

Case Report

Application of Dahl concept on fractured teeth using direct composite resin restorations: A case report

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Abstract Traumatic dental injuries are frequent problems among teenagers, affecting aesthetics, functionality and quality of life. With regards to the present case, there was an inadequate restorative space for anterior restorations due to the dentoalveolar compensation two years after a traumatic event and was particularly challenging. The use of the Dahl concept to create restorative space is well documented particularly in patients with localized tooth wear. However, there are no evidence to justify the feasibility of Dahl concept application on the fractured teeth. The purpose of this article is to provide a detailed description regarding this technique to create the necessary restorative space of the fractured teeth.

Keywords: Dahl concept; dentoalveolar compensation; fractured teeth; restorative space.

Introduction

Traumas to the anterior teeth are common problems especially among children and adolescents and the prevalence of these injuries had increased over the past few decades (Bastone *et al.*, 2000). They were usually caused by sports activities or motor vehicle accidents and crown fractures were the most common type (Poi *et al.*, 2007). Treatment of dental trauma is complex which usually requires accurate diagnosis and comprehensive treatment plan. It is prudent to consider the biological, functional, aesthetic and economic aspects, as well as the patient's desire while offering the best treatment plan for the patients.

Fractured teeth often led to the loss of tooth structure which contributed to the short clinical crowns. Shortening of the clinical crowns due to the tooth structure loss can have significant restorative implications (Johansson *et al.*, 2008). Significant tooth structure loss may result in changes to the occlusal vertical dimension (OVD), possibly with an increased interocclusal space which later accompanied by over eruption of the affected teeth to fill up the space available if

the condition is left untreated (Davies *et al.*, 2002). Hence, inadequate space for restorations possess high clinical challenge to the dentists to carry out the necessary treatment.

Dahl *et al.* (1975) had introduced a technique where they created interocclusal space using a 'partial bite rising appliance'. The technique, known as Dahl concept, is based on the relative axial tooth movement that is observed when a localised appliance or localised restorations are placed in supra-occlusion. Such occlusion re-establishes the full arch contacts over a period of time. Dahl concept is a common treatment approach when an increase in the interocclusal space is required together with an increase in OVD. This technique offers several advantages in which the procedure is relatively safe, simple, and more conservative towards preservation of the tooth tissue with the most cost-effective manner.

The purpose of this article is to illustrate a case report regarding the management of inadequate restorative space due to dentoalveolar compensation after two years of untreated traumatic dental injury using the Dahl concept approach.

Case report

A 22-year-old gentleman was presented at the Universiti Teknologi MARA (UiTM) dental clinic with the chief complaint of anxiety over his appearance due to a fractured maxillary anterior teeth two years prior which had severely affecting his quality of life. He requested for aesthetic restorations of his fractured teeth but also raised his concern regarding the financial constraint that might limit the treatment options for him. The patient's medical, dental, social and family history was unremarkable.



Fig. 1 Pre-operative photo of the fractured teeth from 12-22. a) Smiling view. b) Labial view.

Extra-oral examination revealed that there was no abnormalities and he has average smile lines (Tjan *et al.*, 1984) (Fig. 1a). Intraoral examination revealed uncomplicated crown fracture of all the maxillary incisors (tooth 12 to 22). Tooth 11 and 12 (labial) also presented with defective tooth colour restorations (Fig. 1b). Pulp tests including cold and electrical pulp test showed positive response. Periapical radiographs were taken and showed no periapical radiolucency (Fig. 2). From the clinical assessment and special investigations, the following diagnoses were made: reversible pulpitis and normal apical tissues for all of the maxillary incisors. Occlusal analysis showed

that there was inadequate restorative space with the sign of dento-alveolar compensation between the maxillary and mandibular anterior segment (Fig. 3). Posterior teeth were all presented in good condition and in contact during the intercuspal position (ICP) (Fig. 4).

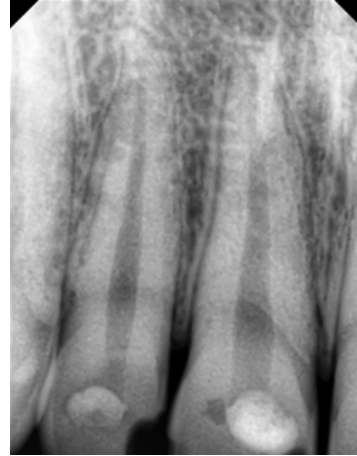


Fig. 2 Periapical radiograph of the fractured teeth revealed normal periapical tissues with healthy periodontal structure.



Fig. 3 Anterior teeth during ICP showing inadequate restorative space with the sign of dentoalveolar compensation.

