACCESS

COMPLICATIONS ASSOCIATED WITH ORTHOGNATHIC SURGERY: A SYSTEMATIC REVIEW

Allana Barbosa Corrêa¹, Alick Brianne Ribeiro Silva², Fernando Matheus Santana Tunel¹, Marco Tulio Leandro Ribeiro², Brenda Cristina Teles Santos¹, João Victor de Oliveira¹, Sara Mariana Alves Ramos³, Jainy Estefany Martins⁴, João Victor de Almeida Góes Silva¹, Eduarda Franciane Lima de Souza⁵, Luís Eduardo Charles Pagotto⁶ and Thiago de Santana Santos^{7,*}

¹Tiradentes University, Aracaju, Sergipe, Brazil

²Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil

³University Center of the Federal District, Brasília, Distrito Federal, Brazil

⁴Itaúna University, Itaúna, Minas Gerais, Brazil

⁵Federal University of Pernambuco, Recife, Pernambuco, Brazil

⁶Oral and maxillofacial surgeon from the clinical staff of the Sirio-Libanês hospital, São Paulo, Brazil

⁷Maxillofacial Education, Aracaju, Sergipe, Brazil

ARTICLE INFO

Article History:

Received 06th April, 2020

Received in revised form

11th May, 2020

Accepted 14th June, 2020

Published online 30th July, 2020

Key Words:

Surgery,
Orthognathic surgery,
Complications.

*Corresponding author:

Thiago de Santana Santos

ABSTRACT

Orthognathic surgery aims to restore the balance between the face and the skull, favoring a significant improvement in masticatory, respiratory, phonetic and facial aesthetics. However, during and after the procedure, some complications can be observed in patients. The objective of this systematic review was to assess in the scientific literature the main complications associated with orthognathic surgery during the intra and postoperative period. A systematic literature review was performed using Science Direct, Embase, Cochrane Collaboration Library and PubMed/MEDLINE as databases. Studies related to complications of orthognathic surgery were selected. The search strategy provided a total of 3.262 studies. After screening by reading the titles and abstracts, 32 studies were considered potentially eligible and read in full by the evaluators. At the end of the analysis, nine articles met all the inclusion criteria and were included in this systematic review. Studies have shown that among the observed complications, neurological injuries were the most frequent, followed by the presence of hemorrhage during osteotomy, dental devitalization, bone fractures and infections. It is important to note that the psychological factor of patients must be taken into account, so that they feel satisfied with the aesthetics of their face after the surgery.

Copyright © 2020, Allana Barbosa Corrêa et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Allana Barbosa Corrêa, Alick Brianne Ribeiro Silva, Fernando Matheus Santana Tunel, Marco Tulio Leandro Ribeiro et al. 2020. "Complications associated with orthognathic surgery: a systematic review", *International Journal of Development Research*, 10, (07), 38452-38457.

INTRODUCTION

Concern for health and aesthetics has always been part of the life of human beings, who have always looked for ways to improve their appearance. Currently, the emergence of new surgical techniques has become promising in the correction of skeletal discrepancies, offering patients excellent results, both in terms of function and aesthetics. Orthognathic surgery aims to reestablish the balance between the face and the skull, favoring a significant improvement in masticatory, respiratory, phonetic and facial aesthetics. Surgery planning requires a trusting interaction between the professional and the patient, in order to reach the final goal of satisfaction with the procedure

(Posnick, 2019 and Olkun, 2019). This therapeutic approach is performed by a multidisciplinary team and requires surgical, orthodontic, speech and psychological planning during the pre and post-operative period (Posnick, 2019). During preoperative planning blood tests should be requested in order to ascertain the systemic health of the patient, another factor to be analyzed is the patient's face, documents such as profile and frontal photographs are extremely important. The correct planning and preoperative reproduction of bone movements before fixing the structures in the planned position is of fundamental importance for successful treatment (Suenaga, 2016). In surgical planning, the use of plaster models allows

