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CLINICAL ARTICLE

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Multidisciplinary full-mouth rehabilitation with soft tissue regeneration in the esthetic zone

Anja Liebermann, Dr med dent, MSc[1] | Stefan Frei, MDT[2] | Madalena Lucia Pinheiro Dias Engler, MSc[1] | Otto Zuhr, Dr med dent[3] | Otto Prandtner, MDT[2] | Daniel Edelhoff, Prof Dr med dent[1] | Reza Saeidi Pour, Dr med dent[1]

[1]Department of Prosthetic Dentistry, University Hospital, Ludwig-Maximilians-University, LMU Munich, Munich, Germany

[2]Master Dental Technician (MDT), Platform Laboratory, Munich, Germany

[3]Department of Periodontology, Center for Dental, Oral and Maxillofacial Medicine (Carolinum), Johann Wolfgang Goethe-University, Frankfurt/Main, Germany

Correspondence
Dr. Anja Liebermann, Goethestrasse 70 – 80336 Munich, Germany.
Email: Anja.Liebermann@med.uni-muenchen.de

Abstract

Objective: Oral rehabilitation often requires a multidisciplinary approach including restorative dentistry, prosthodontics, and periodontology to fulfill high esthetic and functional demands, frequently combined with changes in the vertical dimension. The presence of gingival recessions can be associated with numerous factors, such as brushing or preparation trauma and persistent inflammation of the gingiva due to inadequate marginal fit of restorations. Because gingival recessions can cause major esthetic and functional problems, obtaining stability of the gingival tissue around prosthetic restorations is of essential concern. Modifications of the occlusal vertical dimension require sufficient experience of the whole dental team. Especially in patients with functional problems and craniomandibular dysfunction, a newly defined occlusal position should be adequately tested and possibly adjusted.

Clinical considerations: This case report presents a complete prosthetic rehabilitation combined with a periodontal surgical approach for a patient with gingival recessions and functional/esthetic related problems. The vertical dimension was carefully defined through long-term polymethyl methacrylate provisionals as a communication tool between all parts involved. All-ceramic crowns were inserted after periodontal healing as definitive rehabilitation.

Conclusions: Complex rehabilitation in patients with high esthetic demands including soft tissue corrections requires a multidisciplinary team approach that consists of periodontal surgeon, dentist and dental technician.

KEYWORDS

ceramic, connective tissue graft, minimally invasive restorations

1 | INTRODUCTION

Oral rehabilitation often requires a multidisciplinary approach due to both the complexity of patients' restorative needs and their increasing esthetic expectations. In this context, restorative dentistry, prosthodontics, and periodontology need a synchronized procedure to fulfill high esthetic and functional demands, which might be combined with changes in the vertical dimension.[1] The vertical dimension (VD) is described as the length of the face determined by the amount of separation of both jaws, and is composed by two measurements: occlusal vertical dimension (OVD) and resting vertical dimension (RVD).[2] OVD is the measurement of the distance between two facial points when all teeth are in contact, whereas RVD is the same distance when the head is in the upright position, the mandible is relaxed and the teeth are not touching each other[3,4]; RVD measurements are conducted on soft and mobile tissues and therefore are not considered constant.[4] Because the OVD is related to the teeth, tooth wear is suspected to cause modifications.[5] Physiological loss of dental enamel structure has been reported as varying from 0.02 to 0.04 mm per year, and it is not considered an issue if the patient does not relate discomfort.[5] However, processes

such as attrition, abrasion and erosion (especially combinations) can cause severe tooth wear and generate symptoms categorized as pathological.[5,6] As an association between tooth wear and modification of the OVD exists, a very careful assessment of the patient's OVD prior to prosthetic treatment is essential. Turrell[7] described various methods to assess the OVD. The phonetic approach, based on correlation of the interocclusal distances ("freeway space"), position of the occlusal plane and the position of the tongue relative to the teeth during speech, is a widely used and reported method.[2,8,9] However, no method is considered completely accurate, and the clinical experience of the dental team usually has the major role in treatment processes.[7,10]

