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Modification of anterior guidance in patient with wear in mandibular anterior teeth: a case report

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Abstract

This case report describes how to establish the favorable anterior guidance in an anterior tooth wear patient. The anterior tooth wear is present at lower anterior teeth with an improper contour upper anterior fixed partial dental prosthesis (FPDP) 12-21. The FPDP was removed and replaced with a provisional cantilever FPDP. The favorable anterior guidance was established using a custom incisal guide table. Final restoration was placed. Periodic follow up evaluation is necessary.

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***Key words**: anterior guidance; custom incisal guide table; provisional FPDP*

Introduction

Tooth wear can be found in both anterior and posterior teeth. Clinicians often assume that tooth wear is a result of bruxism (teeth grinding), even though there are many other causes of tooth wear, such as attrition, acid erosion from food and beverages, bulimia, trauma and the patient's habits.[1] A thoroughly oral examination and history-taking should be performed to establish actual causes of tooth wear in order to give a correct diagnosis.[1]

Mandibular movements are limited by the temporomandibular joints (TMJs) and the joints' ligaments, the neuromuscular system, and the teeth. Posselt described mandibular movement by the limits dictated by anatomic structures, as viewed in a given plane which he called border movements.[2] All possible mandibular movements occur within these boundaries. Posterior and anterior determinants of mandibular movement are anatomic structures that dictate or limit the movements of the mandible. The posterior determinants of mandibular movement are the temporomandibular articulations and their associated structures. The posterior determinants cannot be controlled, and it is not possible to influent the neuromuscular responses of the patient unless it is done by indirect means such as the provision of an occlusal appliance. The anterior determinants are the vertical and horizontal overlaps and the maxillary lingual concavities of the anterior teeth which can be altered by restorative or orthodontic treatment.[3] Even though both determinants combine to affect mandibular movement, a correlation between them has not been established.[4,5]

Attrition of the anterior teeth may or may not induce temporomandibular disorder (TMD). Dawson found that pain and discomfort in the musculature, the teeth, and the region of TMJs are consistent with occlusal disease (attritional wear) with many years of his careful observation of thousand patients.[6] However, no previous studies have indicated a strong correlation between occlusion and TMD. Schierz *et al.*[7] found no association between anterior tooth wear and self reports of pain from TMD. Nevertheless unfavorable incisal guidance can be resulted from severe wear of anterior teeth. This may lead to abnormal functional movements of the condyles and contribute to abnormal stresses and movements which are potentially pathologic.[8] A change or modification of unfavorable incisal guidance may have a favorable influence upon the movement pattern of the condyles.[5]

The restorative dental materials have different wear properties compared to natural teeth which can change the wear rate of antagonist natural teeth[9]. Enamel wear caused by a restorative materials should not exceed normal enamel wear rate of about 20-40 μm per year.[10] Otherwise this can lead to an abnormal loading and occlusal destabilization.[11] Gold alloy has been considered the most ideal restorative material because it most resembles enamel in function and wear characteristics.[12-14] Many studies have shown that enamel wear when opposed by porcelain is greater than by gold restorative materials.[14-19] A mismatch of wear rates between teeth and restorations can result in more rapid expose of dentine. The selection of appropriate materials to minimize further wear on tooth and restoration is an important consideration during treatment planning.

Restoration of the anterior dentition is often challenging as not only a satisfactory esthetics achievement but also proper function attained. Establishing proper anterior guidance in a provisional restoration or in an existing dentition is paramount before placing the definitive fixed prosthesis.[20,21] This clinical case report describes a method of achieving both function and esthetics of a maxillary FPDP.

Clinical case report

A 56 years old female came to the Esthetics Restoration and Implant Dentistry Clinic, at Chulalongkorn University. Her chief complaint was of asking for implant placement of the edentulous area of tooth 26. After the treatment of implant 26 was finished, she complained that she had experienced severe tooth wear of her lower anterior teeth after receiving a fixed partial dental prosthesis (FPDP) from tooth 12 to tooth 21 four years previously. She reported about clenching teeth at night while she was sleeping and had uncomfortable feeling of left and right TMJs. A thorough oral examination was performed and replacement of the anterior prosthesis restoration was planned.

