Int. J. Oral Maxillofac. Surg. 2016; xxx: xxx–xxx
http://dx.doi.org/10.1016/j.ijom.2016.11.016, available online at http://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Orthognathic Surgery

Short-term complications after surgically assisted rapid palatal expansion: a retrospective cohort study

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M. Verquin, L. Daems, C. Politis: Short-term complications after surgically assisted rapid palatal expansion: a retrospective cohort study. Int. J. Oral Maxillofac. Surg. 2016; xxx: xxx–xxx.

Abstract. Surgically assisted rapid palatal expansion (SARPE) has been considered a safe procedure with minimal patient morbidity. The aim of this study was to identify short-term complications encountered after tooth-borne expansion with a standardized approach to inform surgeons and orthodontists of the patient risk. In this retrospective cohort study, 55 patients (35 female, 20 male) undergoing SARPE between January 2013 and December 2014 were evaluated. Twenty-eight patients developed one or more complications. Postoperative haemorrhage was seen in six patients. Sixteen patients presented with injury to the infraorbital nerve, five had dental complications, and four had severe postoperative pain. A prolonged hospital stay was necessary for six patients and additional surgery was required in two cases. It is concluded that the short-term complications after tooth-borne SARPE are generally mild; however, the number of complications encountered indicates that SARPE is not free of risk and should be preceded by careful patient selection and planning.

Key words: retrospective cohort study; palatal expansion technique; distraction osteogenesis; maxilla; tooth-borne; complications.

Accepted for publication 29 November 2016

Transverse maxillary deficiency is among the most common types of skeletal dysplasia observed in clinical practice and is often characterized by a unilateral or bilateral crossbite, as well as anterior crowding.[1,2] A possible approach, depending on the level of skeletal maturity and the desired amount of expansion, is surgically assisted rapid palatal expansion (SARPE). The concept of correcting a transverse discrepancy in the maxilla was first described by Angell in 1860.[3,4] Following the introduction of a mid-palatal split technique by Brown,[5] Shetty et al. added a pterygomaxillary osteotomy to achieve predictable expansion of the maxilla,[6] and SARPE quickly became a procedure of choice for widening of the maxilla in skeletally mature patients. It has been performed frequently ever since.

As SARPE is considered a relatively safe procedure in comparison to a segmental Le Fort I osteotomy, data concerning complications are limited. The current literature commonly reports pain, haemorrhage, infection, nerve injury, apical root resorption, and discolouration and devitalization of teeth. Inadequate or asymmetrical expansion and infection of the maxillary sinus are rare, while flaring of

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the alar base, tinnitus, lacrimation, life-threatening epistaxis, and skull base fracture are extremely rare.[7–14]

With a growing number of adults seeking orthodontic treatment, an increase in the indications for SARPE can be expected. It is important to identify complications associated with SARPE to enable patient-specific treatment plans to be drawn up and to provide accurate information concerning the surgery-related risks. The purpose of this retrospective study was to investigate the presence/absence, nature, frequency, and timing of short-term complications presenting after tooth-borne SARPE in a group of consecutively treated patients at a single centre.

Patients and methods

Patients

All 56 patients undergoing tooth-borne SARPE between January 2013 and December 2014 were evaluated retrospectively for postoperative complications following a standardized multidisciplinary protocol at the Catholic University Leuven, Belgium. Exclusion criteria were prior trauma and craniofacial syndromes involving the maxilla. Fifty-five patients remained after applying the exclusion criteria; 35 were female and 20 were male, and they ranged in age from 13 to 47 years. This study was conducted in accordance with the principles stated in the Declaration of Helsinki and was approved by the Research Ethics Committee of the Faculty of Medicine, University of Leuven.

Technique

Prior to surgery, all patients were screened for any relevant medical and surgical history. Baseline radiographic and clinical imaging was obtained for all patients. All surgeries were performed by one of the authors (CP) following a standardized protocol. All patients underwent SARPE under general anaesthesia with nasotracheal intubation combined with a local anaesthetic (lidocaine), with a vasoconstrictor (epinephrine 1:100,000) given for haemostatic purposes before incision.