The dental team is often faced with cases where assessment of a loss in OVD appears to be difficult. Beyond this background an interesting pretreatment option to access an adequate OVD for the individual situation is given by an evaluation period with interim prostheses or long-term provisional restorations.[3,10]

Regarding the stability and long-term maintenance of the treatment outcomes, integration of the prosthetic restorations with the periodontium and the other teeth is necessary.[1] The crown–tooth interface and the relationship between the preparation area and the gingival margin affect the health of periodontal tissues.[11] It has been reported that the use of finish line preparations positioned at the gingival level (equigingival) and below the gingival level, intrasulcularly (subgingival), can harm the gingival tissue due to the difficulty in performing appropriate hygiene of the margins which can lead to plaque accumulation and inflammation.[12]

Gingival recession is one of the most common problems that can affect the periodontal tissues and is defined as "the displacement of the soft tissue margin apical to the cemento–enamel junction with exposure of root surface.[13,14] The occurrence of gingival recession can be associated with numerous factors, such as: (a) gingival biotype (thick or thin—relative to the amount of keratinized gingival tissue), (b) trauma caused by the patient (brushing too hard), (c) trauma caused during the preparation of a tooth and (d) persistent inflammation of the gingiva due to inadequate marginal fit of restorations (violation of the biological width). Because gingival recession can cause major esthetic and functional problems, the stability of the gingival tissue around prosthetic restorations has become one of the most important concerns of dentists.[15] Miller[16] divided gingival recessions into four different classes according to the extension of recession and the possibility of root coverage. When a gingival recession is present around teeth or prosthetic restorations, several surgical approaches are available in order to achieve coverage for biologic and esthetic long-term success. Some related factors like the patient him or herself, the presence of single or multiple recessions, the area in which the recession is located (esthetic or nonesthetic), defect characteristics, stabilization of the flap, wound healing and use of biomaterials (like connective tissue grafts) have been listed as essential to select an adequate surgical approach that will give the most predictable result.[17]

This article presents the prosthetic and periodontal surgical treatment of a patient with gingival recession, loss of VD with occlusal symptoms, functional/esthetic related issues and high esthetic demands.

FIGURE 1 Preprosthetic and presurgical smile appearance

2 | CASE REPORT

A female patient presented to the dental office, unsatisfied with the appearance of her anterior restorations (metal–ceramic crowns) (Figure 1) and with functional complaints. A systematic steps sequence was used for planning and executing the rehabilitation and is presented below.

At the first visit, a thorough oral examination, complete radiographic evaluation and a functional analysis of the temporomandibular joints were made. In addition, registration of the lower jaw's mobility through the zebris jaw registration system (JMAnalyser+, zebris Medical GmbH, Allgaeu, Germany) was made to determine the neuromuscular jaw relation. The evaluation revealed the presence of traumatic occlusal contacts in the anterior region, attrition and abrasion, disc displacement with articular click and suspected bruxism. Gingival recessions were present generally, with exposition of the restoration margins (Figure 2). Study models, an arbitrary face bow record, registration in centric relation (CR), intra and extraoral photographs and a video recording were also obtained to complete the patient's documentation. The maxillary and mandibular study models were mounted in CR using a semi-adjustable articulator (Artex CR, Amann Girrbach, Koblach, Austria).

All data were used to create an anatomical wax-up (AWU) with the new planned occlusal vertical dimension (POVD) which was transferred to the patient's mouth by means of indirect diagnostic intraoral polymethyl methacrylate (PMMA) mock-ups (NEW OUTLINE, anaxDENT, Stuttgart, Germany), fabricated for all teeth except the six maxillary anterior teeth. The mock-ups were inserted to refine the POVD in a dynamic state using the speech method in which any occlusal contact detected during speech was marked and removed (Figure 3). At this point, corrections on the AWU were made to provide the final diagnostic wax-up (DWU) and new lap-side PMMA provisional occlusal veneers were manufactured for the posterior and mandibular anterior

FIGURE 2 Presence of generalized recessions exposing restoration margins of metal–ceramic crowns

