CASE REPORT

Fabrication of maxillary single complete denture in a patient with deranged mandibular occlusal plane: A case report

Kam Wah Foong, Pravinkumar G. Patil *

School of Dentistry, International Medical University, Kuala Lumpur, Malaysia

Received 4 July 2017; revised 16 October 2018; accepted 28 October 2018
Available online 12 November 2018

Abstract Construction of a single complete denture (SCD) is a challenging clinical situation especially when the opposing natural dentition is not in a normal plane of occlusion. Mal-aligned, tilted or supra-erupted teeth in the opposing arch are some of the problems that should be corrected to achieve a balanced occlusion in patients who require SCD. Achieving harmonious occlusal plane is a primary objective of any restorative procedure to facilitate natural mandibular movements and ease of mastication. Establishment of normal occlusal plane in opposite arch is pre-requisite to maintain the stability of the SCD. This clinical report describes restoration of mandibular teeth (with severe attrition and deranged occlusion) by establishing normal plane of occlusion with the help of custom made occlusal plane template (OPT) followed by construction of a complete denture in maxillary arch.

© 2018 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Single complete denture (SCD) is a challenging clinical situation especially when the opposing natural dentition is not in a normal plane of occlusion (Winkler, 1994). Mal-aligned, tilted or supra-erupted teeth in the opposing arch are some of the problems that should be corrected to achieve a balanced occlusion in patients who require SCD (Winkler, 1994). Balanced occlusion is bilateral, simultaneous, anterior, and posterior occlusal contact of teeth in centric and eccentric positions (2005). It is developed to improve the stability of the dentures during all functional and/or parafunctional movements of the mandible (French, 1954; Kurth, 1954; Ortman, 1971; Patil and Parkhedkar, 2009). Lack of occlusal balance may cause a variety of denture related problems including instability, mucosal inflammation, soreness, bone resorption and ultimately leading to patient’s dissatisfaction (Patil and Park hedkar, 2009). Establishment of a normal occlusal plane in the opposite arch is a pre-requisite for developing a balanced occlusion in SCD. An uneven occlusal plane is a common clinical situation in the natural dentition and it may occur due to one or more factors such as improper eruption,
improper shape and position or attrition and abrasion of teeth. Achieving a normal occlusal plane is the primary objective of any restorative procedure to facilitate natural mandibular movements and ease of mastication. The plane of occlusion is actually a curve that is formed by the occlusal and incisal surfaces of the teeth (Glossary, 2005; Patil and Parkhedkar, 2009). Curve of Monson is a combination of anteroposterior curve of Spee and the mediolateral curve of Wilson (Glossary, 2005; Dawson, 1989). Curve of Monson helps to achieve a proposed ideal curve of occlusion in which each cusp and incisal edge touches or conforms to a segment of the surface of a sphere, 8 in. in diameter with its center in the region of the glabella (Glossary, 2005; Dawson, 1989; Monson, 1920, 1922). Based on the curve of Monson, there are various tools and methods that have been described in the literature to evaluate and correct the occlusal plane namely Broderick’s occlusal plane analyzer (BOPA) (Small, 2005; Bedia et al., 2007), Yurkstas metal occlusal template (Yurkstas, 1968; Sharry, 1974) and custom made occlusal plane template (Muley et al., 2014). Though use of the BOPA is widely described in the literature, it requires special holding devices to make it compatible with different articulators (Bedia et al., 2007). Furthermore, metal templates such as the Yurkstas template, cannot be adjusted according to different jaw sizes and may not fit intraorally in relatively smaller or asymmetric arches (Muley et al., 2014). Transparent occlusal plane template (OPT) made of vacuum formed polymer material has been described by Muley et al where it can be adjusted according to various jaw sizes and shapes for direct intraoral evaluation and being a transparent material, it facilitates easy examination (Muley et al., 2014). This clinical report aims to describe restoration of mandibular teeth (with severe attrition and deranged occlusion) by establishing normal plane of occlusion with the help of custom made OPT followed by construction of a SCD in the maxillary arch.