A semi-lunar horizontal incision was made using a scalpel and was completed with monopolar diathermy in the upper buccal fold from the canine up to the infrazygomatic crest bilaterally. A corticotomy according to Le Fort I was made from the posterior aperture to the maxillary tuberosity with a Hall drill, 4-mm above the apex of the upper canine, whilst holding the soft tissue of the upper jaw in a cranial direction with a Le Fort I hook, protecting the infraorbital nerve. Disengagement of the pterygomaxillary suture was performed using a curved osteotome. In conjunction with this procedure, a vertical incision was made over the labial frenulum of the maxilla, the anterior nasal spine was loosened, and the transpalatal osteotomy was completed with a spatula osteotome whilst placing a forefinger on the palate for guidance of the osteotome as it transected the mid-palatal suture. Transverse mobility of the maxillary halves was checked by manipulating a chisel in-between the central diastema. Disengagement of the nasal septum then followed using a septum osteotome. Antibiotics (amoxicillin) were administered intraoperatively and given as prophylaxis for up to 5 days postoperatively.

No standard distraction device was used; each patient's orthodontist inserted a Hyrax-type expander prior to surgery. A latency period of 7 days between surgery and expansion was respected to allow new callus to be formed. The device was activated 0.25 mm twice daily to achieve a daily expansion of 0.5 mm. All patients were assessed for complications clinically and with peri-apical X-rays of the central incisors on a weekly basis by residents at the university hospital under the supervision of one of the authors (CP). This was done for up to 4 weeks postoperatively or until the desired maxillary expansion had been achieved. The continuation of follow-up was then performed by the treating orthodontist.

The weekly clinical examination consisted of adequate anamnesis including an assessment of pain on a visual analogue scale (VAS), extraoral examinations including sensory deficits in the maxillary nerve (V2) region (light touch, pin-prick, and two-point discrimination tests) and an evaluation of the symmetry of expansion, and intraoral examinations including measurement of the central diastema, tooth colour, pocket measurement and mobility of the anchoring teeth (hyrax device) and central incisors using a Periotest M device (DentiSystem, Budapest, Hungary), and inspection of the intraoral wound healing. The weekly examination was concluded with clinical imaging (intraoral and extraoral) to allow comparisons to be made. Additional radiographic images were obtained when indicated after aberrant findings during clinical examination; for example, posterior–anterior films were obtained in the case of asymmetric expansion to allow proper follow-up, and tooth discolouration or mobility was investigated with additional peri-apical images or cone beam computed tomography (CBCT) to exclude direct damage from the burr or the osteotomy. After expansion, the device was blocked and either left in place or replaced with a transpalatal arch for a consolidation period of 6 months.

Outcome

Short-term complications after SARPE refer to unattended and unwanted conditions presenting intraoperatively, during the distraction phase, or postoperatively within 4 weeks after the SARPE procedure. Patients were systematically evaluated for pain, infection, haemorrhage, dental and periodontal changes, nerve injury, and symmetry of expansion, but other complications were also taken into account. Severe postoperative pain was defined as a VAS pain score >7 during the first week after surgery, affecting daily functioning, with only a limited effect of paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs) at the maximum dose allowed. The term 'haemorrhage' was used to describe all cases of postoperative bleeding presenting via the emergency or maxillofacial surgery department, with the exception of regular weekly follow-up after discharge from the hospital. All patients in whom the subjective findings of altered sensitivity in the trigeminal region could be confirmed clinically were categorized under 'nerve injury'. Deviations in the symmetry of expansion were diagnosed based on the comparison of successive extraoral and intraoral images.

Results

Fifty-six patients undergoing SARPE during the study period were identified. One patient had solitary median maxillary central incisor (SMMCI) syndrome and was excluded. Thus, the study cohort consisted of 55 patients. Thirty-five of the patients were female and 20 were male, and they ranged in age from 13 to 47 years (median age 22 years). All patients were skeletally mature and in the permanent dentition phase. Mobilization of the maxillary halves, subsequent expansion, and stabilization was achieved in all patients.

Nerve injury

Paresthesia of the infraorbital nerve and related branches was observed in 16 patients (29.1%). Eight of these patients experienced bilateral involvement of the nerve. Of the unilaterally affected patients, two complained of paresthesia

Please cite this article in press as: Verquin M, et al. Short-term complications after surgically assisted rapid palatal expansion: a retrospective cohort study, *Int J Oral Maxillofac Surg* (2016), http://dx.doi.org/10.1016/j.ijom.2016.11.016