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CLINICAL ARTICLE

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Full mouth oral rehabilitation of a severely worn dentition based on a fully digital workflow

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Abstract

Objective: To demonstrate the use of a complete digital workflow for a full mouth rehabilitation in a severely worn dentition.

Clinical Considerations: The present case report successfully rehabilitated a full-mouth case of a severely worn dentition based on the use of digital technologies, making the diagnosis and treatment process faster, accurate and less expensive. A long-lasting esthetic and functional result are showed after 30-months follow up.

Conclusions: An appropriate knowledge on dental erosion and oral rehabilitation, combined with a digital dentistry approach could lead the clinician to deliver a fast, accurate and predictable noninvasive restorative treatment in cases like the one described.

Clinical Significance: Bruxism-based severely worn dentition is being found more often in population. In this situation, a detailed diagnosis and tailored treatment are mandatory to obtain a predictable treatment outcome. In this sense, the development of adhesive dentistry, new restorative materials and the incorporation of digital technologies can create a predictable synergy to rehabilitate these types of patients with a modern and less invasive approach.

KEYWORDS
adhesive dentistry, CAD/CAM, digital dentistry, S-CAIS, worn dentition

1 | INTRODUCTION

Patients affected by severe dental attrition/erosion often present with a significantly damaged dentition, where vertical dimension of occlusion (VDO) is usually decreased, and supra eruption may have occurred.[1] If this situation is not intercepted at an early stage, full-mouth reconstruction is typically required to restore patient's functionality and esthetics. According to the current literature, the recommended therapy comprises extensive elective root canal treatment and full-crown coverage of the majority of the dentition.[2] However, with the development of adhesive dentistry and new materials, the rehabilitation of these patients can be performed under a more conservative approach, preserving dental structures the most possible and avoiding endodontic treatment.[3,4] In this sense, digital technologies have contributed to accurately diagnose and plan a comprehensive restorative treatment.[5] Thus, the use of computer planning software allows combining the radiographic, prosthetic, surgical, and laboratory fields under a common virtual scenario, permitting a complete virtual treatment planning and optimizing treatment times and costs.[6,7]

CAD/CAM restorations are designed virtually based on digitalized oral tissues. The digital reconstruction is obtained by (1) a laboratory scanner that digitalizes a cast model or a conventional impression, or (2) by an intraoral impression using an intraoral scanner (IOS). Both approaches have been widely described in the scientific literature and are considered reliable sources of clinical information.[8] Once the restoration is designed, it is transferred in a digital format to a fabrication machine (CAM). Depending on the technology, two primary sources have been described to produce these structures. Additive manufacturing is commonly associated with 3D printing or sintering, while subtractive manufacturing is frequently associated with milling. In both situations, computer software completely oversees the process.[9–11]

From a radiologic perspective, volumetric digital imaging has dramatically changed how we approach our patients. Cone beam computer tomography (CBCT) gives a superlative amount of clinical information compared with bidimensional radiographs, allowing the clinician to get a better understanding of patients' pathology and anatomical structures.[12] Nowadays, CBCT is considered the gold standard for comprehensive diagnosis and treatment planning because of the high level of accuracy and low radiation dose.[8]

FIGURE 1 Extraoral photographs.

FIGURE 2 Intraoral photographs. Frontal view.

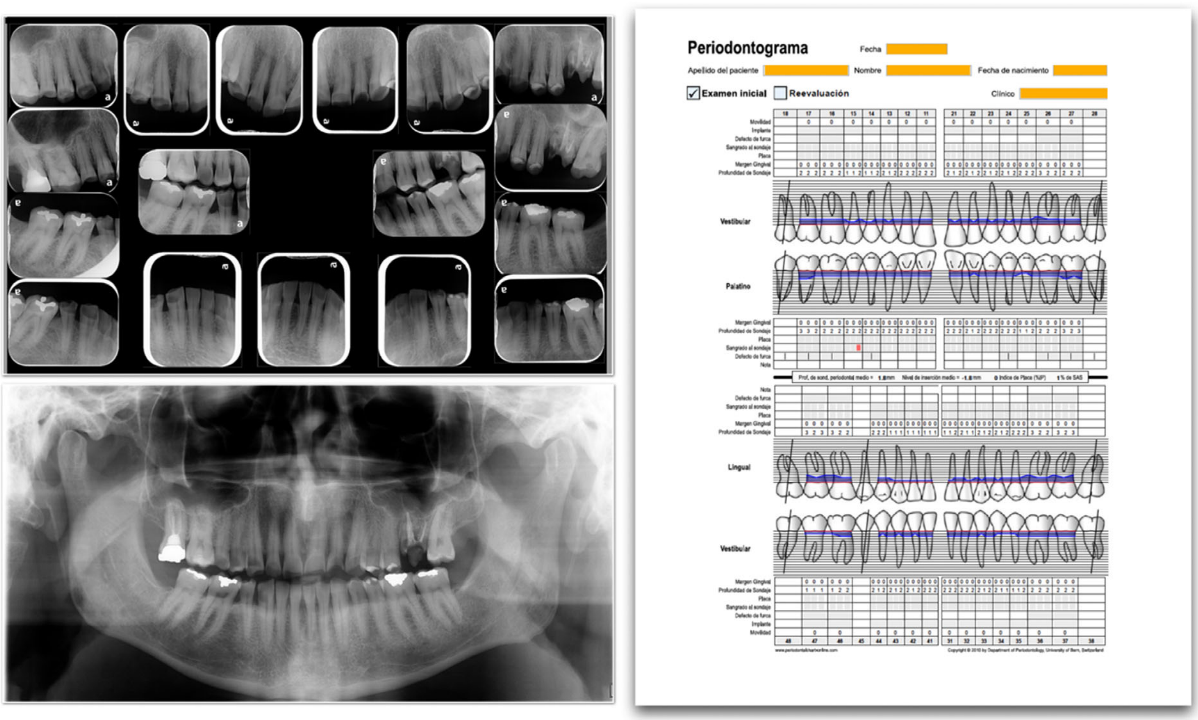


FIGURE 3 Periapical X-rays, orthopantomography, and periodontal chart.