The fixed prosthesis for teeth 12 to 21 was a cantilever FPDP with abutments on teeth 11 and 21. The labial margin of tooth 11 was observed to have gingival recession (Fig. 1). There are many causes of gingival recession. Excessive functional stress from occlusion may also initiate inflammatory change in the periodontium.[22] The lower anterior teeth had a sign of attrition. When the tooth wear on labio-incisal surfaces of lower incisors is evidenced, it maybe a sign of improperly contoured of upper lingual restorations.[23] The lingual aspect of the FPDP was considered as improperly contoured (Fig. 2) from the evidence of attrition of lower anterior teeth. (Fig. 3). The patient described an uncomfortable feeling of TMJs both left and right in the morning after waking up. A palpation test was performed with no sign of pain in the masticatory muscles. TMJs sounds such as clicking

Fig. 1 Front view photograph of the previous FPDP

Fig. 2 Picture of improper contoured of FPDP

Fig. 3 Lower anterior teeth at first visit

and popping were not noted. The maximum mouth opening was 45 mm. Posterior teeth showed neither sign of tooth wear nor any interference. Fig. 4 showed the occlusion of previous FPDP. Occlusion on the right side was classified as class II on both molar and canine (Fig. 4c), while the occlusion on the left side was class II on canine (Fig. 4d). Excursive movement showed mutually protected occlusion (Fig. 4). Overbite and overjet were 9 and 1 mm, respectively. The facial midline was coincided with the maxillary FPDP midline. The mandibular dental midline was 2 mm to the right of maxillary FPDP midline. Periapical radiographs showed normal periapical area of both tooth 11 and 21. Tooth 11 was endodontically treated with metal post while tooth 21 was a vital tooth (Fig. 5).

Deep anterior overbite is not itself a problem and should not be considered problems as long as there are definite stops to prevent supraeruption of lower anterior teeth.[24] Analysis of every patient with deep overbite should begin with observing the relationship of lower incisal edges to determine, if they meet a stable holding contact on the upper anterior teeth. When the unfavorable incisal guidance is detected, the first treatment option is to reshape the lingual of upper teeth or upper restoration to provide a stable holding contact with the lower anterior teeth. The second option is repositioning of upper incisors, if they have been wedged forward. The third option is to restore the teeth after an acceptable alignment by reshaping and repositioning is attained. Then the teeth are prepared and provisional restorations are used to refine the anterior guidance and esthetic concerns.[24]

Since the gingival recession and opened margin of abutment tooth 11 was observed, the replacement of new FPDP from tooth 12 to 21 was included in the treatment plan. The maxillary anterior FPDP was chosen to be removed instead of reshaping of lingual contour of upper FPDP. Furthermore, the intraoral reshaping of FPDP might cause rough surfaces that would abrade the lower anterior teeth. On the other hand, the acrylic resin temporization can be smoother polished, is gentle to opposing teeth, and is easier to modify and clinically adjust.

The treatment plan for this case started with restoring worn lower anterior teeth back to their normal contour using composite resin, removing upper FPDP and replace immediately with the first provisional made by acrylic resin as for reducing muscle stress. After a period of time, the second esthetic provisional FPDP is made using acrylic resin and esthetically veneering with composite resin. The lingual contour of second provisional is adjusted to provide a stable holding contact with lower anterior teeth, group function in straight protrusion, and group function on lateral excursion.