During the treatment planning stage, study casts were fabricated and mounted on an arcon, semi-adjustable articulator (Denar® Mark II system; Water Pik, Inc.) using facebow transfer (Denar® Slidematic Facebow; Water Pik, Inc.). Interocclusal record was taken in centric relation (CR). Diagnostic wax-up (Fig. 5) at an increased OVD of 2 mm was performed and followed by the diagnostic try-in using temporization material (Protemp™ Plus, 3M ESPE) (Fig. 6). Mock up trial was important to evaluate aesthetics and the patient's acceptance of the treatment outcome.



Fig. 4 Right(a) and left(b) buccal view showing posterior teeth in contact during ICP.



Fig. 5 Diagnostic wax-up was done on all maxillary anterior teeth at an increased OVD.



Fig. 6 Mock up trial following the diagnostic wax up.



Fig. 7 Post-operative photos in (a) smiling view and (b) labial view.



Fig. 8 Right (a) and left (b) buccal view after the restorations. It was noted that the posterior teeth were not in contact during occlusion.

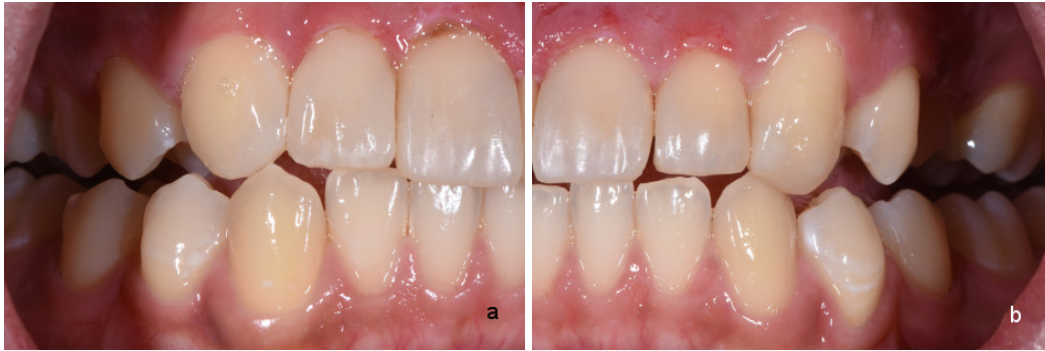


Fig. 9 Right (a) and left (b) canine guidance on lateral movement.

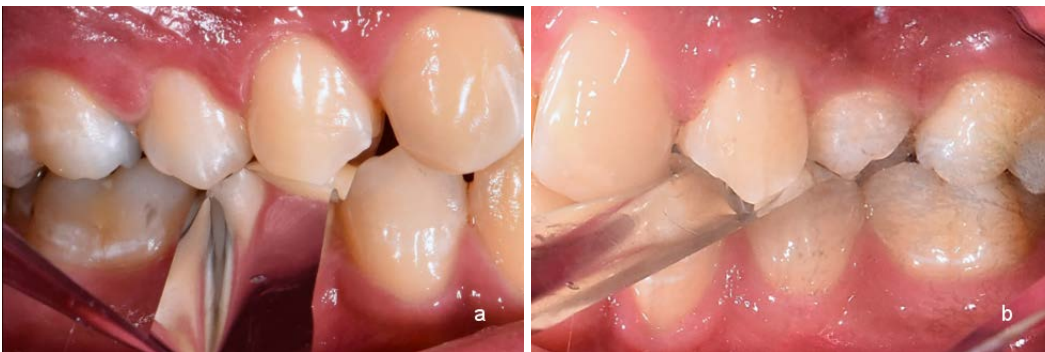


Fig. 10 Right (a) and left (b) buccal view at 3 months follow-up visit. Re-establishment of the posterior teeth contact was achieved.

All of the maxillary anterior teeth were restored using composite resin restorations at an increased OVD, in centric relation (CR) (Fig. 7). Direct composite (ceram.x® one, Denstply Sirona, USA) restorative technique was done on all the maxillary anterior teeth following the diagnostic wax-up with the help of silicone index (Elite HD+, Zhermack, Italy). Standard protocol of rubber dam isolation was used throughout the procedure. Dahl principle was applied in the present case where all the maxillary anterior teeth were restored high in occlusion (Fig. 8) and later the posterior tooth contacts was achieved by a passive eruption of posterior teeth and intrusion on anterior teeth in CR. Stable occlusal relationship need to be achieved after the restorations. Canine guidance and share anterior guidance were prescribed to the patient (Fig. 9). This is an important aspect to ensure the harmony of the occlusion during the jaw movement and to protect the restorations from fracture. At the same time, advice was given to the patient concerning the possible discomfort and difficulty in chewing that may appear temporarily after the treatment due to the

increased OVD by composite resin restorations limited to the anterior teeth only. During this treatment period, no occlusal splint was prescribed to allow passive eruption of posterior teeth and intrusion on anterior teeth happened. However, patient has been advised to follow soft diet.