FIGURE 3 Positioning of the intraoral mock-ups for checking the new POVD during speech. Loss of tooth (erosion and attrition) structure is obvious, especially in the lower anterior region

FIGURE 4 Abutment teeth of the maxillary anterior teeth superimposed with the preprosthetic situation

regions (NEW OUTLINE, anaxDENT, Stuttgart, Germany) in correspondence with the final DWU. In addition, the upper anterior metal–ceramic crowns were removed (Figure 4) and provisional crowns were fabricated from composite resin (Nexco veneering composite, Ivoclar Vivadent, Schaan, Liechtenstein) (Figure 5). The crowns of the maxillary anterior region were adhesively bonded to the prepared teeth (Syntac Classic, Ivoclar Vivadent, Schaan, Liechtenstein) with Dual-curing cement resin cement (Variolink Esthetic DC color light, Ivoclar Vivadent, Schaan, Liechtenstein). This procedure was adopted to maintain these composite crowns for future treatment and prepare them as built-up abutments for the definitive crowns. The patient further had

FIGURE 5 PMMA long-term provisionals for the maxillary posterior teeth and composite resin crowns for the anterior teeth

FIGURE 6 PMMA long-term provisionals for mandibular teeth

FIGURE 7 Cleaning the affected root surfaces with a rubber cup and pumice paste

FIGURE 8 Scaled and cleaned marginal root surfaces

both natural teeth and ceramic crowns to receive the PMMA provisionals (Figure 6), so the bonding procedures adopted were: 1) natural teeth: etching (total etch and rinse with 37% phosphoric acid, Ivoclar Vivadent, Schaan, Liechtenstein), rinsing, adhesive application (Syntac Classic, Ivoclar Vivadent, Schaan, Liechtenstein) and flow resin addition (Tetric Flow A2, Ivoclar Vivadent, Schaan, Liechtenstein) with light-curing; 2) ceramic crowns: silica-coating (CoJet, 3M, Seefeld, Germany), silane application (MonoBond Plus, Kerr, Rastatt, Germany), adhesive (Syntac Classic, Ivoclar Vivadent, Schaan, Liechtenstein), flow resin application (Tetric Flow A2, Ivoclar Vivadent, Schaan, Liechtenstein) and light-curing. The same steps used to prepare the ceramic crowns

FIGURE 9 Flow resin composite addition to fill the interdental spaces along the incisal edge

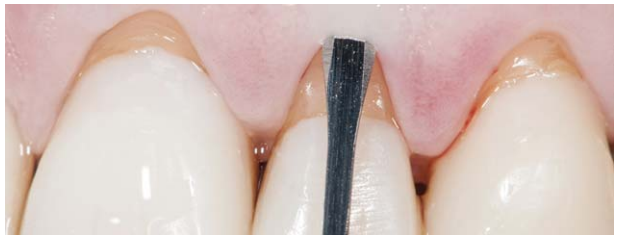

FIGURE 10 Envelope incisions and partial dissection of the tissue to create the implant bed for CTG

FIGURE 11 Insertion of CTG by the tunneling technique

FIGURE 12 Immediate aspect of soft tissue after insertion of CTG, using composite as an anchor for the sutures to stabilize the augmented tissue in the desired coronal position

FIGURE 13 Postsurgical appearance after the healing period prior to prosthetic treatment

were applied to prepare the PMMA provisionals. With these provisionals installed, the patient was able to adapt to the new OVD for the period of 8 to 12 weeks, where adjustments of the occlusion could be made, if necessary. The main purpose of this step is to achieve the freedom in CR, where the posterior teeth protect the anterior teeth in the static occlusion and the anterior teeth protect the posterior ones in the dynamic occlusion. The final POVD raised the reference articulator incisal pin in by about 5 mm using the lower enamel margin of upper and lower canines as references.

Maxillary anterior teeth gingival recessions were present on the buccal side, ranging from 2.0 to 4.0 mm and affecting the esthetic severely. These recessions were classified as Miller Class I. To improve the thickness of the gingiva and cover the previously exposed root surfaces, a tunneling technique in combination with connective tissue graft, harvested from the lateral palate, was applied. After cleaning the affected root surfaces with a rubber cup and pumice paste, the teeth were dried and flow resin composite was used to fill the interdental spaces along the incisal edge. This way the composite could be used later on as an anchor for the suture to stabilize the augmented tissue in the desired coronal position (Figures 7–12).