2. Case report and technique

2.1. Patient details

A 73-year-old female patient presented in March 2017 with a concern of missing upper teeth and reduced height of lower teeth. The medical history of the patient revealed that she is on medication for hypertension and hypercholesterolemia for past 10 years, and these conditions have been under control. Patient recently had her remaining maxillary anterior teeth extracted due to caries while her maxillary posterior teeth were lost many years ago due to caries and periodontal problems. Intra-oral examination revealed a completely edentulous maxillary arch and a partially edentulous mandibular arch. The maxillary edentulous ridge revealed recent extraction sockets with sutures in place (Figs. 1A and 1B). There were no significant surface irregularities or undercuts. On the mandibular arch, all teeth were present except for 38, 45, 47 and 48 (Fig. 1C). There were multiple amalgam restorations on the posterior teeth and severe attrition on the anterior teeth (Figs. 1A–1C). A sinus tract was noted buccally and lingually adjacent to tooth 41. Generalized attrition was noted in mandibular anterior teeth from 33 to 43. Intraoral periapical radiographs were taken for sinus tracing, overview of the root canal treatment planning, periodontal evaluation and to check for any other radiographic findings. Pulp sensitivity test was done, and several teeth were found to be non-vital. Severe attrition of the mandibular anterior teeth resulted in an irregular occlusal plane, and that could have consequently caused unfavorable force distribution to the maxillary complete denture. Patient was classified according to the Prosthodontic
Diagnostic Index Classification as Class III on the basis of treatment difficulty level.

Various treatment options were discussed with patients including implant supported removable or fixed restoration in upper and lower arch, removable partial denture in mandibular arch along with endodontic treatment of badly broken down anterior teeth further treated either by restoring with composite resin or providing esthetic crowns with crown lengthening procedure, or mandibular complete overdenture following endodontic treatment and overdenture abutment preparation with badly broken down anterior teeth. Upper conventional complete denture was the alternate option apart from implant supported prosthesis. Due to financial constraints, patient agreed to proceed with the treatment that does not include implant placement of metal ceramic crowns. The patient hence agreed for complete denture in maxillary arch and composite restorations following root canal treatments on the mandibular anterior teeth. Treatment of malposed, tipped, supraerupted teeth in the mandibular arch makes it difficult to achieve a harmonious balanced occlusion with the complete denture. The OPT was fabricated based on the guidelines given by Muley et al. (2014).

2.2. Technique to fabricate the OPT

A volleyball (Mikasa MVA310; Mikasa Sports) with a circumference of 65–67 cm and diameter of approximately 20.7 cm (8.1 in.) was procured. These dimensions were closely matching to the Monson’s sphere which has a diameter of 8 in. (Glossary, 2005; Monson, 1920, 1922). A single thickness modelling wax sheet was made into a circle to prepare a wax-box of approximately 10 cm in diameter and type III gypsum dental stone (Dental Stone; Pro Dental) was poured into it as described by Muley et al. (2014). After the stone was set, the surface irregularities were smoothened with a thin slurry of the dental stone without changing its original curvature. The concave stone-form was then trimmed to appropriate size to ensure that it fits easily into the vacuum former machine (Ministar; Scheu Dental Technology). A 1.5 mm thick, hard, thermoplastic sheet (Duran; Scheu Dental Technology) was used to adapt onto the stone-form in the machine to fabricate the OPT. After cooling, the occlusal template was removed from the vacuum former and trimmed into a horseshoe shape of suitable size to fit the average dental arch (see Figs. 2A and 2B).

2.3. Use of the OPT

To evaluate and correct the occlusal plane with composite restorations, the OPT was placed on the primary cast and interfering cusps and amount of reduction required were identified. Since the amount of reduction needed was minimal and within the enamel, selective grinding procedure was carried out. Before the mock-grinding procedure, the 4 points were identified namely disto-buccal cusp-tips of 36 and 46 and the cusp-tips of 33 and 43. A thin layer of a quick setting adhesive glue was applied on these 4 cusps to protect them from accidental wearing off during grinding procedure as these 4 points were the part of the Monson’s sphere. The step by step mock grinding was performed on the primary cast with the help of the OPT by alternately keeping it onto the cast and trimming premature contacts with the sandpaper until the OPT touches the 4 identified teeth cusp-tips (Fig. 3A). These areas to be modified were identified on the cast. In the missing areas of 45, the edentulous space was measured to be only 3 mm mesio-distally and was left untreated due to insufficient space for replacement of the premolar and patient was not keen to undergo fixed restorative procedure in that area.

2.4. Refinement of occlusion

Since the mandibular anterior teeth were severely attrited, they needed to be built up with composite resin to maintain the normal occlusal plane. Once the premature contacts were ground-off, the incisal edges of the mandibular anteriors were built-up with inlay casting wax (Mighty Wax Hard; Shofu Inc.) with the OPT as a guide to create the occlusal plane (Fig. 3B). Putty impression (Exaflex; GC Corp.) of the wax-up was taken and cusps which require selective grinding were marked on the cast (Fig. 4A). Interfering cusps on teeth 37, 36, 44 and 46 were trimmed gradually and constantly checking with occlusal template placed intraorally. Putty guide was placed lingually as shown in Figs. 4B and 4C. Teeth to be restored with the composite were beveled to allow more surface area for bonding.

