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Case Report

4-Quadrant Rehabilitation after Parafunctional and Carious Damage

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Introduction

Along with carious as well as non-carious tooth hard substance defects, there is often a loss of vertical dimension and/or an increased occurrence of secondary malocclusions [1]. The article therefore aims in particular to address the primary negative influence of occlusal disharmony (s), mostly associated with an increase in the stress level in the body and a resulting (increased) parafunction (clenching and grinding) as well as secondary compromising effects on neighboring organ systems (Head posture, cervical spine, shoulder region).

Body text

The rapid development in the digital field in the last 10 years, which has a multitude of positive aspects in the predictable planning/production and if the reproducibility of work processes is attributed, it should also deal with the question of a functional therapeutic approach. The exciting question of how functional aspects (clinical and instrumental functional analysis) in their analog tradition with models mounted in relation to the skull in a horizontal and vertical reference position (assignment) of the lower jaw in a partially or fully adjustable articulator system can usefully be integrated into a digital treatment concept remains open to this day now.

Aesthetics and function go hand in hand in dental rehabilitation. According to the industry, a digital interface for the implementation of all functional parameters from the analog articulator system into a digital concept is not yet practicable from the point of view of the authors. The difficulty here seems to be to transfer the "coordinate system of human skulls" incl. Occlusion into the simulation situation (CAD) without geometric losses, so that the projection of the static and especially the dynamic occlusion morphologically corresponds to the patient's circumstances; what makes the crucial point in the production of functionally exact chewing surfaces. Almost all digital systems currently have certain weaknesses in recording and transferring the real patient geometry into the virtual world, compared to the well-researched and proven analog articulator system. Now, a combination of analog (growing by hand by the technician) and a subsequent scan for the digital production of functional occlusal surfaces (CAM) seems to represent a sensible compromise however, a "functionally pure digital workflow" cannot (yet) be assumed. In the recent past, 4D recording systems (predominantly Modjaw®), which allow an implementation of all dynamic occlusion parameters (including facial scan/cephalometric side analysis, better CBCT) in the dental CAD software (e.g. Exocad®) to fill the gap for digital processing (production "Functional chewing surfaces" [2-5]) can be closed without losing the patient's geometry.

The supply of high-performance ceramics or monolithic zirconium restorations should not compensate for possible deficits in the functional area in the form of "airbags". Due to the increasing proportion of patients with abrasions/attritions/erosions and/or parafunctions, the treatment approach presented in this article is representative of a minimally invasive [13] and occlusion-prophylactically oriented treatment concept, in the sense of securing the static occlusion and ensuring an interference-

free dynamic occlusion, [6-8]. This is particularly important in view of the fact that there is only a margin of 0.6-0.8mm at the joint level and the tactility of the masticatory system reacts even more sensitively (0.02-0.03mm) of central importance in the reconstruction of teeth/Occlusal surfaces. The aim of treatment is therefore to create a defensive design of the chewing surfaces in order to minimize the risk of overloading damage to the chewing organ in the case of parafunction, which is primarily not to be regarded as a pathology but as a stress valve for the patient.

Increase in the vertical dimension (problem)

An increase (or decrease) in the vertical dimension poses an additional challenge in myoarthropathy, as well as in deep or covering bite situations, especially when implant-supported dentures are intended to be fixed in a jaw. In the following, it will be shown how this problem is solved within the framework of a synoptic treatment concept. The focus here was on function, phonetics and aesthetics [9, 10].

Case Presentation

Special medical history

A 49-year-old patient, who has been regularly participating in the recall (dental hygiene) in our practice for many years, presented himself with dentition that were in need of renovation and that were inadequately cared for. In addition, there was a deep bite situation with clear traces of abrasion in the upper and lower anterior tooth area, the lower anterior segment 33-43 (Angle Class II/2) is typically in the "raised position" or is compensatory supra-erupted. About 10 years ago, tooth 42 was removed in our practice due to crowding. He claims that he is grinding his teeth. All anamnestic complaints are subjectively rated as grade 1 (Slavicek initial diagnosis sheet), which indicates a moderate complaint situation (adapted complaints) [11-19].

General medical history

Unremarkable (no underlying diseases, no medication)

Diagnosis

The diagnoses, myoartropathy, parafunction-clenching and grinding with visible dental hard tissue abrasion (attrition) accompanied by loss of vertical dimension, tension in the shoulder and neck area, disruption of static and dynamic occlusion (insufficient canine guidance, latero) were derived from the clinical and radiological findings and protrusion facets, mediotrusion pre-contacts), irregular gingival course in the visible FZ area as well as an adult dentition with insufficiently conserved care (Figures 1-15).