The surgical healing period was 6 months in total, with the possibility for definitive treatment of the posterior region and of the mandibular anterior region in between (Figure 13). Figure 14 exemplifies the accommodation of the soft tissue in the recession area during the healing period. Craniomandibular complaints showed significant improvement during the pretreatment phase. Removal of the crowns and preparation of the teeth were performed, full-arch polyether impressions (Impregum Penta, 3M, Seefeld, Germany) were obtained and a second face bow registration was taken. The upper and lower left second molars and the upper right first pre-molar received lithium disilicate (LS2) partial crowns (IPS e.max Press, Ivoclar Vivadent, Schaan, Liechtenstein); the six anterior mandibular teeth received LS2 restorations veneered with glass ceramic (IPS e.max Ceram, Ivoclar Vivadent, Schaan, Liechtenstein) and all other posterior teeth received crowns made of zirconia fused with LS2 through the modified sintering technique (Figures 15 and 16). Using the sintering technique, a wax-up of the final restorations was performed and replicated using a silicon matrix. A reduction of the area referent to the tooth enamel was made on the wax-up and the models were sent to a milling center (Corona Lava Fraeszentrum, Starnberg, Germany), where the wax-up was

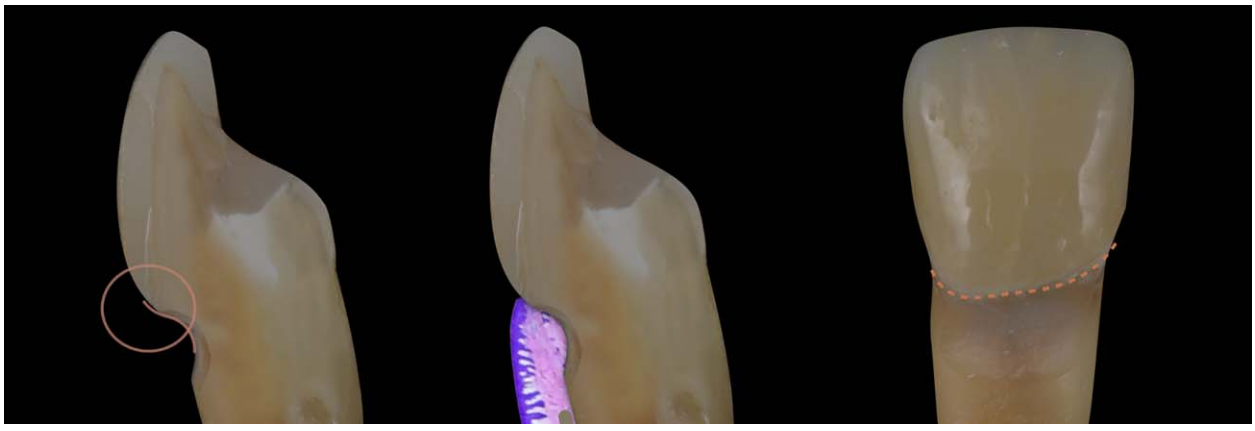

FIGURE 14 Soft tissue accommodation over the recession area in the abraded root. The format of the cervical area of the clinical crown is responsible for the gingival conditioning

FIGURE 15 Definitive full crowns for the posterior teeth fabricated by the modified sintering technique and partial crowns for the upper and lower left second molars fabricated from LS2