---

Fig. 2A  Fabrication of stone-form with copying curvature of volleyball.

Fig. 2B  Stone-form in thermoplastic vacuum formed machine to adapt template.
and for better aesthetics. Teeth were isolated with cotton rolls and suctioning devices. The flowable frame technique (Koirala, 2015) and composite layering technique was used to restore teeth 35, 34, 33, 32, 31, 41, 42, and 43. At the same time, non-carious cervical lesions (NCCLs) on teeth 36, 35, 34, 32, 31, 41, 42, and 44 were restored with flowable composite (Shofu Beautifil Flow Plus; Shofu Inc.). The OPT was placed intra-orally and any interfering cusps or incisal edges were visualized and trimmed accordingly (Fig. 5A). All restored teeth were occlusally refined using fine grit diamond point inclined lingually as shown in Fig. 5B until the OPT touches

and for better aesthetics. Teeth were isolated with cotton rolls and suctioning devices. The flowable frame technique (Koirala, 2015) and composite layering technique was used to restore teeth 35, 34, 33, 32, 31, 41, 42, and 43. At the same time, non-carious cervical lesions (NCCLs) on teeth 36, 35, 34, 32, 31, 41, 42, and 44 were restored with flowable composite
to almost all cusp tips and incisal edges. Composite restorations were then finished and polished and fluoride varnish was applied on the posterior teeth. Mandibular anterior teeth were splinted. An impression of the mandibular arch was taken after all adjustments have been done for the fabrication of the maxillary complete denture.

2.5. Fabrication of maxillary denture

Maxillary primary impression, final impression, maxillomandibular relationship records (Fig. 6), teeth arrangement and try in was carried out in a conventional manner. Denture was then processed, finished and polished. Occlusal refinement of denture was again carried out on the articulator before the denture issue appointment. A harmonious balanced occlusion was achieved (Fig. 7). The maxillary complete denture was then issued and patient is recalled at suitable time for review. The patient was pleased with her function and aesthetics being restored (Figs. 8A and 8B).

3. Discussion

The maxillary complete denture was fabricated following the maxillomandibular relationship record in conventional manner where the vertical dimension of occlusion was reestablished. Maxillary single complete denture was fabricated using heat polymerized acrylic resin with acrylic teeth to minimize the occlusal stresses on the mandibular incisal composite restorations. The presented clinical case situation might have worsened to develop a combination syndrome if it would not have been treated on time (Tolstunov, 2007). The combination syndrome is a dental condition that is commonly seen in patients with a completely edentulous maxilla and partially edentulous mandible with preserved anterior teeth (Tolstunov, 2007). However, in the case presented, there was no severe resorption of the anterior maxillary alveolar bone or posterior mandibular arch. Though the case presented with severe attrition of the anterior teeth, the loss of vertical dimension was observed to be not clinically significant.

A SCD opposing the natural dentition is a challenging clinical situation. The opposing natural dentition may exist situations like partial edentulism, attrition, drifting or supra-eruption of teeth. To achieve better stability of the SCD, the occlusal plane in the opposite partially edentulous or fully dentulous arch needs to be developed to be in a harmonious occlusal plane so that a balanced occlusion can be achieved to maintain good bilateral stability of the SCD. This is because the lack of occlusal balance usually results in several clinical problems such as denture instability, mucosal soreness
and accelerated ridge resorption. The goal of achieving harmonious occlusal plane gets complicated if the dentition has been weakened by periodontal condition or has extensive carious lesion. This clinical report demonstrates the effective management of severe attrition problem in the mandibular arch with drifting and mild supra eruption of posterior teeth. Composite restorations were carried out to restore attrited teeth due to opposing SCD with relatively lower occlusal forces (Fontijn-Tekamp et al., 2000; Michael et al., 1990). The biting strength of denture wearers is about one fifth to one fourth the bite strength and masticatory force of natural dentition subjects and hence leads to decreased occlusal forces on the opposing dentition (Fontijn-Tekamp et al., 2000; Michael et al., 1990). Reestablishment of normal occlusal plane in opposite arch is pre-requisite to maintain the stability of the SCD (Winkler, 1994). The tools or techniques namely Broderick occlusal plane analyzer, Yurkstas metal occlusal template and the OPT have satisfactorily been used in clinical practice to restore such clinical situations (Small, 2005; Bedia et al., 2007; Yurkstas, 1968; Sharry, 1974; Muley et al., 2014).