dental elements to be viewed in a three-dimensional way, while in virtual planning it is possible to view the entire skull, with better reproducibility in simulations, offering more advantages to the surgeon, as well as better results for the patient, avoiding complications during and after the procedure (Centenero, 2014 and Vale, 2016). Orthognathic surgery favors several advantages in the correction of dento-skeletal disorders. However, during and after the procedure, some complications can be observed (Steenen, 2016 and Posnick, 2016). Among the intraoperative complications, the occurrences of hemorrhages are highlighted due to lesions of large blood vessels, such as the lower alveolar artery, superior alveolar artery, maxillary artery, facial artery, sublingual artery and retromandibular vein. Another type of complication observed during surgery is the occurrence of fractures resulting from inadequate vertical osteotomy on the lower border and horizontal osteotomy performed above the tongue, as well as fractures associated with the separation of the proximal and distal segments of the maxillary bones (Thastum, 2017 and Kim, 2017). However, some complications, such as the presence of neurological injuries, musculoskeletal pain, changes in nasal morphology, temporomandibular disorders, delayed union or non-union of the osteotomy site, as well as the presence of infections and psychological changes caused by the change in facial aesthetics, are observed only in the postoperative period (Alolayan, 2014 and Kim, 2017). The professionals involved in the treatment must know the causes of the possible complications that occur during and after the surgery to treat the affected patients, thus favoring better results in relation to the functionality and aesthetics of the stomatognathic system. Therefore, the objective of this systematic review was to assess in the scientific literature the main complications associated with orthognathic surgery during the intra and postoperative period.

MATERIALS AND METHODS

This study followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Statement (Moher, 2009).

Information of sources and search strategies: A literature search was performed in July of 2020 in the following electronic databases: Science Direct, Embase, Cochrane Collaboration Library, and PubMed/MEDLINE. The following review question was developed according to population, intervention, comparison, and outcome (PICO): "What is the complications associated with orthognathic surgery?" and a keyword search was performed. The search was carried out without time and language restrictions. Hand searches were also conducted by cross-checking the reference lists of the included articles. Duplicates were removed upon identification. The search strategy was based on combinations of the following keywords: ("surgery") AND ("orthognathic surgery") AND ("Complications" [MeSH]).

Eligibility criteria and Study selection: The reviewer independently screened and assessed potential articles. Studies that did not fulfil the inclusion criteria were excluded. In the first stage, the titles and abstracts of all retrieved reports were screened for potentially eligible studies. The full text articles of the previously identified studies were then examined in detail according to predefined eligibility criteria for inclusion

in the qualitative review. Disagreements were solved by discussion between the authors. The inclusion criteria were:

- Studies that evaluated the complications associated with orthognathic surgery.
- With regard to inclusion criteria, the review exclusively focused on randomized controlled trials with clearly specified inclusion and exclusion criteria.
- The surgical technique had to be identical for the patients in all of the included studies.
- In addition, a study sample of at least 10 patients was required, as well as an observation period of at least 3 months.

Exclusion criteria:

- Animal studies.
- in vitro studies.
- Opinion articles.
- Letters to the editor.
- Review articles.
- Interviews, updates.
- Abstracts.
- Unpublished studies.

The review authors independently screened the articles for data extraction. Any disagreements were resolved by discussion.

RESULTS

Study selection and characteristics: The search strategy developed in this systematic review identified a total of 3,262 studies located in the evaluated databases. After screening through reading the titles and abstracts and excluding duplicate articles, 32 studies were considered potentially eligible and read in full by the evaluators. At the end of the analysis, nine articles published between 2001 and 2019 met all the inclusion criteria and were selected for this systematic review (Panula, 2001; Kim, 2007; Ho, 2011; Davis, 2016; Lee, 2016; Friscia, 2017; Olate, 2018; Hwang, 2019; Zaroni, 2019). The flowchart applied for the article selection and selection process is illustrated in Figure 1. In total, 5,939 patients undergoing orthognathic surgery were evaluated in the selected studies, with the sample ranging from 17 patients (Hwang, 2019) to 2,268 patients (Davis, 2016). The types of surgery performed are listed in Table 1. The average follow-up time ranged from 6 months to 2.7 years. All included studies evaluated the main complications associated with orthognathic surgery. The main methodological aspects and observed results can be seen in Table 1.