FIGURE 16 Fabrication of the maxillary anterior teeth within different steps on the master cast

scanned and zirconia frameworks (Lava Classic, 3M, Seefeld, Germany) were fabricated (Lava™ CNC 500 Milling System, 3M, Seefeld, Germany). With the silicon replicate matrix used as the reference, a wax-up of the previously reduced enamel portion was built (lost-wax technique) and LS2 veneering caps (IPS e.max Press, Ivoclar Vivadent, Schaan, Liechtenstein) were generated through the injection technique. These veneering caps were then attached to the zirconia frameworks using glass-ceramic powder (DCM hotbond fusio system, Dental Creative Management GmbH, Rostock, Germany) and sintered at 770°C with a heating rate of 30°C 3 min holding time in a ceramic furnace (AUSTROMAT, DEKEMA Dental-Keramiköfen GmbH, Freilassing, Germany). The LS2 restorations were bonded with a resin-based composite (Variolink Esthetic light, Ivoclar Vivadent, Schaan, Liechtenstein) and the zirconia restorations were adhesively cemented with Multilink

FIGURE 17 Aspect of the maxillary gingival tissue and crowns at 2-year follow-up

FIGURE 18 Aspect of the mandibular anterior veneered teeth at 2-year follow-up

FIGURE 19 Occlusion and gingival marginal stability at 2-year follow-up

FIGURE 20 Lateral view with restored front and canine guidance after prosthetic treatment

Automix (Ivoclar Vivadent, Schaan, Liechtenstein) following the manufacturer's recommendations.

By the time the surgical healing period was completed, the OVD was fully restored and the gingival margin stabilized. Treatment of the maxillary anterior region was then initiated. The composite resin crowns previously cemented were prepared to serve as the final abutments for the definitive new crowns. The decision to keep and prepare the crowns was made in order to build up new resin abutments, improving the shape and the background color. New impressions were taken and the new six upper crowns were fabricated using zirconia frameworks covered by the layering technique (CREATION ZI-CT, Willi Geller International GmbH, Meiningen, Austria) to accomplish a better esthetic result. Figures 17–22 present the final result at 2-year follow-up. The dental laboratory work was performed by MDT Stefan Frei.

3 | DISCUSSION

Reconstruction of a smile involving soft tissue corrections combined with occlusal rehabilitation is a challenging procedure and should be solved by an interdisciplinary dental team. In these complex cases where extensive corrections are necessary, a long pretreatment period is often required to explore the treatment goal. With this approach, it is possible to evaluate the final treatment goals for functional, phonetic and esthetic aspects which cannot be completely anticipated by the dental technician. A long pretreatment period enables improved predictability of the final restorations.[18,19]

Three pretreatment options for functional evaluation of a therapeutic OVD can be utilized: (1) conventional removable repositioning splints made of PMMA; (2) tooth-colored removable CAD/CAM splints made of polycarbonate; (3) fixed tooth-colored splints (or restorations) made of PMMA.[19] All three options are suitable to functionally evaluate the new OVD. However, the use of conventional splints normally interferes in the patient's social life with their visibility and difficulty in speaking and eating properly. Therefore, continuous interruption of the therapy can be expected. Tooth-colored splints can provide better quality of life and additional esthetic evaluation, because of their natural appearance. PMMA long-term provisionals,[19] in contrast, can provide the closest simulation of the definitive restorations in terms of function and esthetics, since they are fixed as a 24-h splint and thereby offer a perfect evaluation of the new defined occlusal plane and concept, as well as phonetics.[19] In the present case, the chosen option of pretreatment for evaluation of the therapeutic OVD was option 3, with fixed PMMA restorations on the posterior teeth in conjunction with composite resin crowns on the maxillary anterior teeth due to the patient's high esthetic demands.

FIGURE 21 Patient's postoperative lip appearance

When fabricating the definitive restorations, several materials are available. Ceramic materials are widely indicated since they are able to fulfill esthetic and biological requirements with optimal mechanical and optical properties.[20,21] However, different types of indications are found for different ceramic types. LS2- and leucite-reinforced ceramics show satisfying results when used for inlays, onlays, veneers and single crowns, offering excellent esthetic appearance, wear resistance, color stability and biocompatility.[20] In the presented case, LS2 was the chosen option for partial crowns and veneers. Despite the good optical characteristics of LS2, the mechanical properties are still lower than those found in zirconia ceramics (470 MPa compared to 900 to 1200 MPa).[22,23] Nevertheless, zirconia has been indicated mostly as a framework material, veneered by a glass ceramic, mainly due to esthetic requirements (first-generation zirconia is purely white and opaque) and for its susceptibility to the aging phenomenon (hydrothermal degradation) when exposed to a humid environment.[24,25] The veneer can be made by several techniques, the powder layer technique being the most common; however, it has a high rate of failure by chipping[21]—mostly because of the thermal coefficient mismatch and the difference in flexural strength between the zirconia framework and the veneering porcelain.[26,27] New "high" translucent zirconia materials of the third and fourth zirconia generation, being lately introduced onto the dental market as multilayer blanks for monolithic restorations, would have