Figure 1: Portrait en face.

Figure 2: Front in occlusion.

Figure 3: Slight smile.

Figure 4: I-tone.

Figure 5: Occlusal view of the upper jaw.

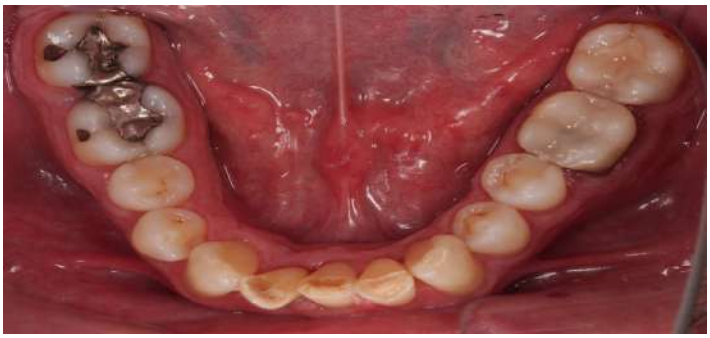


Figure 6: Occlusal view of the lower jaw.

Figure 7: Lateral view on the right.

Figure 8: Lateral view on the left.

Figure 9: Full smile (start of treatment).

Figure 10: OK front 3-3.

Figure 11: UK front 3-3.

Figure 12: Initial situation Panoramic X-Ray.

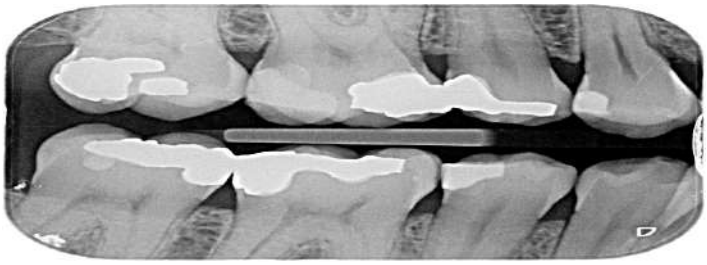


Figure 13: Right bitewing.

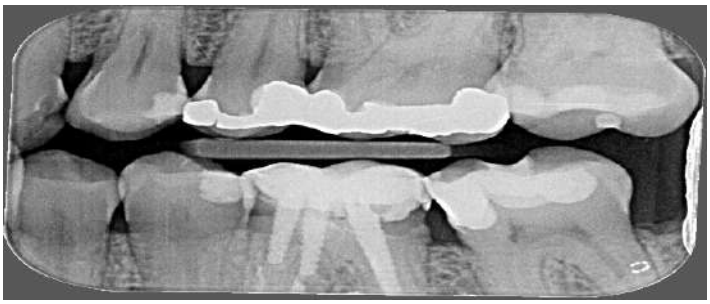


Figure 14: Bitewings on the left.

Figure 15: Centric bite registration with Frontjig according to Gutowski (prior to registration, the masticatory musculature is deprogrammed using the Aqualizer).

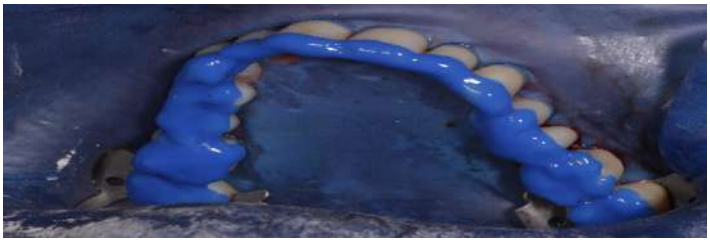
Figure 16: The Behrend clinometer (Amann Girrbach GmbH, Pforzheim) is helpful as an "auxiliary tool" for determining the ideal tooth axis positions and the course of the cutting edge after the facebow has been transferred. A "laboratory analog" of the clinical device is used here, which is "switched" by the dental technician in front of the articulator, allowing wax-up in accordance with the axis and the incisal edge.

Figures 17,17a, 18 and 18a: Functional-aesthetic wax-up/mock-up.

Figures 18b, 18c: Extraction of tooth 36, which is not worth preserving, using the socket preservation technique (bone substitute material and resorbable collagen membrane).

Figure 19: Determination of the implant position with planning software with subsequent data transfer.

Figure 20: Making a surgical template (Nobel Guide).