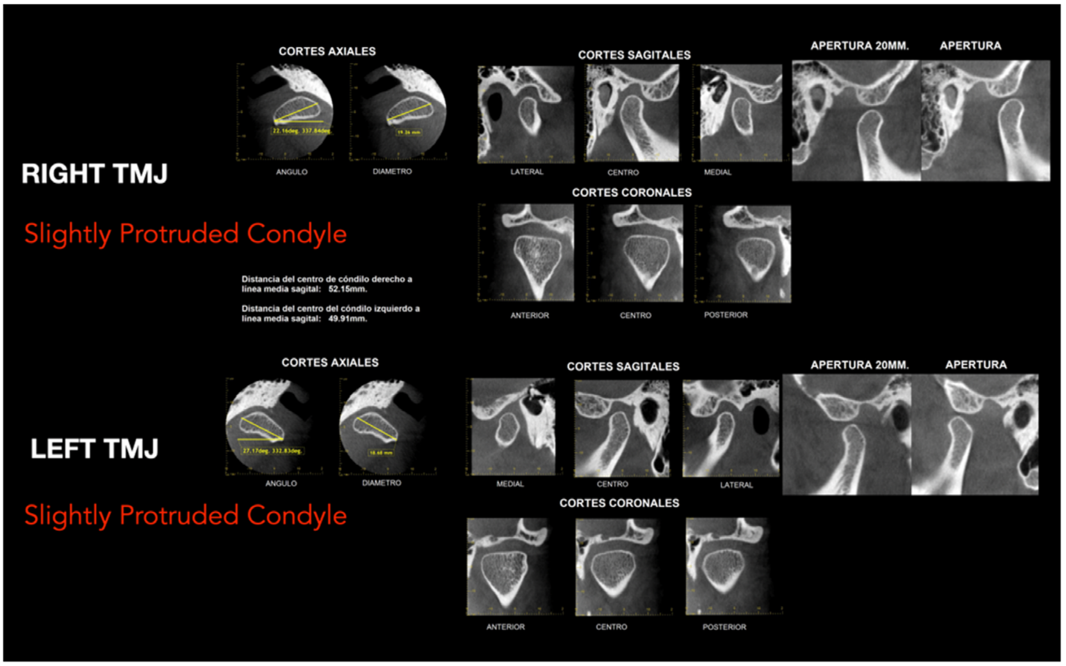
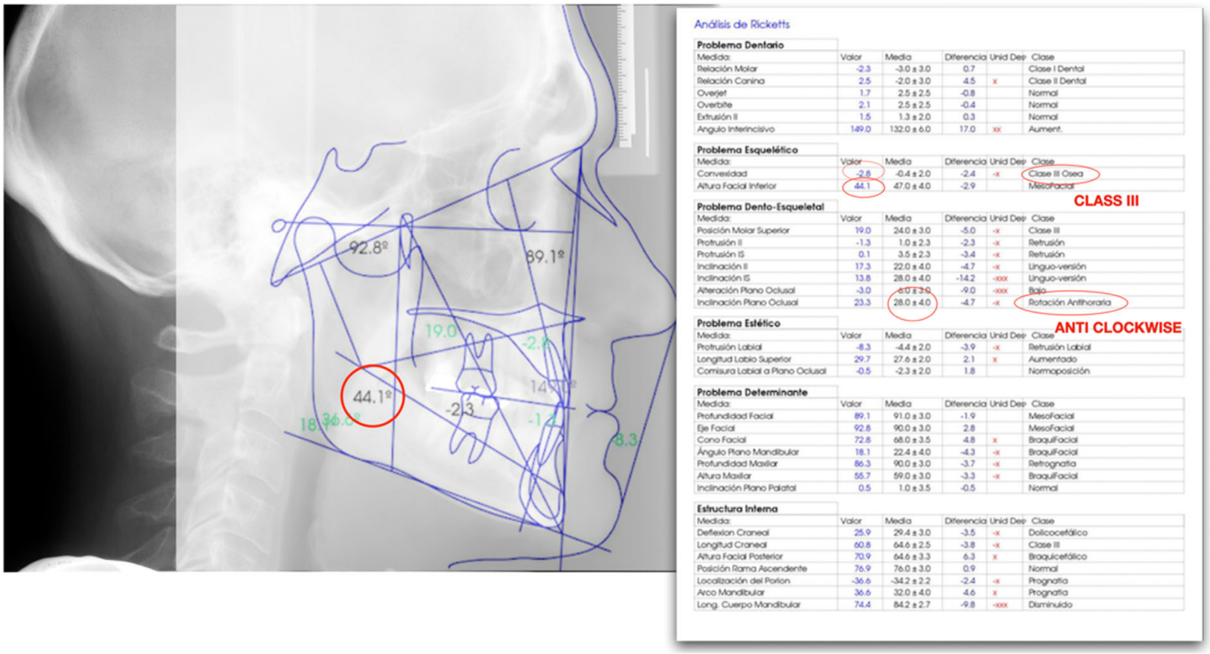


FIGURE 4 Initial CBCT of the temporomandibular joints.



Análisis de Ricketts

Medida:	Valor	Media	Diferencia	Unid Des	Clase
Problema Dentario					
Relación Molar	-2.3	-3.0 ± 3.0	0.7		Clase I Dental
Relación Canina	2.5	-2.0 ± 3.0	4.5	x	Clase II Dental
Overjet	1.7	2.5 ± 2.5	-0.8		Normal
Overbite	2.1	2.5 ± 2.5	-0.4		Normal
Extrusión II	1.5	1.3 ± 2.0	0.3		Normal
Angulo Interincisivo	149.0	132.0 ± 6.0	17.0	xx	Aument.
Problema Esquelético					
Convexidad	-2.8	-0.4 ± 2.0	-2.4	-x	Clase III Osea
Altura Facial Inferior	44.1	47.0 ± 4.0	-2.9		Mesofacial
Problema Dento-Esqueletal					
Posición Molar Superior	19.0	24.0 ± 3.0	-5.0	-x	Clase III
Protrusión II	-1.3	1.0 ± 2.3	-2.3	-x	Retrusión
Protrusión IS	0.1	3.5 ± 2.3	-3.4	-x	Retrusión
Inclinación II	17.3	22.0 ± 4.0	-4.7	-x	Linguo-versión
Inclinación IS	13.8	28.0 ± 4.0	-14.2	-xxx	Linguo-versión
Alteración Plano Oclusal	-3.0	6.0 ± 3.0	-9.0	-xxx	Bajo
Inclinación Plano Oclusal	23.3	28.0 ± 4.0	-4.7	-x	Rotación Antihoraria
Problema Estético					
Protrusión Labial	-8.3	-4.4 ± 2.0	-3.9	-x	Retrusión Labial
Longitud Labio Superior	29.7	27.6 ± 2.0	2.1	x	Aumentado
Comisura Labial a Plano Oclusal	-0.5	-2.3 ± 2.0	1.8		Normoposición
Problema Determinante					
Profundidad Facial	89.1	91.0 ± 3.0	-1.9		MesoFacial
Eje Facial	92.8	90.0 ± 3.0	2.8		MesoFacial
Cono Facial	72.8	68.0 ± 3.5	4.8	x	BraquiFacial
Ángulo Plano Mandibular	18.1	22.4 ± 4.0	-4.3	-x	BraquiFacial
Profundidad Maxilar	86.3	90.0 ± 3.0	-3.7	-x	Retrognatia
Altura Maxilar	55.7	59.0 ± 3.0	-3.3	-x	BraquiFacial
Inclinación Plano Palatal	0.5	1.0 ± 3.5	-0.5		Normal
Estructura Interna					
Deflexion Craneal	25.9	29.4 ± 3.0	-3.5	-x	Dolicocefálico
Longitud Craneal	60.8	64.6 ± 2.5	-3.8	-x	Clase III
Altura Facial Posterior	70.9	64.6 ± 3.3	6.3	x	Braquicefálico
Posición Rama Ascendente	76.9	76.0 ± 3.0	0.9		Normal
Localización del Porion	-36.6	-34.2 ± 2.2	-2.4	-x	Prognatia
Arco Mandibular	36.6	32.0 ± 4.0	4.6	x	Prognatia
Long. Cuerpo Mandibular	74.4	84.2 ± 2.7	-9.8	-xxx	Disminuido

FIGURE 5 Initial tele-radiography with Ricketts cephalometric analysis.

FIGURE 6 3D-Printed lucia JIG for deprogramming.

CBCT data can be combined with digital impressions in specialized software. The files obtained from a CBCT are saved as Digital Imaging and Communication in Medicine (DICOM files). Each file represents a single "slice" in the axial plane. When a set of DICOM files is gathered, the result is a tridimensional reconstruction.

Regarding digital impressions, there are different types of files, being the most common the standard tessellation language (STL). It consisted in a mesh of small triangles representing the surface of a body.[9] When DICOM and STL are digitally superimposed, the result is surface and volumetric information of the patient, allowing for a precise diagnosis and planning, especially when implants are going to be placed.[13] After the implant is digitally planned, a surgical template can be designed, exported, and usually 3D printed. This situation links the virtual treatment and the actual patient by accurately transferring the simulated intervention to the oral cavity. This concept is described as static-computer-assisted implant surgery (S-CAIS).[14]

The aim of this manuscript is to describe the diagnostic, planning phase, and clinical procedure of a full mouth reconstruction in a severely worn dentition based on a complete digital workflow.