Fig. 4 show occlusion of previous FPDP, **4a**) Protrusive excursion; **4b**) Frontal view; **4c**) Centric occlusion on right side; **4d**) Centric occlusion on left side; **4e**) Working excursion on right side: canine guidance; **4f**) Balancing excursion on right side; **4g**) Working excursion on left side: canine guidance; **4h**) Balancing excursion on left side

Fig. 5 Periapical radiographic at first visit

The anterior guidance is highly variable from patient to patient. There are no arbitrary guidelines to standardize anterior guidance.[25] So, the presence of a stable holding contact between lingual upper restoration and the lower anterior teeth and the patient comfort and the absence of lower anterior attrition were used to determine if the anterior guidance is favorable in this case.[24,25]

Worn lower anterior teeth were restored to their normal contours using composite resin restoration. Then the upper FPDP was removed. The abutments for teeth 11 and 21 were prepared and the buccal margins of restorations were placed 1 mm subgingivally. The immediate provisional cantilever FPDP was made using acrylic resin (Temphase A3.5, Kerr, Orange CA, USA), then veneering with composite resin. This first provisional restoration was made in order to reduce the stress on the masticatory muscles by reducing the lingual contour compare to the previous FPDP. This provisional was used for 1 month. Patient reported no muscle discomfort.

Then the upper arch with provisional restoration and lower arch impressions were made. The dental casts were poured using type IV dental stone. An interocclusal record was made by taking a protrusive wax bite (Fig. 6). Dental stone models were mounted on a semi-adjustable articulator (Artex®, Amann Girrbach, Pforzheim, Germany) using protrusive wax bite and facebow registration. A thin sheet of cast protector was applied to the occlusal surfaces of dental casts (Figs. 6-8). The condylar guidance was set according to the protrusive wax bite. The articulator's standard incisal guide table was lubricated with petroleum jelly to prevent adherence of the resin. A custom incisal guide table (Fig. 9) was fabricated using pattern resin (GC Corp, Tokyo, Japan). The resin was mixed, molded and placed on the incisal guide table and the incisal pin was locked firmly in position. The articulator was moved anteriorly and laterally in protrusive and lateral excursions. The pin was moved in every possible position within border movements until the resin was polymerized (Fig. 10). The impressions of abutment teeth 11 and 21 were poured using modeling stone (Vel Mix, Kerr, USA) and then remounted on the articulator. A second provisional FPDP was created using acrylic resin. Incisal guidance of the provisional FPDP was adjusted using the custom incisal guide table. Composite resin was used to veneer the front surface of the provisional FPDP to achieve an esthetic result. The pontic area of tooth 12 was an ovate pontic design. The gingival thickness over the alveolar ridge

at the pontic area was around 3 mm. A round diamond bur was used to sculpt the gingival tissue to create an ovate pontic (Fig. 11). Composite resin was added to the tissue side of the pontic area. The provisional FPDP was cemented with temporary cement (TempBond NE, Kerr, USA) on tooth 11 and TempBond clear (Kerr) on tooth 21. (Fig. 12) The patient returned every week for 4 months for evaluation. The anterior guidance was adjusted as necessary as for establishing a stable holding contact, group function in straight protrusion, and group function in lateral excursion. A minimally amount of composite resin was added to the tissue site of pontic. The patient felt no muscle or TMJs discomfort.

Fig. 6 Protrusive wax bite registration

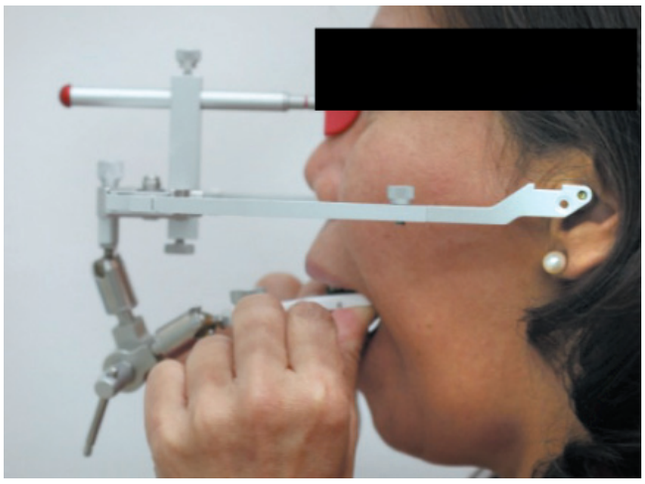

Fig. 7 Face-bow registration

Fig. 8 Articulator and custom incisal guidance

Fig. 9 The custom incisal guidance was made using GC pattern resin.