MAIN RESULTS

Panula (2001) retrospectively evaluated the incidence of pre, intra- and postoperative complications of orthognathic surgery and its implications for the patient. In this study, the most frequently observed complication was a sensorineural deficit in the region innervated by the lower alveolar nerve. The same result was observed in the study developed by Kim (2007), in this article a case of severe intraoperative bleeding was also reported.

Table 1. Summary of the descriptive characteristics and results of the included studies (n=9).

Author (year)	Country	Number of patients	Age (mean)	Type of surgery	Follow-up (mean)	Summary of the results
Panula (2001)	Finland	655	30.3years	Mandibular Osteotomies <ul style="list-style-type: none"> • BSSO • Anterior subapical segment (Kole) • Posterior subapical segment • Genioplasty • Body osteotomy • Intraoral vertical ramus osteotomy • Maxillary Osteotomies • Le Fort I • Anterior supra-apical segmental (Wassmund) • Posterior supra-apical segmental (Schuchardt) SARME 	1.8 years	The most common complication was a neurosensory deficit in the region innervated by the inferior alveolar nerve; mild in 32% of patients (183 of 574 patients with an osteotomy in the mandible) and disturbing in 3% of patients (18/574). The most serious complication was severe intraoperative bleeding in 1 patient necessitating major blood transfusions and later embolization of the internal maxillary artery.
Kim (2007)	South Korea	301	40 years	BSSRO; BSSRO and genioplasty; BSSRO & Le Fort I osteotomy; BSSRO & Le Fort I osteotomy and genioplasty; Genioplasty; BSSRO and paranasal augmentation; BSSRO and genioplasty and paranasal augmentation; Le Fort I osteotomy; Genioplasty and anterior segment osteotomy; BIVRO; BIVRO and others; BSSRO and others; BIVRO and Le Fort I osteotomy; Angle shaving; SSRO and IVRO.	1 year	The most common complication was a neurosensory deficit in the region innervated by the inferior alveolar nerve. The most serious complication was severe intraoperative bleeding. No complication was fatal.
Ho (2011)	United Kingdom	85	23.3 years	Segmental Le Fort I osteotomy.	2.4 years	The overall complication rate was 27%. Three patients (4%) had devitalisation of teeth, three (4%) developed minor periodontal defects, and one had tooth loss. Eight patients (9%) had plates removed, and two patients developed persistent postoperative palatal fistula.
Davis (2016)	Canada	2.268	26.9 years	BSSO; Le Fort; 1-Piece Le Fort; Segmental Le Fort; FG; BSSO+FG; Le Fort+FG; BSSO+Le Fort; BSSO+LeFort+FG.	NI	Eight percent of patients developed an surgical site infection. None of the patient demographics was associated with an increased risk for infection. Most initial infections (62%) and most recurrent infections (78%) occurred in the mandible. Twenty-six percent of patients who developed SSIs had recurrent infections after antibiotic treatment. Surgical site infection necessitated hardware removal for 14% of patients. Adverse effects from the antibiotics were seen in 4.2% of patients.
Lee (2016)	South Korea	1.455	26.4 years	For double-jaw surgeries, Le Fort I osteotomies were performed through a horizontal incision in the buccal sulcus from the right first molar to the left first molar, resulting in a horizontal osteotomy line at least 5 mm away from the root apices. The osteotomy was completed from the piriform rim to the posterior extent of the zygomatic buttress in the lateral wall of the maxilla in a plane horizontal to the Frankfort horizontal plane. After fracture, the maxilla was passively positioned into the desired location using an inter-occlusal interim splint.	2.7 years	Descending palatine artery ligation, genioplasty, and mandibular sub-apical osteotomy were associated with a significant risk of tooth discoloration. Patients should be informed preoperatively of the possibility of tooth discoloration. Additionally, the descending palatine artery should be preserved during Le Fort I osteotomy to reduce the risk of tooth discoloration.