2 | MATERIALS AND METHODS

2.1 | Diagnosis, planning, and provisional treatment

A 53-year-old male patient with a severely worn dentition leading to impaired occlusal function was referred by his general dentist for an examination. His chief complaint was being unhappy with the esthetics of his smile and having sensitivity in several teeth. Patient revealed inconstant soreness at the posterior region of the masseter muscles bilaterally as well as constant pain at the posterior region of the left temporal muscle. Patient reported muscle fatigue when he wakes up in the morning. He related the habit of regularly drinking carbonated soda for more than 30 years.

Patient's main goal was to stabilize the masticatory function, improve his oral esthetics and recover his self-confidence through a comprehensive oral rehabilitation.

At the clinical examination, the patient presented muscular discomfort in both posterior masseter regions during muscle palpation and a painful nodule in the posterior left temporal region. His mandibular assisted aperture was diminished approximately to 28 mm with a soft end feel. He related discomfort when opening in the left temporomandibular joint region.

Intraorally, there was a total absence of disocclusion guidance leading to occlusal interferences in eccentric mandibular movements by posterior teeth. His dental examination showed a severely worn dentition with dentin exhibition in several teeth, some of them close to having a pulp exposure. Spontaneous and thermal induced sensibility were present in some of them. Tooth #2.6 presented a crown-radicular fracture with a soft tissue invasion over the remaining crown.

Extraoral and intraoral photographs were taken (Figures 1 and 2). Maxillary and mandibular intraoral digital impressions (IOS) and digital bite registration in maximum intercuspation were obtained (Medit i500, Seongbuk-gu, Seoul, Korea).

A set of complementary radiographs consisting of (1) a full mouth periapical set, (2) an orthopantomography, (3) maxillary CBCT, (4) temporomandibular joint (TMJ) computed tomography in: maximum intercuspation, 20 mm aperture and maximum aperture bilaterally, and (5) a tele-radiography with a Rickett's Cephalometric Analysis were requested[15,16] (Figures 3 and 4). All the imageology requested was pondered based on the ALARA principle to get adequate information from different perspectives to get an accurate diagnosis and treatment planning.

TMJ'S CBCT showed a slightly protruded condyle in maximum intercuspation (MIC) bilaterally with a diminished space between the anterior region of the condyle and the inferior surface of the anterior wall of the glenoid cavity. Anterior displacement of right and left condyles was limited, showing a diminished translation of both structures in maximum aperture (Figure 5).

Ricketts cephalometric analysis revealed a diminished VOD with 42° of Ricketts Inferior Third angle (RIT) and an anti-clockwise rotation on the mandible. These findings led to a skeletal Class III. (Figure 6). Patient was referred for periodontal treatment and endodontic evaluation before starting the prosthetic planning phase. His periodontal exam showed a plaque-induced gingivitis that was solved by a prophylaxis and oral hygiene instructions. Endodontic treatment was then performed in teeth diagnosed with irreversible pulpitis.

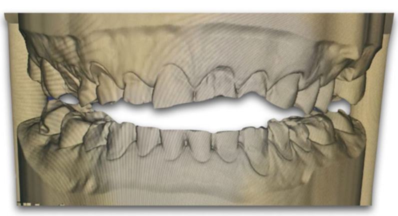


FIGURE 7 Tridimensional digital models. Interocclusal relation after deprogramming with an augmented VOD.

FIGURE 8 Superimposition of standard tessellation language (STL) files over digital photography. Digital wax up (Exocad Smile Creator).

After a comprehensive clinical, photographic, and imaging analysis, new digital intraoral impressions were taken. Bite registration was performed using a leaf gauge. Vertical occlusal dimension was increased by 6 mm, considering the amount of space necessary to restore the superior and inferior abraded incisors. Bite aperture favored the clockwise rotation of the mandible. STL files from digital impressions were imported into a CAD Software (Exocad, Exocad GmbH, Darmstadt, Germany), and a digital Lucia JIG was virtually designed, and 3D Printed (P30, Straumann, Basel, Switzerland). 3D-printed Lucia JIG was rebased intraorally with pattern resin (GC Pattern Resin LS, GC, Tokyo, Japan) and occlusal contacts were checked.[17] (Figure 6) Patient was asked to use the interocclusal dispositive for 72 h. It was indicated to remove it only for eating and oral hygiene purposes. Soft diet was suggested during this phase.

After 72 h, a new intermaxillary digital record was performed with the Lucia JIG in position. Mandible presented in a more posterior position compared to the first bite register. The new interocclusal position was then transferred to Exocad (Figure 7). Extraoral photographs and STL files of maxillae, mandible and the latest occlusal register were superimposed (Exocad Smile Creator, Exocad GmbH, Darmstadt, Germany, Figure 8). Based on this new relation, a full mouth digital wax up was designed to restore the appropriate teeth dimension, shape and interocclusal relationship (Figure 9). Wax up was then exported and upper and lower 3D printed models were fabricated (P30, Straumann, Basel, Switzerland, Figure 10). Based on 3D printed models a mock-up was carried out to corroborate the esthetic proposal (Hydrorise Putty, Hydrorise Light Body, Zhermack, Rome, Italy; Luxatemp Ultra, DMG, NJ, USA). New photographs were taken (Figure 11).

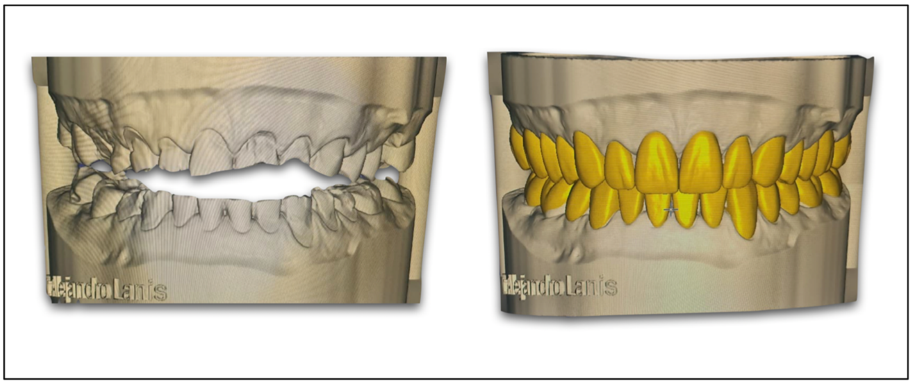


FIGURE 9 Digital wax up.