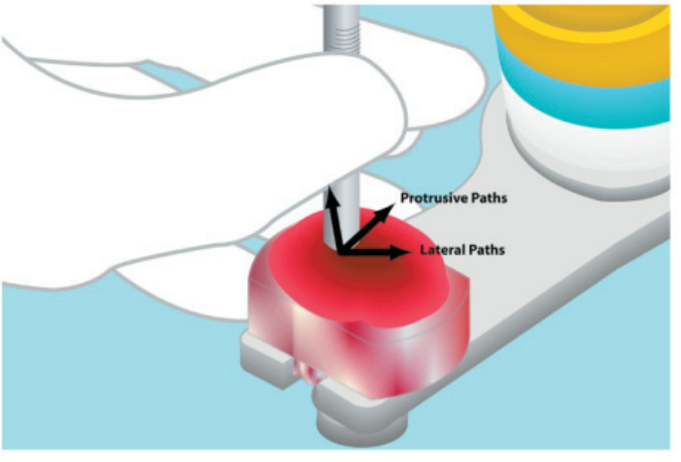

Fig. 10 demonstrates fabrication of custom incisal guidance.

Fig. 11 Occlusal view of soft tissue at ovate pontic area.

Fig. 12 The provisional restoration.

Polyvinylsiloxane was used for making final impression (Flexitime®, Heraeus, Hanau, Germany) and interocclusal record (Occlufast, Zhermack, Rome, Italy). was made. A wax pattern of the metal substructure was made. Then the full contour wax pattern of FPDP (Fig. 13) was checked to see if the lingual contour was duplicated properly using disclosing powder (Fig. 14). The cut-back of the wax pattern was also checked for proper lingual contour. The hi-noble metal substructure was cast and the lingual contour was again checked using disclosing paper (Fig. 15). The thickness of the labial aspect of the metal substructure was adjusted to 0.3-0.4 mm thickness in order to obtain an esthetic result. The metal substructure was tried on the abutment teeth. Radiographic was used to check for marginal fitness (Fig. 16). The final cantilever FPDP was then fabricated using Vita classical A3.5 shade at cervical 1/3 and using Vita A3 elsewhere. Occlusion was checked and adjusted (Fig. 17). Fig. 18 showed occlusion of final FPDP. The marginal fit was confirmed by radiography (Fig. 19). The restoration (Fig. 20) was cemented with TempBond and left in place for 1 month. Then the patient was called back in to check on the function and anterior guidance of the FPDP. There were no sign of muscle or TMJs discomfort. The restorations of the lower anterior

teeth show no wear (Fig. 21) and the patient was very satisfied. Then the FPDP was removed and cemented with self adhesive resin cement (Rely-XTM Unicem, 3M, ESPE, St. Paul MN, USA). Excess cement was removed and a radiographic examination of the FPDP was performed.

The patient returned for a follow up evaluation at 1 month (Fig. 22) and then periodically every 6 months.

Fig. 13 Full-contour wax pattern.

Fig. 14 Anterior guidance was checked with disclosing powder.

Fig. 15 Anterior guidance was checked with disclosing paper.

Fig. 16 Periapical radiography of frame work try in.

Fig. 17 Anterior guidance was checked at insertion visit.