During the follow-up, 3 months later, the re-establishment of the posterior tooth contact was achieved. Shim stock hold in occlusion was evident (Fig. 10). The sensibility test of all maxillary anterior teeth also showed positive response. The patient claimed that he had adapted well to the new occlusion. He was really happy with his new appearance and claimed that his quality of life had significantly improved after the treatment.

Discussion

There was inadequate restorative space in the present case, due to the dentoalveolar compensation of the anterior teeth. There are several techniques that can be applied in order to gain the restorative space. Increasing the OVD using full mouth rehabilitation may give adequate restorative

space needed. However, it can be technically challenging and requiring long term high maintenance. On the other hand, preparation of the affected teeth for indirect restorations without changing the OVD might involve significant tooth structure removal for vital teeth and risk of root canal treatment (Saunders and Saunders, 1998; Lim, 2015). Therefore, management of the present case had been carefully planned and carried out using the minimally invasive approach known as Dahl concept. Previously, the application of the Dahl concept to create restorative space was well-documented and commonly applied to the tooth wear patients (Gough and Setchell, 1999; Redman *et al.*, 2003; Gulamali *et al.*, 2011).

The difficulty in the management of the present case was the inadequate interocclusal space for restorations due to the dento-alveolar compensation, two years after a traumatic event; of which the patient had not sought any treatment. The apparent lack of restorative space presented a dilemma for the dental clinicians, especially when the area is localised. The common approach is to conform to the existing occlusion and create the necessary interocclusal space by further reduction of the fractured teeth during tooth preparation for indirect restorations. However, employing this conventional prosthodontic approach could have severe adverse sequelae. Further reduction of the affected teeth might lead to a lack of axial height and cause insufficient retention and resistance form of the conventional crowns. Tooth preparation and the associated loss of coronal tissue could be detrimental to the pulp and contribute to the risk of elective endodontic treatment (Mehta *et al.*, 2012).

Another approach is to create the necessary space by reorganising the occlusion by means of an arbitrary increase of the OVD. A different variation involves reconstruction of the occlusion to a centric relation (CR). However, this can lead to restorations being placed on multiple unaffected teeth which can be considered as invasive and increase the complications of a long-term maintenance which will contribute to an expensive cost to the patient. Surgical technique such as crown lengthening procedures might increase the clinical crown height but unfortunately would introduce

surgical complications, high treatment cost and lengthen the treatment period (Poyser *et al.*, 2005).

There are certain criteria for case suitability in treating the patient using the Dahl approach (Saha and Summerwill, 2004). These include localized anterior tooth surface loss, good oral hygiene, good periodontal health and stable posterior support. In addition to that, the dento-alveolar compensation that was observed in this patient was similar to tooth wear cases, hence a conservative approach using Dahl concept was adopted to treat the present case (Gough and Setchell, 1999; Lim, 2015).

Consequently, relative axial tooth movement using Dahl concept was applied to the present case to create the necessary restorative space (Dahl and Krogstad, 1982). The principle involved behind this technique is the combination of intrusion of the mandibular anterior teeth in contact with the palatal composite resin build-up in maxillary anterior teeth and the passive eruption of the unopposed posterior teeth. Some mandibular repositioning might be involved in this principle (Redman *et al.*, 2003). Subsequently, the restorative space was created for definitive restorations later. Poyser *et al.* (2005) had reported posterior teeth that re-established contact over a period of about 4 to 9 months' time after Dahl concept application. However, it should be noted that the duration of treatment of the present case was 3 months.

The main concerns that could be faced after the Dahl concept application are the pulpal symptoms, periodontal problems, temporomandibular joint dysfunction symptoms and apical root resorption (Poyser *et al.*, 2005). However, no such complication was reported in the patient of the present case.

Conclusion

The present case report described a conservative and non-invasive method of achieving adequate restorative space with the application of the Dahl concept. To the best of our knowledge, there is a lack of evidence to support the feasibility of the application of the Dahl concept on the fractured teeth. However with the signs of dento-alveolar compensation, this technique

could be considered during treatment planning stage to create the necessary space for the restorations. Precisely planned restorative phases in the present case had contributed in achieving the optimum and aesthetics final treatment outcome with the least invasive approach.

Declaration

This work was previously presented as poster presentation at the 7th Malaysian Association for Prosthodontics (MAP) Annual Scientific Conference, held 6th-8th October 2017, in Balai Ungku Aziz, Faculty of Dentistry of University Malaya, Kuala Lumpur.

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