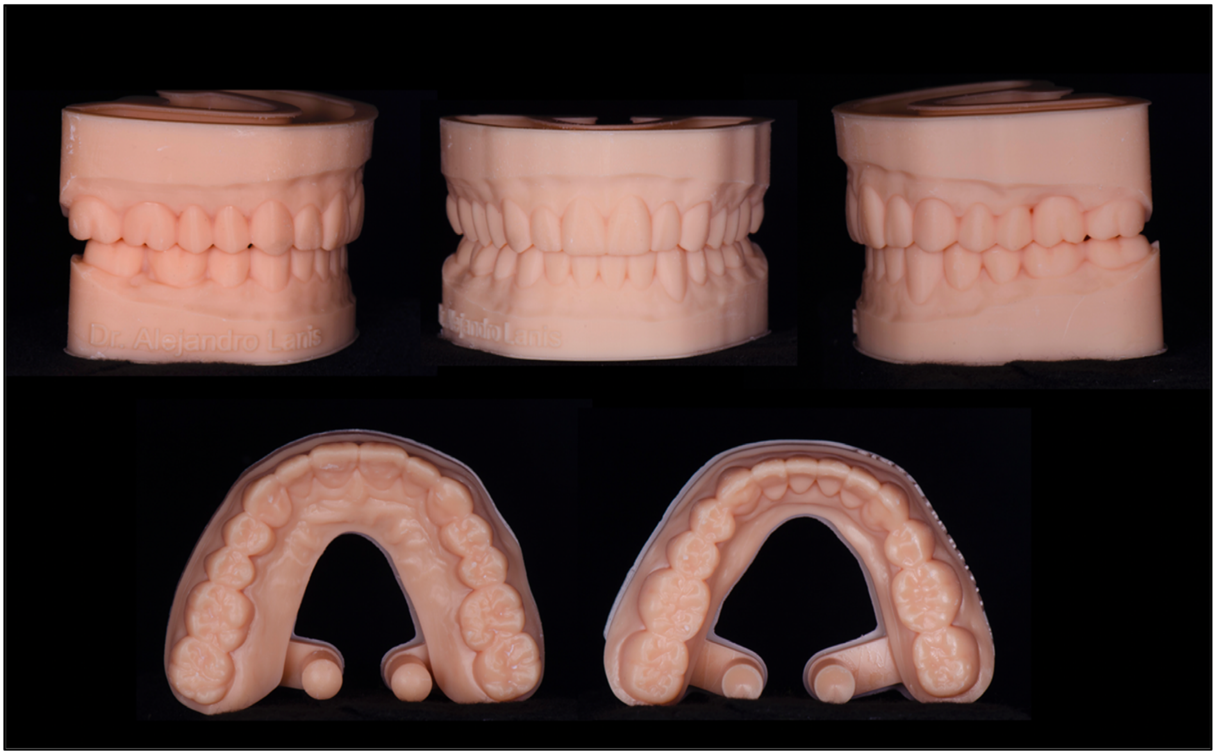


FIGURE 10 3D-Printed models of the digital designed wax up.

After mock-up approval, new indexes were created over 3D-printed models using clear light body silicon (Elite Transparent, Zhermack, Rome, Italy). Adhesive temporization was performed as follows[18] (Figure 12). (1) Each tooth was isolated and etched. (2) Flowable composite resin was injected and polymerized tooth by tooth, starting with upper anterior and lower anterior teeth (canine to canine) to obtain anterior coupling and disocclusion guidance. (3) After occlusal checking, posterior groups were treated similarly. (4) Minor intraoral adjustments were performed (Tetric Evo Flow, Ivoclar Vivadent AG, Schaan, Liechtenstein) (Figure 13). The result was a stable centric occlusion with a mutually protected scheme and augmented VOD. The patient was dismissed and asked to come back for re-evaluation after 3 weeks.

After patient's recall, he was asked for a second tele-radiography with Ricketts cephalometric analysis and second TMJ's CBCT following the same indications as the first one.

The cephalometric analysis demonstrated a change in VOD, showing normal parameters of RIT angle (47°) (Normal range 47 ± 4°). TMJ's CBCT showed a more centric condyle position bilaterally. Both condyles showed an increased displacement during anterior translation in maximum aperture (Figures 14 and 15).

Clinically, the muscular pain and discomfort disappeared, and mandibular-assisted aperture improve up to 43 mm. Intraorally, minor resin wear was perceived, and no mayor findings were observed.

Patient was satisfied with the functional and esthetic outcome of the provisional phase. He also described not feeling muscular fatigue in the mornings anymore relating a better sleeping.

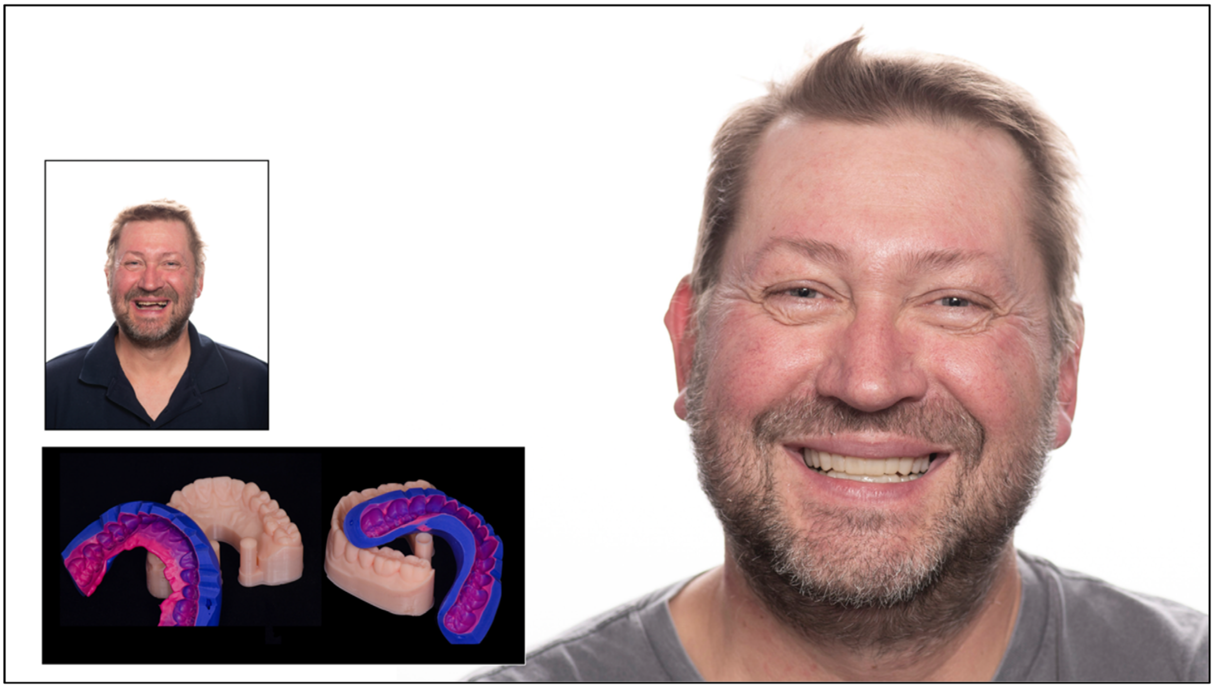


FIGURE 11 Silicon indexes and extraoral photography with mock-up.

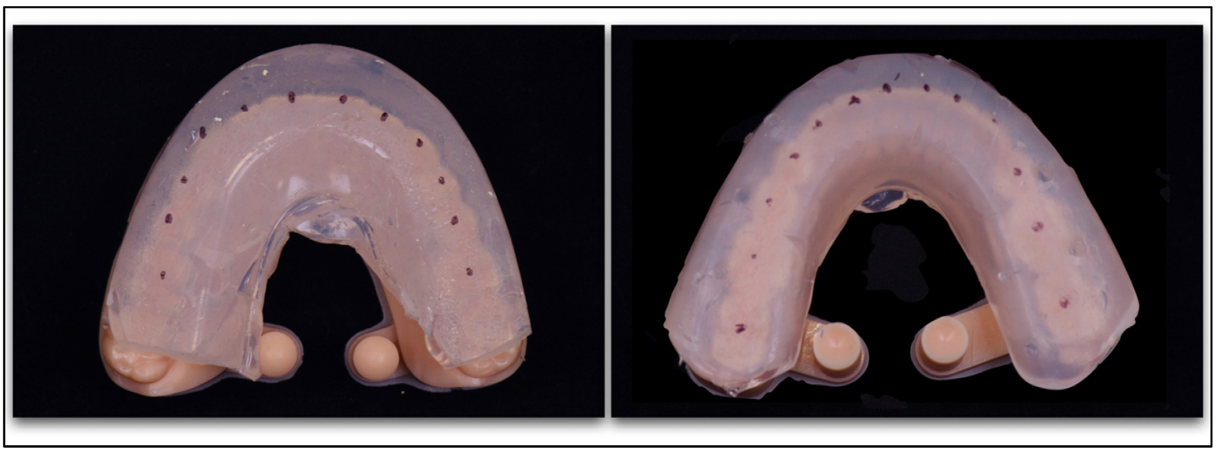


FIGURE 12 Clear silicon indexes over 3D-printed models.