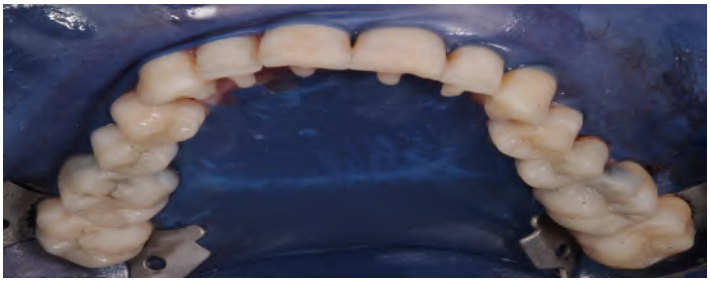


Figure 20b-20f: Semi permanent build-up with composite/ establishment of a new vertical and horizontal relation of the lower jaw in ZKP (centric condylar position) with temporary composite build-ups upper/lower 7-7 (Tetric Evo Ceram, Vivadent) using the wax up using a transparent silicone key (Elite Transparent, zhermack).

Figure 20g: Marking of the desired gingival margins based on the mock-up.

Figure 20h: Buccal minimally invasive ostectomy using a round bur and subsequent external gingivectomy (while maintaining the biological width) to correct the asymmetrical soft tissue course.

Figure 20i: State after healing and tissue maturation 8 months after the operation.

Figure 21: Minimally invasive preparation of the entire lower jaw to accommodate partial crowns and veneers in pressed ceramic.

Figure 22: Registration: The contralateral side was left for bite registration and served to support the temporomandibular joints and maintain the new/therapeutic vertical dimension. Only then was the final preparation of the teeth with dissolution of the supporting zones in the lower jaw and subsequent bite registration with thermoplastic material (Bite Compound, GC Japan).

Figure 23: Impressions of the prepared teeth using the double cord technique: Insertion of a first, soaked (Racestyptine solution, Septodont) cord (Ultrapak 0, Ultradent), over which a second, soaked cord with a larger diameter is placed (Ultrapak 1, Ultradent). Waiting time until the impression can be taken with the laid cords about 10 minutes. A screwed implant impression mount (Impression Coping Open Tray Branemark System, Nobel Biocare) is placed on the implant after a healing phase of 2 months.

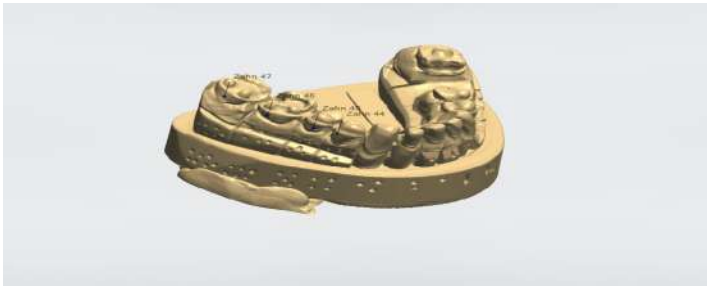


Figure 24a: Model scan.

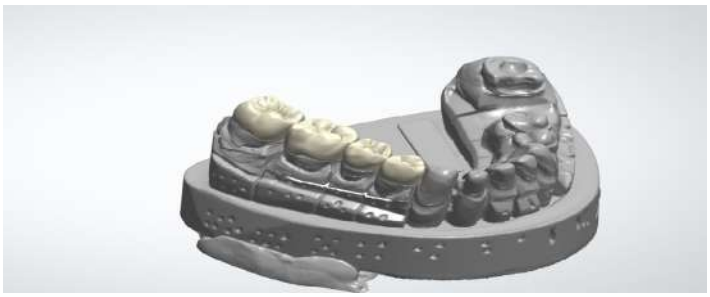


Figure 24b: Virtual crown design.

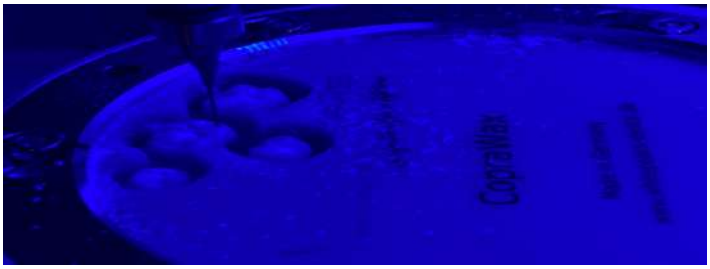


Figure 24c: Implementation in wax.

