

Clinical Paper
Orthognathic Surgery

Prevalence and risk factors of tooth discolouration after orthognathic surgery: a retrospective study of 1455 patients

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Abstract. This study was conducted to evaluate the prevalence of tooth discolouration and to examine the factors that may pose a higher risk for tooth discolouration after orthognathic surgery. This was a retrospective study of 1455 orthognathic surgeries. The following data were collected for analysis: presence of discoloured teeth, sex, age at operation, the extent of the surgical displacement of the maxilla, and whether patients had undergone genioplasty, zygomoplasty, or descending palatine artery (DPA) ligation. Out of 1339 patients who underwent double-jaw surgery, 49 received root canal treatment due to tooth discolouration. No tooth discolouration was found in the 116 patients undergoing single-jaw surgery. DPA ligation, genioplasty, and mandibular sub-apical osteotomy were associated with a significant risk of tooth discolouration. Patients should be informed preoperatively of the possibility of tooth discolouration. Additionally, the DPA should be preserved during Le Fort I osteotomy to reduce the risk of tooth discolouration.

Key words: orthognathic surgery; tooth discolouration; Le Fort I osteotomy; descending palatine artery; zygomoplasty; segmental osteotomy; pulp necrosis; genioplasty.

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Orthognathic surgery is increasingly used in South Korea to correct skeletal malocclusions and address cosmetic concerns. There are many benefits of orthognathic surgery, including improved masticatory function, reduced temporomandibular joint problems, and improved

facial aesthetics.^{1–3} Despite the advantages of orthognathic surgery, the procedures are difficult and many complications associated with this surgery have been identified.⁴ Tooth discolouration is among these complications; however the prevalence and risk factors of

tooth discolouration following orthognathic surgery remain unclear.

Orthognathic surgery can pose a risk to the viability of teeth, and previous studies have reported that blood flow changes that

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affect the tooth pulp may occur during and after orthognathic surgery. A study by Justus et al. showed that the pulpal blood flow was increased between the second and third week after surgery,⁵ and Kim reported that increased blood flow in the low-compliance environment of the dental pulp increased tissue pressure, which ultimately led to pulpal injury or death.⁶ Long-term studies (longer than 6 months) have reported significant reductions in pulpal blood flow to levels below presurgical baseline measurements following Le Fort I osteotomy.^{7,8}

Current evidence suggests that there is a strong relationship between pulpal blood flow changes and orthognathic surgery. However, the specific factors that affect the pulp blood supply and cause tooth discolouration have not been identified. Therefore, the prevalence of tooth discolouration was evaluated in this study, and the factors that pose a higher risk for tooth discolouration after orthognathic surgery were identified. It is hoped that this research will heighten the awareness of oral and maxillofacial surgeons to this potential complication.

Materials and methods

This was a retrospective study of 1455 orthognathic surgeries (1339 double-jaw surgeries and 116 mandibular single-jaw surgeries) performed in the department of oral and maxillofacial surgery of a university hospital in Seoul, Korea, from January 2010 to June 2013. Patients with problems related to osteogenesis, congenital malformations, or a history of maxillofacial trauma were excluded.

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. Plates were placed bilaterally at the piriform rims and zygomatic buttresses. Bilateral sagittal split ramus osteotomies (BSSRO), as described previously by Wyatt,⁹ were then performed for the patients undergoing double-jaw surgery; patients requiring mandible-only surgery also underwent BSSRO with this technique. Medial ascending ramus and buccal

vertical cuts were completed. The buccal vertical cut was continued through the inferior border and included 3–4 mm of the lingual cortex. After chiselling, the medial and lateral cortical plates were separated. Three-hole adjustable plates and screws were used for rigid fixation of the split segments.

The patient medical records containing information on the surgical procedures were reviewed and the following data were collected for analysis: presence of discoloured teeth, sex, age at operation, the specific orthognathic procedure performed, the extent of the horizontal and/or vertical displacement of the maxilla, operation time, and whether the patient had undergone genioplasty, zygomoplasty, descending palatine artery (DPA) ligation, or segmental osteotomy procedures. Before surgery, patients were specifically informed of the possibility of tooth discolouration after surgery. Additionally, the patients were instructed that they would need to be seen immediately if they or their orthodontist noticed tooth discolouration during postoperative orthodontic treatment.

Photographs of the teeth were obtained for all patients before surgery, using the same camera settings (ISO, exposure, aperture, and light intensity). If a patient presented with tooth discolouration after surgery, additional pictures were obtained using the same camera settings and comparisons were made with the pictures taken previously on the same screen. Also, a shade assessment was performed using a VITA shade guide. This was done by both the prosthodontic dentist and the dental hygienist to record the shade from the

photograph; the darker shade was selected when there was a difference of opinion. Shade assessment results were arranged in order of value from high to low (B1, A1, B2, D2, A2, C1, D4, A3, D3, B3, A3.5, B4, C3, A4, and C4) ignoring both hue and chroma. A shade difference of ≥ 3 steps was considered to be remarkable in terms of discolouration. Patients with a problem persisting for 6 months or longer underwent further interventions, as outlined below, and were recorded for the study.

The term 'tooth discolouration' may not be synonymous with 'pulp necrosis', as there may be a case of pulp necrosis without discolouration. However, there was no tooth with remarkable tooth discolouration that showed activity under electrical pulp testing in this study; in fact, it was noted that all of the discoloured teeth showed necrotic pulp during root canal therapy (RCT).

All patients who presented with tooth discolouration were treated for the discolouration in accordance with the university protocol following an evaluation in the department of endodontics (Fig. 1). Detailed information was retrieved for each of these patients, including the time of onset, number of affected teeth, and duration from operation to treatment. The study protocol was approved by the necessary institutional review board.

The data collected were analyzed using IBM SPSS Statistics version 19.0 software (IBM Corp., Armonk, NY, USA). The influence of the type of operation (single-jaw or double-jaw surgery), multi-piece osteotomy, and genioplasty on postoperative pulp viability was determined using

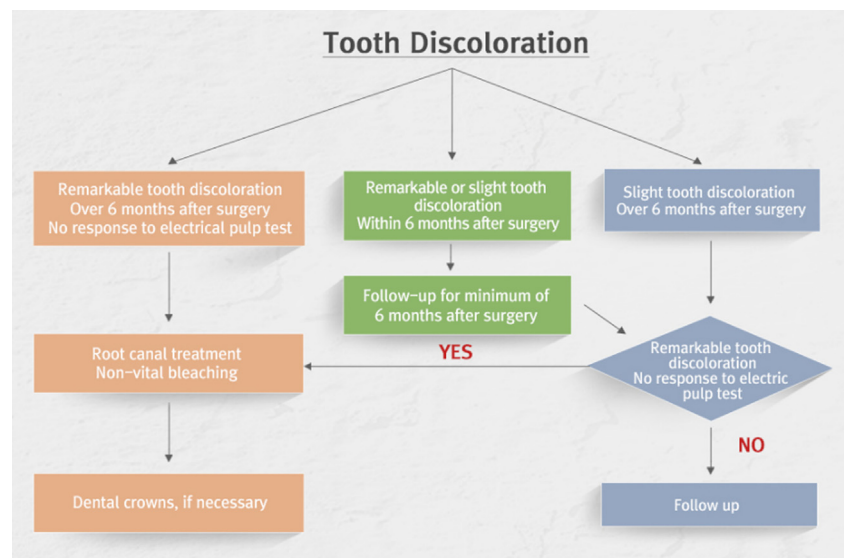


Fig. 1. Treatment protocol for tooth discolouration after orthognathic surgery at the study hospital.

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