.....Continue

Frischia (2017)	Italy	423	37.5 years	BSSRO; BSSRO + genioplasty; Le Fort I osteotomy; Le Fort I osteotomy + genioplasty; Le Fort I osteotomy+ BSSRO; Le Fort I osteotomy+ BSSRO + genioplasty.	1 year	One hundred eighty-five complications in 143 (33.8%) of the 423 treated patients were reported. Complications detected were nerve injury (49 cases, 11.9%), infections (10 cases, 2.4%), complications related to fixation plates or screws (30 cases, 7.1%), bad split osteotomy (8 cases, 1.9%), secondary temporo-mandibular joint disorders (36 cases, 8.5%), dental injuries (21 cases, 5%), condilar resorption (2 cases, 0.5%), and necessity of a second-time surgery (24 cases, 5.7%).
Olate (2018)	Brazil	250	18 – 55 years	Monomaxillary surgery, double procedures (bimaxillary ormonomaxillary surgery with genioplasty), and maxillary, mandibular, and chin surgeries.	1.1 year	The intraoperative complications totaled 20 patients (8%), of which 8 had deficiencies in the orthodontic device, either by breakage or because it lost its bonding, 10 patients with a bad split in the sagittal split osteotomy, 1 patient with increased bleeding during the surgery, 1 patient with dental injury verified during surgery, and 1 patient with damage to the lower lip.
Hwang (2019)	South Korea	17	22.88	Orthognathic Surgery for patients with cleft lip/palate	0.6 year	Intraoperative complications include hemorrhage, inadequate fracture, injury to theinjuries to the inferioralveolarnerveand lingual nerve, root damage, and fistula.
Zaroni (2019)	Brazil	485	29.9	The most frequent was BSSO (35.9%),followed by Le Fort I osteotomies(34.5%).	NI	A total of 93 complications were reported (19.2%), including postoperative malocclusion, hemorrhage, inferior alveolar nerve injury, bad split, and infection.

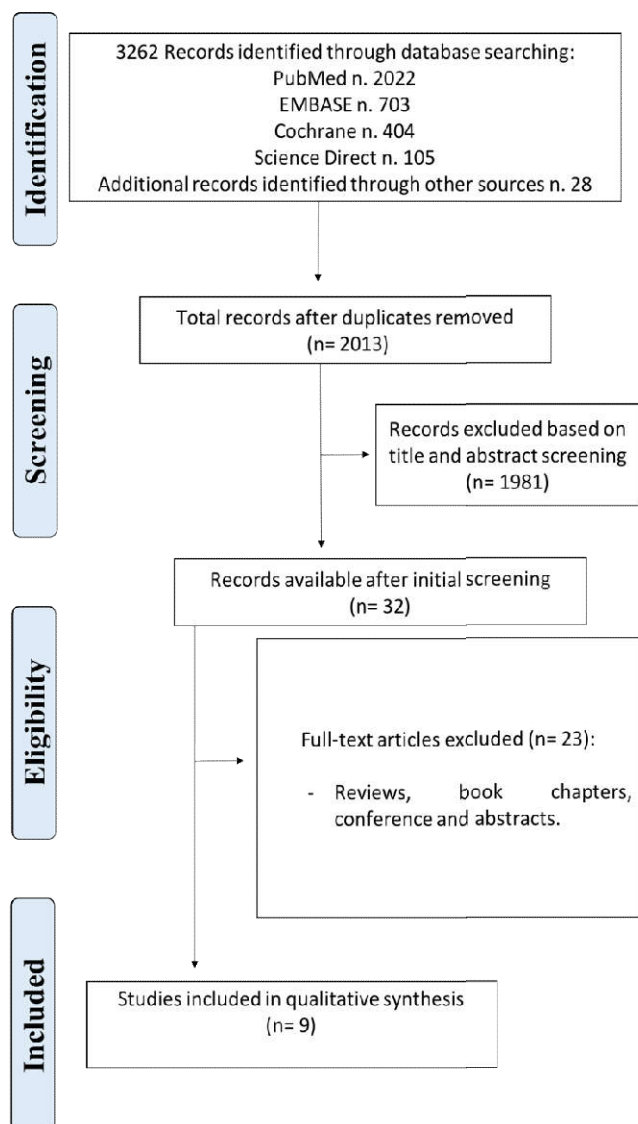
Legends: BSSO, bilateral sagittal split osteotomy; SARME, surgically assisted rapid maxillary expansion; BIVRO, bilateral intraoral vertical ramus osteotomy; BSSRO, bilateral sagittal split ramus osteotomy; IVRO, intraoral vertical ramus osteotomy; SSRO, sagittal split ramus osteotomy; FG,functional genioplasty.