Fig. 18 Occlusion of final FPDP, **18a**) Final restoration in centric occlusion; **18b**) Final restoration in protrusive excursion; **18c**) Centric occlusion on right side; **18d**) Centric occlusion on left side; **18e**) Working excursion on right side: canine guidance; **18f**) Balancing excursion on right side; **18g**) Working excursion on left side: canine guidance; **18h**) Balancing excursion on left side

Fig. 19 Periapical radiography of final prosthesis

Fig. 20 Final restoration at insertion visit

Fig. 21 Restored lower anterior teeth

Fig. 22 Patient's smile after final restoration

Discussion

In many cases of tooth wear, the vertical dimension of occlusion (VDO) is maintained by tooth eruption and alveolar bone growth. As teeth are worn, the alveolar bone undergoes an adaptive process and compensates for the loss of tooth structure to maintain the VDO. Therefore, VDO should be conservative and should not be changed without a careful approach.[23,26] In the present case, there was no loss of VDO and the room for restoration was enough, so it was decided that the vertical dimension should not to be changed.

A cantilever FPDP is FPDP that one side of the pontic is attached to a retainer. Cantilever FPDP have remained popular because some of the difficulties encountered in making three unit FPDPs are lessened. Also many clinicians are reluctant to prepare an intact tooth to be used as an abutment. Cheung et al. (1990) found that the long-term prognosis of a single-abutment cantilever is poor[27] as forces are best tolerated by the periodontal supporting structures when directed in the long axes of the teeth.[28] However, multiple-abutment teeth can resist harmful tipping forces, and movement of the abutments is less likely.[3] Furthermore, the overall root surface area of multiple-abutment teeth are usually greater than that of the replaced tooth and thus biomechanically favorable.[29] Properly treated endodontically treated tooth also has been shown to serve well as an abutment with post and core foundation for retention and strength.[3] It is not necessary to prepare more abutment tooth if the splinted teeth 11 and 21 were used as abutment. This would also provide better prognosis compare to a single-abutment cantilever.[3,29]

The previous cantilever FPDP used teeth 11 and 21 as abutment teeth which can be done if tooth 21 had a condition that need to be restored. However the favorable anterior guidance of the previous FPDP might not be attained, which lead to the attrition wear of opposing natural teeth within 4 years in service.

The material of choice in the anterior region can be all ceramic which will provide a pleasing appearance in terms of light transmission and reflectivity. However, in this case, the lingual space of the FPDP was limited, so porcelain fused to a high noble metal was chosen instead. Many studies show that the 0.3-0.5 mm thickness of metal coping is strong enough.[30,31] Nevertheless, the thickness of the metal coping obtained from a dental technician usually is more than 0.5 mm and sometimes it might almost 1 mm. So, the thickness of the labial metal substructure must be checked and controlled by the dentist as it should not be thicker than 0.5 mm in order to achieve

an esthetic result with adequate strength. In this case report, the thickness of the metal substructure at the labial area was controlled to be 0.3-0.4 mm. The porcelain labial margin was planned for this case, because it will diminish the opacity typical for metal ceramic margin and create more natural blend with the adjacent root structure.[32] The lingual design of restoration is three-quarters metal. The cast gold alloy would provoke less abrade to the opposing teeth comparing to porcelain.[14-19]

An ovate pontic design is the most esthetically appealing pontic design. Its convex tissue surface resides in a soft tissue depression or hollow in the residual ridge, which makes it appear, that a tooth is literally emerging from the gingiva.[3] The convex design of this pontic has been recommended to fulfill esthetic, functional, and hygienic demands.[33,34] Orsini *et al.* concluded that a provisional FPD with an ovate-shaped pontic made of low fusing ceramic may be beneficial during the interim phase of treatment.[35] The advantage of an ovate pontic is not only a pleasing appearance but also its strength. Its recessed form is not susceptible to food impaction. The broad convex geometry is stronger than of a modified ridge lap pontic, because the unsupported, thin porcelain that often exists at the gingivofacial extent of the pontic is eliminated. However, additional evaluation appointments are necessary for minimally add up a material on to the tissue side of pontic to get the convex shape.[3]

Establishing proper anterior guidance in provisional restoration or in an existing dentition is paramount before placing the definitive fixed prosthesis.[20,21] Some clinicians may overlook the importance of establishing anterior guidance, which is essential for successful treatment. There are several ways to customize the incisal guide table to accurately duplicate the lingual contour of anterior maxillary restoration.[36-39] In this case, GC resin was used due to its availability in the clinic and its easily handling.