For tooth #2.6, it was decided to do an extraction and immediate implant placement combined with transcrestal sinus floor augmentation.[19–21] Using Codiagnostix Software (Straumann, Basel Switzerland) it was virtually planned to place a 4.1 by 8 mm tissue-level implant. This selection would allow to perform a guided osteotomy until the sinus floor and then perform an osteotome-transposition of it, permitting to place a 12 mm length implant (Figure 16). A surgical template was designed and exported for 3D printing (Straumann TL RN, Straumann, Basel, Switzerland). Socket Sealing Abutment Technique (SSA)[20] was selected to protect the allograft material around the implant. (Maxgraft, Botiss Biomaterials GmbH, Zossen, Germany).

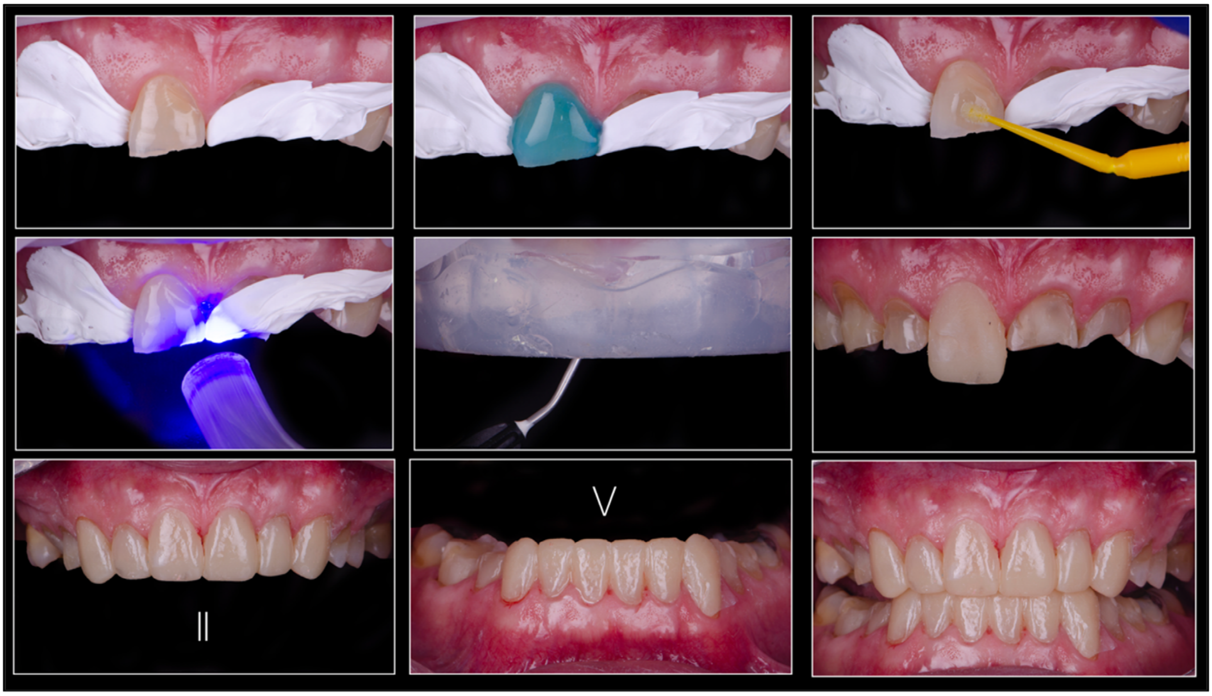
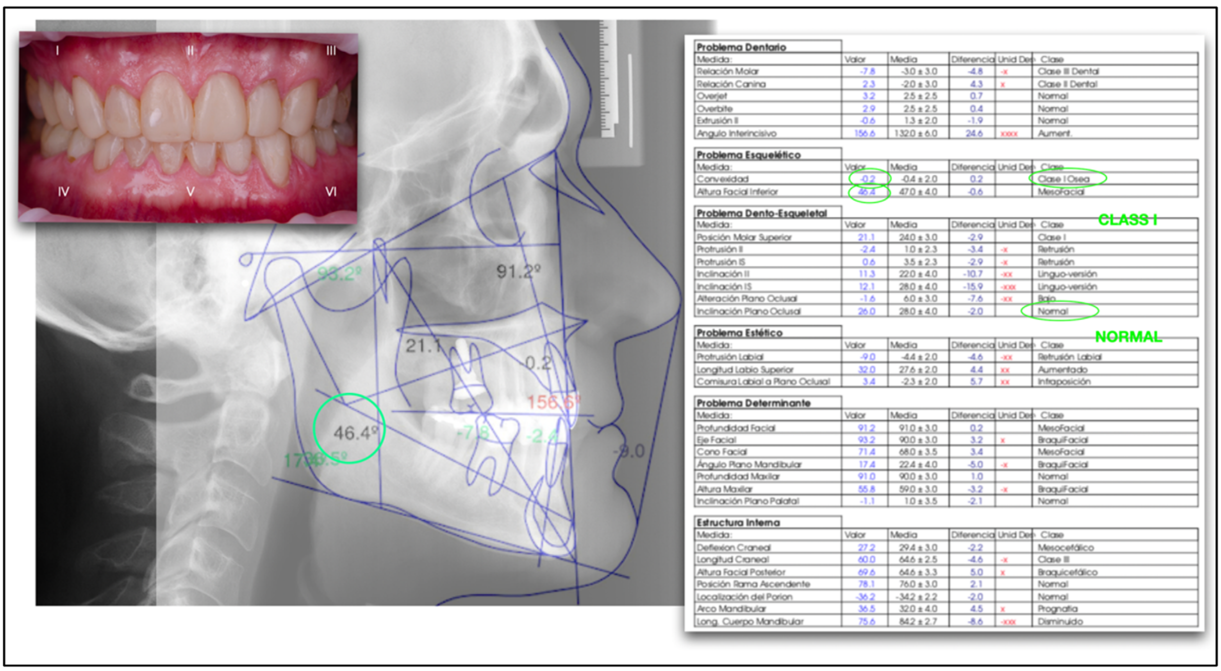


FIGURE 13 Provisional bonding process using flowable composite injected through clear silicon matrix.



Problema Dentario					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Relación Molar	-7.8	-3.0 ± 3.0	-4.8	-x	Clase III Dental
Relación Canina	2.3	-2.0 ± 3.0	4.3	x	Clase II Dental
Overjet	3.2	2.5 ± 2.5	0.7		Normal
Overbite	2.9	2.5 ± 2.5	0.4		Normal
Extrusión II	-0.6	1.3 ± 2.0	-1.9		Normal
Angulo Interincisivo	156.6	132.0 ± 6.0	24.6	xxxx	Aument.