FIGURE 22 Postoperative fronto-lateral profile view. Dental laboratory work performed by MDT Stefan Frei

been an alternative solution for high-strength demands in the posterior regions.[28,29] In the presented case, the restorative team decided to use zirconia covered by LS2 (using the modified sintering technique[27]) as the material of choice for all the full crowns, primarily because of the patient's history of abrasion and attrition. Consequently, it was possible to obtain high-strength crowns with a low risk of chipping of the veneering LS2 ceramic. Beuer et al.[30] evaluated the fracture strength of crowns made of zirconia frameworks and covered with dental ceramics by three different methods: (1) the traditional veneering technique; (2) the overpressing technique; and (3) the sintering technique. The results showed that crowns with sintered veneer caps had a significantly higher strength than those prepared by the other two methods, and most of the fractures in this group were complete (framework + covering cap), which indicates improved union between the two parts. The higher fracture strength can also be explained by the higher strength of LS2 when compared to the covering porcelains used in the veneering and overpressing techniques.

Dentogingival complex health is directly related to respecting the biological width, which is composed of two structures: the connective tissue attachment, with an average apicocoronal width of 1.07 mm, and the junctional epithelium, with an average width of 0.97 mm. Violation of the biological width can cause damage like gingival recession, especially in thin gingival biotypes.[11] The presence of recessions can result in root sensitivity, impaired esthetic appearance and root caries; therefore, many surgical techniques have been developed with the purpose of covering recessions.[31] Techniques such as free gingival grafts, sliding laterally or coronally advanced flaps and guided tissue regeneration have proved to be efficient in covering recessions and gaining clinical attachment.[32] However, it has been reported that the addition of a connective tissue graft (CTG) in a recession area can improve the thickness of the marginal gingiva and further enhance treatment outcomes and improve the long-term results.[31] The study of Rebele et al.[33] showed a statistically significant difference of gingival thickness between groups with recessions treated by a coronally advanced flap only (mean thickness 0.91 mm) and with the use of CTG combined with the tunneling technique (mean thickness 1.63 mm) after 12 months. Previous studies, comparing use and non-use of CTG with different techniques, showed similar results.[34,35] The consensus is that the use of CTG is the most predictable and effective approach to covering recessions, particularly in thin gingival biotypes, since it increases the thickness of these tissues. CTGs are commonly used in conjunction with a coronally advanced flap. In this technique, vertical relaxing incisions are made in the buccal flap, which can retard the healing process and the early esthetic result. The tunneling technique produces fast early healing due to the absence of relaxing incisions. Only envelope incisions are made, with partial dissection of the tissue beyond the mucogingival junction (to have enough relaxation of the flap); the CTG is inserted into this recipient bed and held by sutures. This procedure improves recovery and allows the patient to be back to social activities in a short period of time (2 weeks for natural color of the gingiva and no visible marks).[31,32] Facing these advantages and the expectation of a predictable final result, the chosen surgical approach utilized in this case was CTG in conjunction with the tunneling technique.

4 | CONCLUSIONS

Complex cases must be carefully evaluated before tracing a treatment plan. A systematic steps sequence and a long pretreatment period are fundamental to achieve a predictable and satisfactory result for the patient, the dentist and the dental technician. The acknowledgment of well-established techniques and materials available also has a critical role in the treatment's overall success.

CONFLICT OF INTEREST

The authors do not have any financial interest in the companies whose materials are included in this case report.

ORCID

Anja Liebermann Dr med dent, MSc http://orcid.org/0000-0002-1385-2195

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