Flat incisal guide tables found on many semi-adjustable articulators may not satisfactorily reflect the necessary position, anatomic contours, and desired incisal edge length of the anterior teeth required for extensive reconstructive restoration.[40] Fabrication of a custom incisal guide table is recommended as an aid to more accurate reproduction of incisal guidance.[41,42] The custom incisal guide table is used on an articulator to produce a physiologically acceptable anterior guidance. It facilitates communication with the dental laboratory technician to provide proper occlusion along with changes of the anterior lingual contours or incisal lengths. Properly used in a clinical setting, this can minimize chair time and insertion adjustments.[43]

According to the literature, the wearing time of a provisional crown varies. The trial period of overlay prostheses which are reversible and conservative is between 3 weeks and 5 months, and that of intensive fixed provisional prostheses is 2 to 6 months.[44-48] In this case, the patient was carefully monitored to evaluate the adaptation to the provisional for more than 3 months. That trial period may be shorter than in other case reports, however the patient showed no discomfort, wear or muscle fatigue.

In the past, there was less emphasis on the relationship between function and esthetics. Most dental treatments might concentrate on function only. However, nowadays esthetic dentistry is a primary concern. Patients care more about the appearance of their face, body and also their teeth. Providing esthetics by favorable anterior guidance is the key to long-term occlusal stability, which will lead to the success of the case.

Conclusion

This clinical case report described how to reestablish favorable anterior guidance in an anterior tooth wear patient using a custom incisal guide table.

The ovate pontic of the FPDP was designed for esthetic purposes. Porcelain fused to a metal FPDP was used in this case due to the limited lingual clearance and to prevent attrition of the lower anterior teeth. Periodic evaluations and adjustments were of paramount importance in a case like this in order to check if the patient felt comfortable with the new anterior guidance and whether there was any attrition of the restoration on the lower anterior teeth until the final restoration could be cemented. However, after cementation of the final restoration, the periodic follow-up evaluations were still necessary.

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รายงานการรักษาผู้ป่วย: การปรับเปลี่ยนแนวนำฟันหน้าในผู้ป่วยที่มีการสึกของฟันหน้าล่าง

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[2]หลักสูตรทันตกรรมบูรณะเพื่อความสวยงามและทันตกรรมรากเทียม คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

บทคัดย่อ

รายงานการรักษาผู้ป่วยนี้ได้แสดงถึงวิธีการสร้างแนวนำฟันหน้าที่เหมาะสมในผู้ป่วยที่มีการสึกของฟันหน้า ผู้ป่วยมีการสึกของฟันหน้าล่างและมีสะพานฟันชนิดติดแน่นบริเวณฟันคู่สบหน้าบนที่มีความนูนทางด้านลิ้นมากกว่าปกติ การรักษาเริ่มโดยทำการรื้อสะพานฟันชนิดติดแน่นนั้นออกแล้วแทนที่ด้วยสะพานฟันชนิดติดแน่นแบบชั่วคราวที่มีความนูนทางด้านลิ้นที่เหมาะสมในระยะเวลาหนึ่ง จากนั้นทำการสร้างแนวนำฟันหน้าที่เหมาะสมด้วยการใช้แท่นแนวนำด้านหน้าเฉพาะบุคคล จึงทำการสร้างสะพานฟันชนิดติดแน่นแบบถาวรตามแนวนำฟันหน้านั้น การนัดผู้ป่วยมาอย่างสม่ำเสมอ ทั้งระหว่างการรักษาและหลังจากทำการใส่สะพานฟันติดแน่นถาวรไปแล้วเป็นสิ่งจำเป็น

(ว ทันต จุฬาฯ 2555;35:241-58)

คำสำคัญ: *แท่นแนวนำด้านหน้าเฉพาะบุคคล; แนวนำฟันหน้า; สะพานฟันชนิดติดแน่นแบบชั่วคราว*