Problema Esquelético					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Convexidad	-0.2	-0.4 ± 2.0	0.2		Clase I Osea
Altura Facial Inferior	46.4	47.0 ± 4.0	-0.6		MesoFacial

Problema Dento-Esqueletal					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Posición Molar Superior	21.1	24.0 ± 3.0	-2.9		Clase I
Protrusión II	-2.4	1.0 ± 2.3	-3.4	-x	Retrusión
Protrusión IS	0.6	3.5 ± 2.3	-2.9	-x	Retrusión
Inclinación II	11.3	22.0 ± 4.0	-10.7	-xx	Linguo-versión
Inclinación IS	12.1	28.0 ± 4.0	-15.9	-xxx	Linguo-versión
Alteración Plano Oclusal	-1.6	6.0 ± 3.0	-7.6	-xx	Bajo
Inclinación Plano Oclusal	26.0	28.0 ± 4.0	-2.0		Normal

Problema Estético					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Protrusión Labial	-9.0	-4.4 ± 2.0	-4.6	-xx	Retrusión Labial
Longitud Labio Superior	32.0	27.6 ± 2.0	4.4	xx	Aumentado
Comisura Labial a Plano Oclusal	3.4	-2.3 ± 2.0	5.7	xx	Infraposición

Problema Determinante					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Profundidad Facial	91.2	91.0 ± 3.0	0.2		MesoFacial
Eje Facial	93.2	90.0 ± 3.0	3.2	x	BraquiFacial
Cono Facial	71.4	68.0 ± 3.5	3.4		MesoFacial
Ángulo Plano Mandibular	17.4	22.4 ± 4.0	-5.0	-x	BraquiFacial
Profundidad Maxilar	91.0	90.0 ± 3.0	1.0		Normal
Altura Maxilar	55.8	59.0 ± 3.0	-3.2	-x	BraquiFacial
Inclinación Plano Palatal	-1.1	1.0 ± 3.5	-2.1		Normal

Estructura Interna					
Medida:	Valor	Media	Diferencia	Unid Desv	Clase
Deflexion Craneal	27.2	29.4 ± 3.0	-2.2		Mesocefálico
Longitud Craneal	60.0	64.6 ± 2.5	-4.6	-x	Clase III
Altura Facial Posterior	69.6	64.6 ± 3.3	5.0	x	Braquicefálico
Posición Rama Ascendente	78.1	76.0 ± 3.0	2.1		Normal
Localización del Porion	-36.2	-34.2 ± 2.2	-2.0		Normal
Arco Mandibular	36.5	32.0 ± 4.0	4.5	x	Prognatia
Long. Cuerpo Mandibular	75.6	84.2 ± 2.7	-8.6	-xxx	Disminuido

FIGURE 14 Lateral tele-radiography with Ricketts cephalometric analysis after temporization.

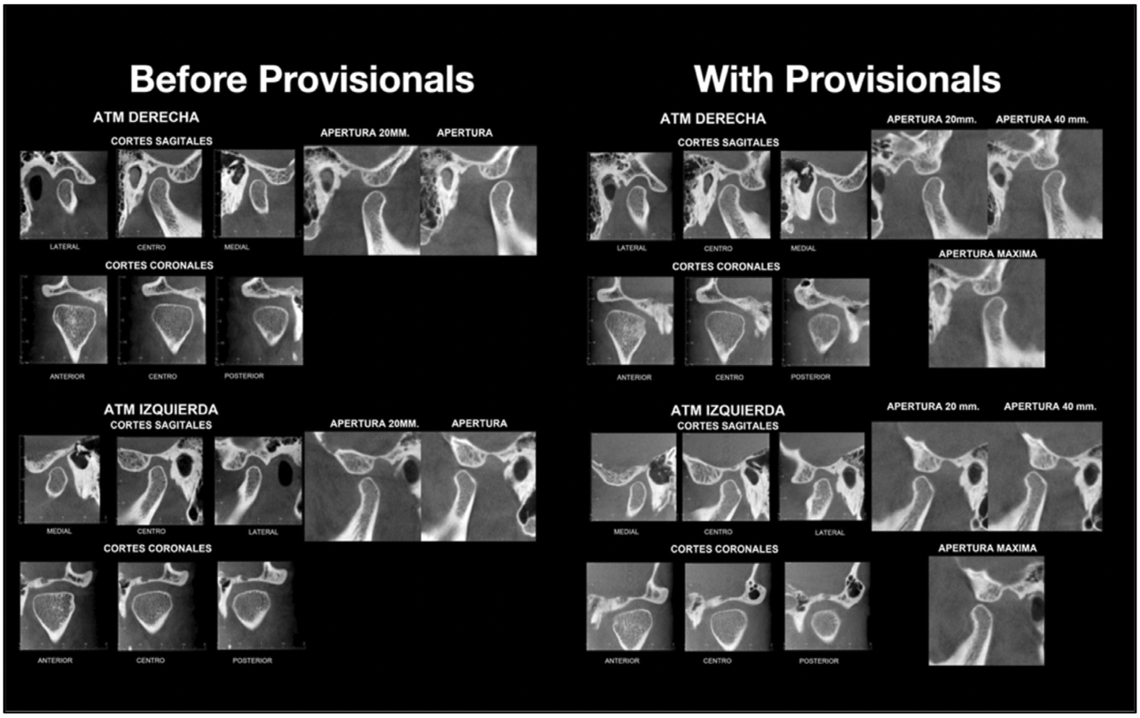


FIGURE 15 CBCT of temporomandibular joints after temporization.

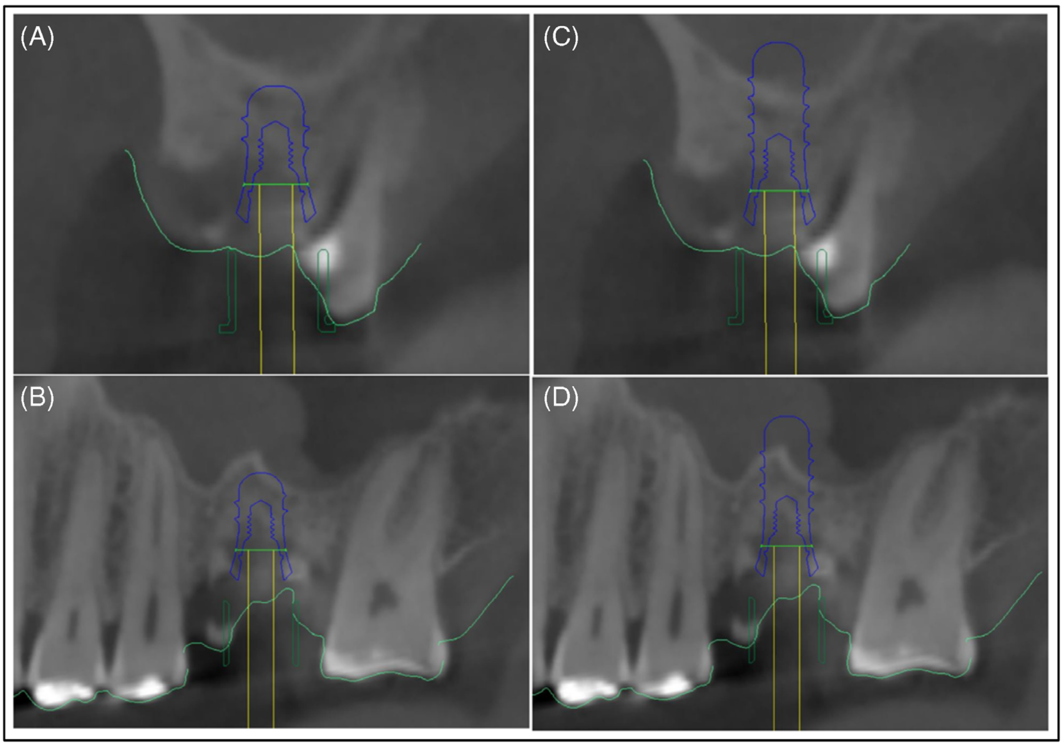


FIGURE 16 Digital Implant Treatment Planning. (A) Transversal view of 8 mm length implant. (B) Tangential view of 8 mm length implant. (C) Transversal view of 12 mm length implant. (D) Tangential view of 12 mm length implant.