Ho (2011) evaluated the complication rates associated with segmental maxillary surgery, the overall complication rate was 27%. Three patients (4%) had devitalized teeth, three (4%) developed small periodontal defects and one had tooth loss. Eight patients (9%) had plaque removed and two patients developed persistent postoperative palatal fistula. There was no segmental loss of bones or teeth. The authors concluded that complications in this cohort were relatively low and that segmental maxillary surgery is safe as an adjunct in carefully selected cases.

Davis (2016) determined the prevalence of surgical site infection after orthognathic surgery at a referral center. 8% of patients developed infection of the surgical site. None of the patient's demographic data was associated with an increased risk of infection. Most initial infections (62%) and recurrent infections (78%) occurred in the jaw. 26% of patients who developed surgical site infection had recurrent infections after treatment with antibiotics. Adverse effects of antibiotics were seen in 4.2% of patients. The prophylactic use of first generation cephalosporins, such as cefazolin, appears to be more effective than penicillin and clindamycin in preventing infection of the surgical site.Hwang (2019) evaluated the complications associated with surgeries that aimed to treat cleft lip/palate. Surgical complications included hemorrhage, inadequate fracture, lesion of the lower alveolar nerve and lingual nerve, damage to the tooth root and fistula. All patients recovered during the follow-up period of 6 months or more after surgery.

DISCUSSION

Orthognathic surgery seeks to promote a significant improvement in the function and aesthetics of patients with dento-skeletal deformities. However, complications can occur, the main ones being functional and psychological (Jędrzejewski, 2015). In the study by Kim (2017) it was observed in the postoperative period of patients undergoing orthognathic surgery, the presence of neurological complications affecting mainly the lower alveolar nerve, the mental nerve, the incisor nerve and the infraorbital nerve. These findings corroborate the studies by Panula (2001) and Kim (2007), in which the most frequent complication was the sensorineural deficit in the region innervated by the lower alveolar nerve. In the study by Friscia (2017), Zaroni (2019) and Hwang (2019), nerve injuries were also reported, however, they were not the main complications observed in the postoperative period of the studied patients. Verweij (2017) stated in his study that the presence of a sensorineural deficit occurred more frequently in individuals over 31 years of age. However, these neurological changes were easily recovered, without causing permanent damage to the patients' nerves. Another post-surgical neurological complication reported in the literature is ischemic paralysis of the facial nerve, caused by the deep injection of vasoconstrictors and compression of the nerve by a hematoma.



Correct anesthetic technique, as well as drug therapy associated with the use of corticosteroids after surgery, can prevent temporary neurological lesions of the facial nerve (Koh, 2011). In this systematic review, no studies were reported that reported complications associated with facial nerve palsy in patients undergoing orthognathic surgery. However, because it is a condition that can cause inconvenience to the patient, the surgeon must take the necessary care to avoid a possible late complication. Emshoff (2000) observed in his study that after performing Le Fort I maxillary osteotomies, patients did not show a positive response regarding pulp vitality in the first weeks. However, this pulp response was reversible, returning to normal over time. Le Fort I osteotomy can also induce direct changes in sensory nerves, temporarily affecting the sensitivity of the oral mucosa and palatal mucosa (Kim, 2017). In the study by Ho (2011) it was observed that 4% of the patients presented permanent damage in relation to pulp vitality, this being a type of complication that must be explained previously to the patients before the surgical procedures, in order to avoid later endodontic infections caused by postoperative pulp necrosis. The occurrence of postoperative infection in patients undergoing orthognathic surgery can be determined by a combination of factors, among which, the surgical technique and asepsis employed, as well as the patient's immunological condition, stand out. Cellulite, abscess, maxillary sinusitis and osteomyelitis, are the types of infections that can occur after

