COMPARATIVE STUDY

Reduction of Palatal Midline and Para-Midline Fractures Using Intra-arch Wire Fixation Versus Transmucosal Miniplate Stabilization: Prospective Randomized Clinical Study to Evaluate Postoperative Occlusion

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Abstract

Purpose The aim of the study is to compare the post reduction sequelae of transmucosal miniplate fixation technique for stabilization of palatal fractures with intra-arch wiring technique.

Materials and Method This study was prospectively undertaken on 16 patients, dividing them into two treatment arms based on random sampling methodology (Group A & B). For patients in Group A, intra-arch wire stabilization technique and in Group B trans-mucosal miniplate stabilization technique was used. The pre-operative and post-operative occlusion and time taken for stabilization in both the techniques was compared.

Results The mean time taken for reduction and stabilization of palatal fracture in group A was 10.9 ± 2.21 min and in group B was 14.2 ± 1.13 min. Four out of eight study patients in group A required post reduction interception to stabilize occlusion postoperatively, whereas none of the patients in group B needed any post operative intervention.

Conclusion The post operative occlusal stability was found better in study patients included in group B when compared to group A patients, although satisfactory post-operative occlusion was obtained even in group A with post-operative interception for occlusal stability.

Keywords Palatal fracture · Bone · Fracture · Maxillofacial · Oral surgery

Introduction

Palatal fractures are not uncommon in this era of high velocity trauma. It is reported by various authors that association of palatal fractures with Le Fort fractures may be up to 13.2 % [1]. In the past various modalities were instituted for the fracture stabilization and fixation including transpalatal bar/wire fixation, occlusal splints and conventional arch bars. With the conventional non-rigid modalities of fixation, mal-rotation and disinclination of palatal shelves is not uncommon post reduction. Fractures that sagittally divide the palate present a challenge for reduction and stabilization due to the splaying of the split palate and buccal version of the palatoalveolar segments [2]. Reduction of the posterior palatal splaying as seen in Hendrickson's Type II and Type III fractures presenting as buccal version of the palate-alveolar selves require a reliable fixation modality during the phases of healing to maintain functional occlusion. This study compares a non-rigid conventional method of intra-arch wire fixation to functionally stable and clinically achievable transmucosal miniplate stabilization for the management of palatal fractures.

Materials and Methods

A prospective randomized clinical study was undertaken to assess the post-operative sequelae and stabilization of palatal midline and para-midline fractures (Fig. 1) using interarch wire fixation and transmucosal miniplate

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Fig. 1 The para mid-palatal fracture line in Water's view preoperatively

stabilization. The sampling was random with inclusion criteria: (1) Patient more than 18 years of age, (2) Presence of palatal midline and para-midline fracture (Hendrickson's Type II and Type III fractures), and (3) Patients willing to sign an informed consent for inclusion in this clinical trial. For eliminating confounding factors for this study, only the patients with Lefort I or High Lefort I with palatal fractures were included. A total of sixteen patients were enrolled for this study. Out of the 16 study patients, eight were subjected to intra-arch wire fixation for stabilization of the palatal fracture (Group A) and eight underwent transmucosal miniplate stabilization for the palatal split (Group B). In group A the intra-arch wire was placed from 2nd premolar- 1st molar of right maxillary quadrant to 2nd premolar- 1st molar of the left maxillary quadrant. In group B the intra-arch wire (26 gauge) was initially placed to stabilize the fracture segment and achieve satisfactory occlusion and then a 2 mm titanium miniplate 2 hole with gap was secured using 2 mm × 8 mm titanium screws over the palatal mucosa in posterior region of hard palate (Fig. 2). The transpalatal arch wire was then removed after mini plate fixation on the palate (Fig. 3) and occlusion on both the sides was evaluated. The transmucosal miniplate was kept in situ for a period of six weeks. All the 16 patients were followed up regularly for a minimum period of eight weeks. The persistence of acceptable occlusion and inter-cuspatation obtained intra-operatively, in the postoperative 8 weeks was kept as the primary assessment criteria of classifying

Fig. 2 Stabilization of fracture with trans-palatal wire and trans-mucosal miniplate

Fig. 3 Trans mucosal miniplate in position

the study patients as having satisfactory reduction and occlusion. All the study subjects were evaluated on weekly basis for the assessment of post-operative occlusion and its comparison with inter-cuspatation of teeth obtained intra-operatively. All the study patients were not on post-operative inter maxillary fixation, but arch bars and maxillomandibular fixation was done in patients presenting with deranged occlusion in the post-operative period. A single blinded observer who had adequate knowledge of dental occlusion was involved to assess the patients' postoperative occlusion and compare it with a photographic documentation of intra-operative occlusion. The inter group comparative assessment of the treatment modalities used in both study was done using contingency tables. The other parameters assessed in the study were—mean age of such trauma, time taken for stabilization and fixation of the palatal fracture.