2.2 | Definitive treatment

Patient signed an informed consent for the treatment and for the use of clinical images for further educational purposes. The extraction of 2.6 was carefully performed using periotomes for septum preservation. The socket was degranulated. S-CAIS was performed drilling only with a 2.8 mm diameter drill until reaching the sinus floor. Transcrestal sinus floor elevation was then carried out using osteotomes and

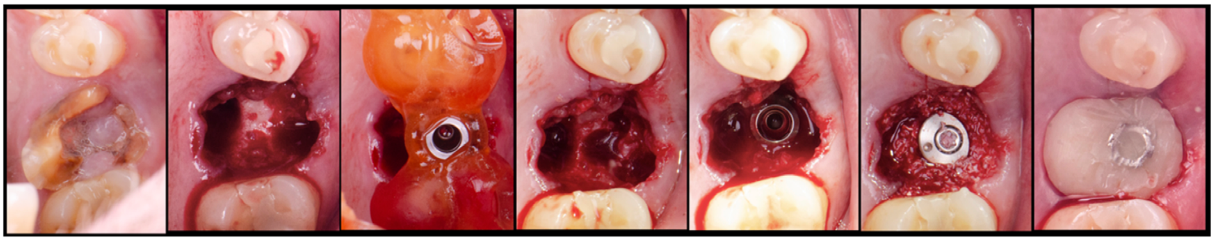


FIGURE 17 Computer-assisted osteotomy and immediate implant placement into the molar septum. Socket seal abutment (SSA) Technique.

FIGURE 18 CAD/CAM anterior lithium disilicate monolithic restorations.

FIGURE 19 Bonding process of anterior CAD/CAM lithium disilicate monolithic restorations.

0,5 cc of allograft for sinus augmentation. Straumann TL RN 4.1 × 12 mm implant was then placed into the alveolar septum and the alveolar gap was filled with the same allograft. Insertion torque was greater than 50 Ncm. Following SSA protocol, a resin-customized healing abutment was installed to seal the grafted socket and maintain the emergency profile of the extracted molar (RN Titanium Abutment,

FIGURE 20 CAD/CAM posterior lithium disilicate monolithic restorations.

FIGURE 21 Intraoral photographs of the initial situation and after treatment completion.

Straumann, Basel, Switzerland, Figure 17) Amoxicillin 875 mg twice a day for 7 days and Ibuprofen 600 mg twice a day for 3 days were prescribed. At 7 and 14 days follow up, patient presented an uneventful healing.[22]

Three months after implant placement, the definitive prosthetic treatment was initiated.

Provisional restorations were utilized as reduction guides for teeth preparation in anterior teeth. Since palatal coupling was necessary, maxillary central incisors, lateral incisors, and canines were prepared for crowns and lower incisors and cuspids for veneers, following the wax-up design. Immediate Dentin Sealing (IDS)[23] was performed (Optibond FL, Kerr Dental, CA, USA). Digital impressions were taken. A bite register was obtained based on posterior bilateral contacts. Vaseline was applied over prepped teeth and mock-up was utilized as short-term provisional.

Digital files were sent to the lab. Impression models were superimposed over the digital wax up and definitive restorations were designed in Exocad. After approval, CAD/CAM Lithium Disilicate structures were milled and stained (IPS e.max CAD LT A2, Ivoclar Vivadent AG, Schaan, Liechtenstein) (Ceramill Motion 3, Amann Girrbach GmbH, Pforzheim, Germany). 3D printed models of the preparations were requested for restorations contacts evaluation and staining.[24,25] (Figure 18).

In the following appointment, mock-up of the anterior teeth was removed. After absolute isolation, maxillary and mandibular anterior restorations were bonded (Variolink Veneer DC Light, Ivoclar Vivadent AG, Schaan, Liechtenstein). No occlusal adjustment was needed (Figure 19).

In the following appointment, posterior mandibular restorations were used as a guide for teeth reduction. Teeth were prepped as

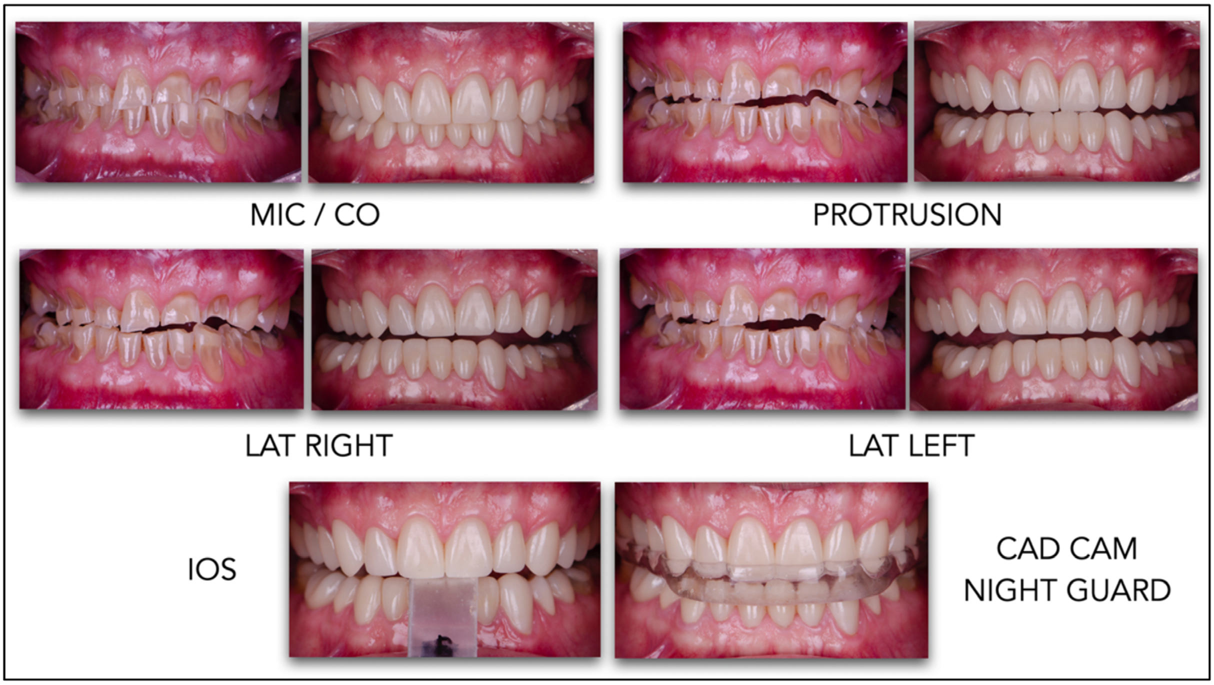


FIGURE 22 Intraoral photographs of the initial situation and after treatment completion in during functional analysis. Nightguard wad digitally designed milled.