This article also described the composite layering technique for bulk composite restorations with the help of the OPT. Beveling of the attrited teeth before composite restorations results in a less obvious restoration margin as there is a gradual increase in composite material at the margins. Composite layering technique allows the restored teeth to look more natural and life-like as it is based on the anatomic and optical characteristic of the natural teeth. By using composite material of various shades, it mimics the natural darker and opaque dentin shade and lighter and translucent enamel shade. The longevity of direct composite restorations in anterior region involving the incisal edges is considered to be one of the concern. Providing esthetic crowns like metal-ceramics along with esthetic crown lengthening would be preferred for the longevity of the crowns in such situations.

In this report, the restoration of mandibular teeth were carried out by establishing normal plane of occlusion with the help of the custom made OPT followed by construction of a complete denture in maxillary arch. The custom made OPT is useful in diagnosing the occlusal irregularities, during mock preparation of the diagnostic casts as well as for performing occlusal refinement.

4. Conclusion

The use of OPT aids the clinician in the development of a harmonious occlusal plane from a deranged one. The OPT can be used during pre-treatment and planning stages on a stone-cast as well as used during treatment directly intra-orally. The techniques of fabrication of the OPT described in this article results in a quick, easy, adjustable and very cost-effective way to fabricate an OPT. Furthermore, the OPT fabricated is made of a transparent material which allows better visualization of progress during planning and treatment phases.

Conflict of interest

The authors declared that there is no conflict of interest.

References

Bedia, S.V., Dange, S.P., Khalikar, A.N., 2007. Determination of the occlusal plane using a custom-made occlusal plane analyzer: a clinical report. J. Prosthet. Dent. 98, 348–352.
Dawson, P.E., 1989. Evaluation Diagnosis and Treatment of Occlusal Problems. Elsevier, St Louis, pp. 373–381.
Fontijn-Tekamp, F.A., Slagter, A.P., Van Der Bilt, A., Van’t Hof, M. A., Witter, D.J., Kalk, W., et al, 2000. Biting and chewing in overdentures, full dentures, and natural dentitions. J. Dent. Res. 79, 1519–1524.
French, F.A., 1954. The problem of building satisfactory dentures. J. Prosthet. Dent. 4, 769–781.
Glossary, 2005. The glossary of prostodontic terms. J. Prosthet. Dent. 94, 10–92.
Koirala, S., 2015. Midline Diastema Closure with Direct-bonding Restorations. Dental Tribune International.
Kurth, L.E., 1954. Balanced occlusion. J. Prosthet. Dent. 4, 150–167.
Michael, C.G., Javid, N.S., Colaizzi, F.A., Gibbs, C.H., 1990. Biting strength and chewing forces in complete denture wearers. J. Prosthet. Dent. 63, 549–553.
Monson, G.S., 1920. Occlusion as applied to crown and bridgework. J. Nat. Dent. Assoc. 7, 399–417.
Monson, G.S., 1922. Some important factors which influence occlusion. J. Nat. Dent. Assoc. 9, 498–503.
Muley, B., Patil, P.G., Khalikar, A.N., 2014. A simple technique to fabricate custom made occlusal plane template. J. Indian Prosthodont. Soc. 14 (Suppl 1), 334–336.
Ortman, H.R., 1971. The role of occlusion in preservation and prevention in complete denture prosthodontics. J. Prosthet. Dent. 25, 121–138.
Patil, P.G., Parkhedkar, R.D., 2009. Functionally generated amalgam stops for single complete denture: a case report. Dent’ Res. J. 6, 51–54.
Sharry, J.J., 1974. Complete Denture Prosthodontics. McGraw-Hill, New York, pp. 313–314.

Small, B.W., 2005. Occlusal plane analysis using the Broderick flag. Gen. Dent. 53, 250–252.
Tolstunov, L., 2007. Combination syndrome: classification and case report. J. Oral. Implantol. 33, 139–151.
Winkler, S., 1994. Essentials of Complete Denture Prosthodontics. Ishiyaku Euroamerica, St. Louis.
Yurkstas, A.A., 1968. Single dentures. In: Sharry, J.J. (Ed.), Complete Denture Prosthodontics. second ed. McGraw-Hill, New York, p. 300.