Figure 24d: Molar, Premolar and lower Canine restorations milled in wax (gray) and "functionally" adapted by the technician using the "hand waxing technique" (light blue) (CAD/CAM) in the lower jaw. Check again functional parameters (defensive design of the occlusal surfaces, if necessary elimination of posterior interferences, aesthetic control in the patient's mouth

Figure 25: Incorporation of the definitive restoration in the lower jaw after a prior try-on. Selective incorporation of the previously etched and silanized (Monobond S, Silan, Ivoclar, Liechtenstein) Empress (Ivoclar, Liechtenstein) partial crowns and hand-layered feldspar veneers (Creation, Willi Geller, KLEMA, Austria) with Syntac Classic (Ivoclar, Liechtenstein) and Variolink Esthetic (warm), (Ivoclar, Liechtenstein) after previous blasting of the prepared tooth surfaces (Rondoflex plus, Kavo) with aluminum oxide powder of grain size 27µm (Rondoflex plus, Kavo) and enamel etching with 35% phosphoric acid (Ultraetch, Ultradent).

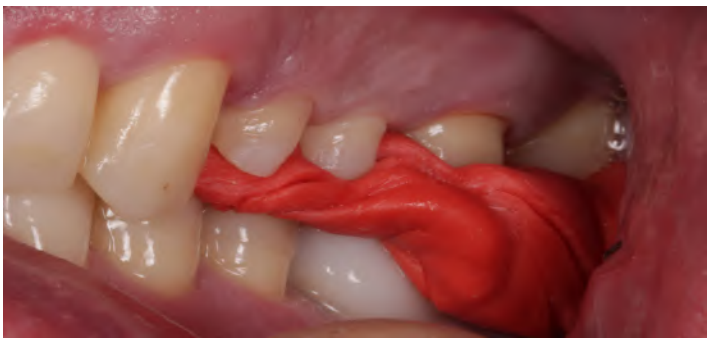


Figure 26 and 27: Registration with face bow and subsequent sequential bite registration with thermoplastic resin (Bite Compound, GC Japan).

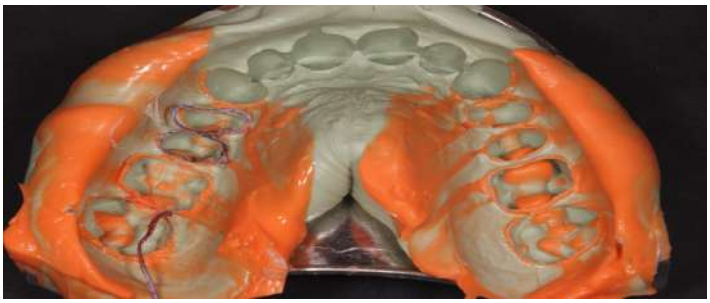


Figure 28 and 29: Impression and Articulation with subsequent split-cast control.

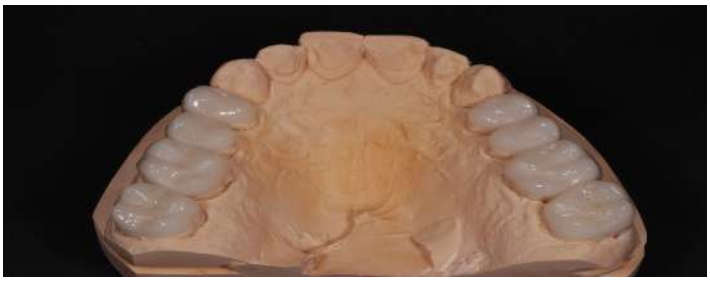


Figure 30: Completed partial press ceramic crowns according to the specifications of the "hand-customized" CAD / CAM milled occlusal surfaces.

Figure 31: Absolute drainage before insertion.

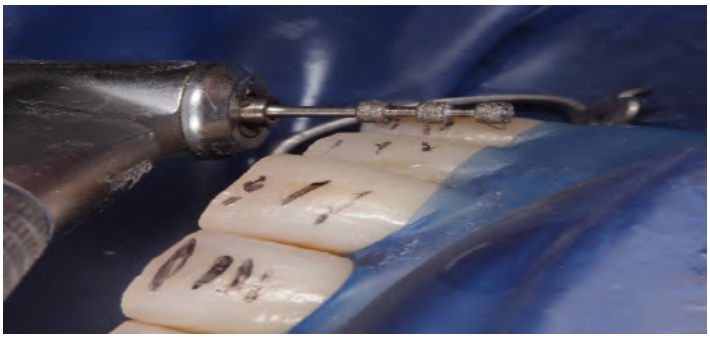


Figure 32: Final preparation of the anterior segment 13-23.