FIGURE 23 Initial extraoral photography and after treatment completion photography.

minimally invasive as possible. IDS was performed. Digital impressions were taken, and files were sent to the lab. The same designing protocol as anterior restorations was utilized, and the same material was used. Bys-acril was also used for short-term provisional restorations. In the next appointment, provisional material was removed, and definitive CAD/CAM restorations were bonded (Figure 20). For the posterior maxillary restorations, the same protocol was utilized except for tooth #2.6 where the customized healing abutment was removed at the time of digital impressions. A scan body (TL RN Scan Body, Straumann, Basel, Switzerland) was used to transfer the implant position to the lab digitally. A screw-retained crown was designed to be cemented over a ti-base (TL RN Variobase, Straumann, Basel, Switzerland). The implant crown and all the posterior maxillary restorations were milled using lithium disilicate.

During the following clinical session, maxillary restorations were bonded under absolute isolation and the implant crown was installed and torqued at 35 Ncm. A Teflon plug was inserted to protect the screw and the prosthetic chimney was covered with composite resin (Tetric Evo A2, Ivoclar Vivadent AG, Schaan, Liechtenstein). Minor occlusal adjustments were performed (Figure 21).

Bite was opened 5 mm in the anterior region using a leaf gauge, and upper and lower digital impressions were taken and. New occlusal relation was registered. Files were sent to the lab for a nightguard design and fabrication (ProArt CAD Splint, Ivoclar Vivadent AG, Schaan, Liechtenstein). In the follow-up appointment, no complications were observed. Nightguard was delivered and oral hygiene instructions were given to the patient. Extraoral and intraoral photographs were taken. (Figures 22 and 23).

The patient has been under periodic follow-ups for 30 months without presenting any complications. He has been receiving adequate supportive periodontal treatment every 6 months (Figure 24).

3 | DISCUSSION

Nowadays, it is more and more frequent to find patients suffering from bruxism and it is not unusual to observe abraded teeth and fractured restorations. Heavy bruxism combined with an acid diet could be considered as a dangerous combination to develop dental abrasion and erosion. This situation can lead to functional and esthetic complications and teeth sensitivity.[1] When the amount of dental wear is not compensated by dentoalveolar extrusion, the patient's VOD can

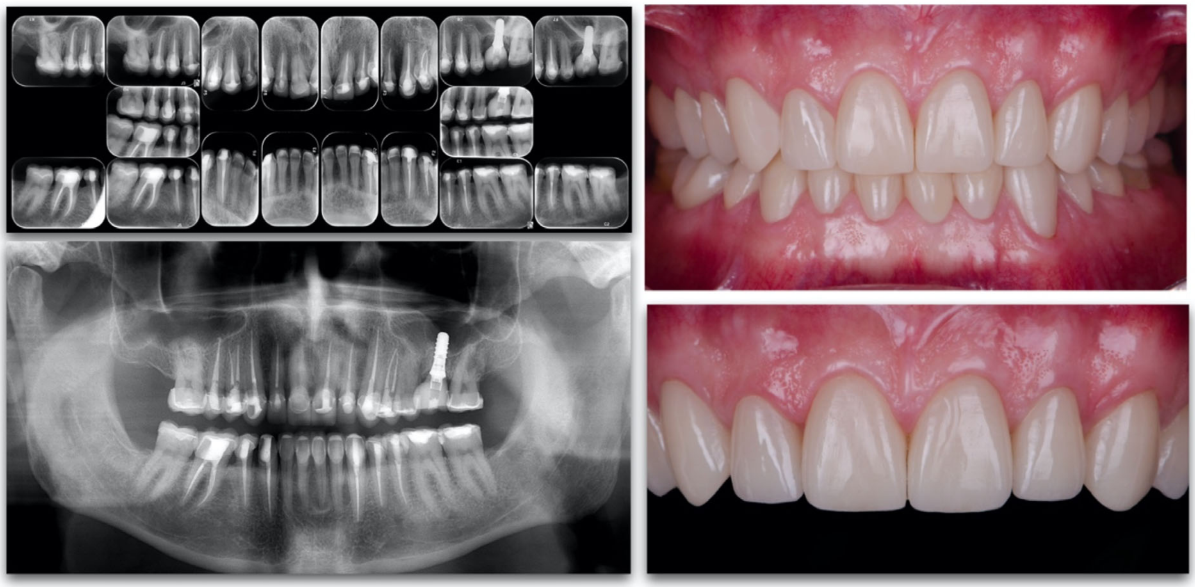


FIGURE 24 Thirty months follow up. Periapical X-rays, orthopantomography and intraoral photos.

decrease significantly and sometimes this phenomenon can affect the TMJ, muscles, and ligaments of the stomatognathic system.[2]

In the described case report, the patient presented with a severely worn dentition and diminished VOD. He related pain and soreness in some of the elevator muscles, and this situation was also observed during the clinical exam. After stabilization of the occlusion and devolution of an adequate VOD with temporary restorations, patients' symptoms disappeared.[2,11] Occlusal stabilization and an adequate vertical occlusal dimension are important factors for an adequate muscle-skeletal function and are considered essential for comprehensive oral rehabilitation. However, when significant changes of the VOD are proposed, it is essential to allow enough time for patient's anatomical structures to get used to the proposed restorative treatment.[11] The use of provisional restorations is a simple and stable way to check if the proposed augmentation of the vertical dimension is inside the boundaries of patient's tolerance, avoiding pain or discomfort after the definitive treatment. Since composite resin is less expensive than ceramics or zirconia, and allows for modifications, it is a reliable material for long-term temporization. However, since provisional structures can be in place for several months, it is mandatory to create appropriate restorative conditions to allow adequate oral hygiene procedures. Digital imaging and CAD/CAM wax up play an important role during this phase.

Since the introduction of CBCT into our field in the late 1990s, digital tridimensional imaging has contributed enormously to dentistry's diagnosis and treatment planning. Information collected from CBCT can be applied for different specialties and nowadays is considered the gold standard for the evaluation of other structures in the maxillofacial area.[3,4,8] In the described clinical situation, tridimensional digital imaging was utilized to evaluate teeth, bone ridges and temporomandibular joints during the different treatment phases.[7] Moreover, the registration of DICOM files obtained from CBCT with STL files coming from intraoral digital impressions allowed for a tailored digital implant treatment planning, allowing to perform a computer-assisted immediate implant placement and a transcrestal sinus elevation based on the use of the molar septum as the main anchorage structure.[5,6] Freehand osteotomy into bone septum can be challenging since implant drills usually slip and eventually can break the remaining bone, making the installation of the implant unfeasible. Therefore, S-CAIS can be very helpful in avoiding intraoperative complications when utilizing this approach.[9–11]

Modern oral rehabilitation is based on the combination of conservative restorative techniques and the use of digital technologies to support the design and fabrication of prosthetic structures.[12] The evolution of adhesive dentistry in the last decade is changing how restorative procedures are performed and shifting how teeth are prepared to retain prosthetic structures.[13,14] In the described clinical situation, minor teeth preparations were performed and adhesive protocols were strictly followed to bond reinforced ceramic restorations. Additionally, all data acquisition, treatment planning, designing and manufacturing of prosthetic structures was conducted based on the use of a digital workflow using specialized software and hardware.[15–26] Thus, CAD/CAM dentistry contributed to restoring a highly deteriorated oral and muscle-skeletal system in a precise and fast manner, optimizing the whole treatment process.

4 | CONCLUSIONS

An appropriate knowledge on dental erosion and oral rehabilitation are very important factors to perform an adequate dental treatment in cases like the described situation. Moreover, the combination of those skills with digital dentistry could lead the clinician to deliver a faster, accurate and predictable non-invasive restorative treatment in cases with severely worn dentition where complex full oral rehabilitation is needed.

DISCLOSURE

Authors disclose no conflict of interest in any of the products, instruments, and technologies described in this article.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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