Results

The mean age of the study subjects in Group A was 26.7 ± 6.82 year(s), and in Group B it was 29.5 ± 6.1 year(s). The mean time taken for fixation of fracture by intra-arch wire technique in Group A was 10.9 ± 2.21 min (Fig. 4), whereas stabilization and trans-mucosal miniplate fixation took 14.2 ± 1.13 min (Fig. 5). Comparing time taken for the fixation procedure in the two groups using student's *t* test, value of *t* was found to be -3.70 with probability of this comparison being 0.0024. Among the patients in group A, 3 out of eight patients had observable changes in occlusion in first post-operative week. One patient in 'group A' came back with complain of deranged occlusion and inability to bite on posterior teeth in the second post operative week. All the patients in group B had stable occlusion post operatively (Fig. 6). The intergroup comparison is summarized in Fig. 7. The patients with deranged occlusion in group A, were kept on post operative intermaxillary fixation with elastics to attain satisfactory occlusion. Analysis using 2×2 contingency table to compare data obtained in regard to post-operative occlusal stability, applying Fisher's exact test, the two-tailed *P* value equals 0.0769 suggesting the association between study groups and outcomes to be not quite statistically significant. But the post operative corrective intervention to stabilize occlusion was required in 50 % of cases in group A, where only inter-quadrant wire was used to stabilize the palatal fracture.

Discussion

The sagittal or parasagittal palatal fractures as isolated fractures are not so common in mid-face trauma. The clinical signs which can be used to identify fracture of palate are ecchymosis on palate, laceration of palatal mucosa and/or upper lip, widening of maxillary dental arch, malocclusion, and loss of incisor teeth, palatal

Fig. 4 Graph showing time taken for wire stabilization of fracture in group A

Fig. 5 Graph showing time taken for trans mucosal mini plates for stabilization of fracture in group B

segments palpated for mobility, step deformities and presence of diastema between anterior teeth [1, 3, 4]. The radiographic evaluation is done to confirm the involvement of palatal fractures using Water's view, basal view of skull, occlusal film, CT scans and conventional tomography [3].

The palatal vault fracture classification as proposed by Hendrikson et al. [5] classifies fractures of the palate into following six fracture types: I, anterior and posterolateral alveolar; II, sagittal; III, parasagittal; IV, para-alveolar; V, complex; and VI, transverse. Many modalities are used for management of various types of palatal fractures, among all intermaxillary fixation with or without intra-arch wire fixation is commonly used when indicated. Over-lapping of the loose fragments of palate or inadequate reduction is possible and therefore to prevent this transmucosal mini-plate fixation is advocated by some authors. It has been observed that transpalatal plate fixation increases stability after reduction, restores width and depth of palatal platform, and limits the rotation and disinclination of palatoalveolar segments [2].

In the presented study the stabilization of sagittal or parasagittal fractures of the palate was done using two hole 2.0 mm miniplate secured with $2 \text{ mm} \times 8 \text{ mm}$ screws. The occlusion pre and post operatively was evaluated and compared. The occlusion was deranged in none of the patients (out of 8) in group B in the post operative period, whereas 4 patients required interception for the correction of occlusion postoperatively in group A where only intra-arch wire was used for stabilization. There was no post-operative complication like necrosis, inflammation or resorption of bone around the fixation screws after 6 weeks at the site of trans-mucosal plate fixation (Fig. 8).

In a study undertaken by Pollock RA, on miniplate fixation in sagittal type of palatal fracture and removal after 8–12 weeks of repair, it was concluded that there was adequate healing with satisfactory post-operative occlusion [2].

Cienfuegos et al. through their study on 45 patients of palatal fracture and its management by transmucosal 2.0 mm locking plate fixation demonstrated stability and

Fig. 6 Post operative occlusion after 8 weeks on **a** right side and **b** left side

Fig. 7 Patients requiring postoperative intervention for occlusal correction in group A and group B

Fig. 8 Transmucosal miniplate site after plate removal showing healthy granulation

no complications like mucosal necrosis, bone exposure, fistulae or infections. In their study the plates were removed after 12 weeks after bone healing was confirmed by CT images. The stability of fractured segments was achieved with preservation of bone and mucosal blood supply [1]. In our study the plate removal was done at post-operative 6 weeks, with acceptable clinical results. Post operative imaging for confirmation of bone healing was not

undertaken where clinically acceptable out-come was obtained in the presented study as per the recommendations of the institutional ethics committee to prevent radiation exposure to the study patients.

Conclusion

On comparing both the techniques in our study, it can be concluded that trans-mucosal miniplate stabilization for sagittal or parasagittal fracture of palate is a more reliable method as compared to intra-arch wiring alone. The post-operative results obtained were also satisfactory with trans-mucosal stabilization with no complications and better patient compliance when compared to intra-arch wiring.

Compliance with Ethical Standards

Conflict of interest None.

Human and Animals Rights RAC approval obtained.

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