Figure 33: Control of substance removal with a "fanned silicone key"

Figures 34 and 35: Impression of the 360-degree veneer preparations with the double cord technique and the insertion with absolute drainage.

Figure 36: Bruxchecker evaluation.

Figure 37: Front in occlusion

Figure 38: Front in protrusion

Figure 39: Final portrait in face with a smile.

Figure 40: That is convincing.

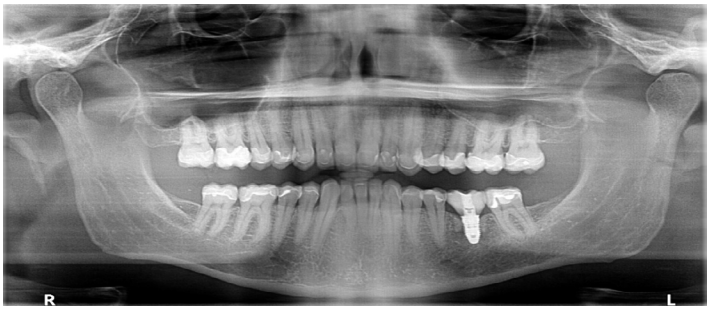


Figure 41: OPT final image.

Figure 42: The brilliance of the feldspar restorations in detail is unparalleled.

Pretreatment

After the findings were recorded and the teeth were professionally cleaned, the clinical functional analysis, an impression to create situation models, recording of the photo status, clinometer registration (Figure 16), individual face bow transfer, condylography (axiography), bite registration in the central condyle position10 after deprogramming the masticatory muscles14 with an Aqualizer using the front jig and GC Bite Compound (Figure 15) according to Gutowski8, wax up/mock up (Figures 17,18,18a). Extraction of tooth 36, which is not worth preserving, socket preservation with bone substitute material (BioOss, Geistlich Pharma AG, Wohlhusen).

Healing phase 2 months (Figures. 18b-c) Establishment of a new vertical and horizontal relationship of the lower jaw in central position of the condyle with temporary composite abutments 5-5 lower jaws (Tetric Evo Ceram, Vivadent) using the wax up (Figure 20a) using a transparent silicone key (Elite Transparent, Zhermack) (Figures 20b-e), accompanying jaw physiotherapy to support the adaptation to the new VDO [2,3,4]. Surgical aesthetic crown lengthening on left central and lateral incisors (Figure 20g) Reevaluation/acceptance of the new VDO after an adaptation phase of 8 weeks (Figure 20i). After pretreatment, all of the teeth in the lower jaw planned for the definitive restoration turned out to be worthy of preservation.

Definitive restoration

Guided surgery implantation for the definitive restoration in the lower jaw (Nobel Guide, Nobel Bio care) with single tooth implant 03615 (Figure 19,20). Preparation for the final restoration in the lower jaw 37-47 pressed ceramic partial crowns and feldspar veneers (Figure 21). Production "semi digital" first milled in wax via CAD/CAM and then subsequently "waxed/optimized" by the technician "manually" in the articulator according to functional aspects (Figure 24a-d). Impression-taking, centric bite taking, face bow transfer, try-ons and definitive incorporation in the subsequent sessions (Figures 22, 23, 25). Preparation for the definitive restoration in the upper jaw SZB (4-7) pressed ceramic partial crowns, Impression taking, centric bite registration, face bow transfer, try-ons and definitive integration in the subsequent sessions (Figures 26-31). Final preparation of the upper anterior segment 3-3 to accommodate 360 degree veneers (Creapress coping, fully veneered with feldspar ceramic, creation) (Figures 32-35) Production of Bruxchecker film for checking the (nocturnal) grinding behavior and as an auxiliary tool for identifying previous or incorrect contacts (Figure 36-42).

Discussion/Epicrisis

Basically, the discussion was the removal of the root canal treated tooth 36 versus preservation in the case of apical periodontitis and insufficient composite build-up, as well as the correction of the asymmetrical gingival course in the aesthetic upper jaw area (21,22) with a high smile line and the extensive need for conservative and/or prosthetic treatment in the room. After weighing both ethical and financial aspects, the patient decided to remove tooth 36 with replacement with a single tooth implant and the prosthetic restoration of the remaining teeth with partial crowns and veneers in both the upper and lower jaw, which in terms of the desired (high) aesthetic-functional objectives should then also meet the requirements of the patient. In addition, the asymmetry in the visible gingival area should be corrected by an aesthetic/surgical crown extension at 21, 22 to compensate for

the asymmetry of the soft tissue and hard tissue (using a labial ostectomy).

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