surgery. Currently, with the correct use of aseptic techniques, as well as the advancement of surgical techniques and the implementation of broad-spectrum antibiotics, the rates of postoperative infection are increasingly lower (Posnick, 2017 and Kim, 2017). In the studies by Davis (2016), Friscia (2017) and Zaroni (2019), the presence of surgical site infection after orthognathic surgery was observed. However, Posnick (2017) reported that the rates of postoperative infections are low when using antibiotics, cefazolin or cephalexin in the postoperative period. Thus, the importance of knowing the systemic health conditions of the patient through the request of preoperative exams is emphasized, in order to establish an adequate drug therapy, avoiding the occurrence of acute or chronic infections. Vascular complications can occur as a result of traumatic rupture of blood vessels or due to the presence of pre-existing coagulopathies. Injuries to the lower alveolar artery, upper alveolar artery, maxillary artery, facial artery, sublingual artery and retromandibular vein can cause hemorrhage during surgical procedures. However, this complication can be resolved through the use of hemostatic materials (Nardi, 2002 and Thastum, 2017). These findings corroborate the studies by Olate (2018), Hwang (2019) and Zaroni (2019) in which the presence of intraoperative hemorrhage was observed, however, this complication did not present risks for patients, being easily treated. There is a huge variety of complications associated with orthognathic surgery, professionals must know the types of complications, to be able to treat when necessary. The best way to avoid complications is to carry out a correct preoperative planning.

Conclusion

To obtain a satisfactory result during the performance of orthognathic surgery, it is necessary to carry out an adequate planning, through a correct and precise diagnosis, taking into account the skeletal and dental aspects of the patients. Studies have shown that among the observed complications, neurological injuries were the most frequent, followed by the presence of hemorrhage during osteotomy, dental devitalization, bone fractures and infections. It is important to note that the psychological factor of patients must be taken into account, so that they feel satisfied with the aesthetics of their face after the surgery. The planning of orthognathic surgery must bring together different tools, as well as the performance of a multidisciplinary team so that a correct rehabilitation of the patient occurs, minimizing the risks of intra and postoperative complications.

Conflict of Interest: The authors declare no conflicts of interests.

Ethics approval: Not applicable.

Figure legends: Figure 1. PRISMA flow diagram of screened studies

REFERENCES

- Alolayan AB, Leung YY. 2014. Risk factors of neurosensory disturbance following orthognathic surgery. *PLoS One*, 9(3):e91055.
- Centenero S. 2014. Planificación tridimensional y utilización de férulas Computer Aided Design/Computed Aided Manufacturing encirugía ortognática. *Rev Esp Cirug Oral y Maxilofac*. 36(3): 4-9.

- Davis CM, Gregoire CE, Steeves TW, Demsey A. 2016. Prevalence of Surgical Site Infections Following Orthognathic Surgery: A Retrospective Cohort Analysis. *J Oral Maxillofac Surg.*, 74(6):1199-1206.
- Emshoff R. 2000. Effect of segmental Le Fort I osteotomy onmaxillary tooth type-related pulpar blood-flow characteristics. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod.* 94(6): 749-752.
- Frischia M, Sbordone C, Petrocelli M, et al. 2017. Complications after orthognathic surgery: our experience on 423 cases. *Oral Maxillofac Surg.*, 21(2):171-177.
- Ho MW, Boyle MA, Cooper JC, Dodd MD, Richardson D. 2011. Surgical complications of segmental Le Fort I osteotomy. *Br J Oral Maxillofac Surg.* 49(7):562-566.
- Hwang DS, Choi HS, Kim UK, Song JM. 2019. Complications Following Orthognathic Surgery for Patients With Cleft Lip/Palate. *J Craniofac Surg.*, 30(6):1815-1819.
- Jędrzejewski M, Smektała T, Sporniak-Tutak K, Olszewski R. Preoperative, intraoperative, and postoperative complications in orthognathic surgery: a systematic review. *Clin Oral Investig.* 2015;19:969-977.
- Kim SG, Park SS. 2007. Incidence of complications and problems related to orthognathic surgery. *J Oral Maxillofac Surg.*, 65(12):2438-2444.
- Kim YK. 2017. Complications associated with orthognathic surgery. *J Korean Assoc Oral Maxillofac Surg.* 43(1):3-15.
- Koh KM, Yang JY, Leem DH, Baek JA, Ko SO, Shin HK. 2011. Facial nerve palsy after sagittal splitramus osteotomy: follow up with electrodiagnostic tests. *J Korean AssocMaxillofacPlastReconstr Surg.*, 33:190-197.
- Lee UL, Lee EJ, Seo HY, Han SH, Choi WC, Choi YJ. 2016. Prevalence and risk factors of tooth discolouration after orthognathic surgery: a retrospective study of 1455 patients. *Int J Oral Maxillofac Surg.*, 45(11):1464-1470.
- Nardi P, Guarducci M, Cervino M. Orthognathic surgery. Study of nerve injuries. *MinervaStomatol.* 2002; 51(12): 461-71.
- Olate S, Sigua E, Asprino L, de Moraes M. Complications in Orthognathic Surgery. *J Craniofac Surg.* 2018;29(2):e158-e161.
- Olkun HK, Borzabadi-Farahani A, Uçkan S. 2019. Orthognathic Surgery Treatment Need in a Turkish Adult Population: A Retrospective Study. *Int J Environ Res Public Health.* 16(11):1881.
- Panula K, Finne K, Oikarinen K. 2001. Incidence of complications and problems related to orthognathic surgery: a review of 655 patients. *J Oral Maxillofac Surg.*, 59(10):1128-1137.
- Posnick JC, Choi E, Chavda A. 2017. Surgical site infections following bimaxillary orthognathic,osseous genioplasty, and intranasal surgery: a retrospective cohort study. *J Oral Maxillofac Surg.*, 75(3):584-595.
- Posnick JC, Choi E, Liu S. 2016. Occurrence of a 'bad' split and success of initial mandibular healing: a review of 524 sagittal ramus osteotomies in 262 patients. *Int J Oral Maxillofac Surg.*, 45:1187-1194
- Posnick JC, Kinard BE. 2019. Orthognathic Surgery Has a Significant Positive Effect on Perceived Personality Traits and Perceived Emotional Facial Expressions in Subjects with Primary Maxillary Deficiency. *PlastReconstrSurg Glob Open.* 7(4):e2198.
- Steenen SA, van Wijk AJ, Becking AG. 2016. Bad splits in bilateral sagittal split osteotomy: systematic review and meta-analysis of reported risk factors. *Int J Oral Maxillofac Surg.*, 45(8):971-979.
- Suenaga H, Taniguchi A, Yonenaga K. 2016. Computer-assisted preoperative simulation for positioning of plate fixation in Lefort I osteotomy: A case report. *J Formos Med Assoc.* 15(6): 470-474.
- Thastum M, Andersen K, Rude K, Nørholt SE, Blomløf J. 2016. Factors influencing intraoperative blood loss in orthognathic surgery. *Int J Oral Maxillofac Surg.*, 45:1070-1073.
- Vale F, Scherzberg J, Cavaleiro J. 2016. 3D virtual planning in orthognathic surgery and CAD/CAM surgical splints generation in one patient with craniofacial microsomia: a case report. *Dental Press J. Orthod.*, 21(1): 2-9.
- Verweij JP, Mensink G, Fiocco M, van Merkesteyn JP. 2016. Incidence and recovery of neurosensorydisturbances after bilateral sagittal split osteotomy in different age groups: a retrospective study of 263patients. *Int J Oral MaxillofacSurg.* 45:898-903.
- Zaroni FM, Cavalcante RC, João da Costa D, Kluppel LE, Scariot R, Rebellato NLB. 2019. Complications associated with orthognathic surgery: A retrospective study of 485 cases. *J Craniofac Surg.*, 47(12):1855-1860.
