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Case Report

Adaptation Skills and Temporomandibular Joint Neutrality: A Case Report of a Failed Orthognathic Surgery Intervention

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Abstract: The present study describes the case of a severe surgical complication in a 42-year-old female patient undergoing bimaxillary orthognathic surgery for the correction of skeletal class III, where a detachment of the surgical plates and fibrous healing of the palatal suture occurred. The aim of this study was to enlighten two important concepts: (I) how occlusal and mandible position changes can be well tolerated by the temporomandibular joint even in the case of a failed orthognathic surgery; (II) how a prosthodontic approach based on the search for occlusal stabilization made it possible to manage a complicated clinical case. Clinical Presentation: Clinically, the patient presented an occlusal instability and a split and mobile maxillary bone with respect to the cranial base. The case was resolved using full-mouth prosthodontic rehabilitation to fix the occlusal instability and guide maxillofacial surgeons, establishing the new occlusal position during an orthognathic reintervention. Clinical Relevance: The function was reestablished independently on any treatment planning centered on the temporomandibular joint repositioning concepts. However, although neuromuscular plasticity and the patient's adaptation skills can explain the clinical success in such complex rehabilitations, these findings must be interpreted with caution due to the limited generalizability inherent to the study's design.

Keywords: orthognathic surgery; oral rehabilitation; prosthodontics; orthodontics; temporomandibular joint; occlusion

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1. Introduction

The demand for complex rehabilitations in dentistry has increased over the course of recent years thanks to the improved knowledge on the predictability of extensive prosthodontics and orthodontics procedures. On top of that, orthognathic surgery is needed as part of the standard of reference approach to the correction of dentofacial deformities that cannot be solved with the use of conventional orthodontics, such as malocclusions owing to skeletal problems, cleft lip and palate, hemi-facial microsomia, and post-traumatic jaw deformities and malocclusions [1–4]. In this scenario, the digital articulation of dental models is gradually replacing the conventional physical approach for occlusal prediction planning [5]. While traditional surgical planning is based on the use of manual models, photographs, and two-dimensional radiographs, virtual surgical planning introduced the advantage of three-dimensional (3D) imaging and digital models [6]. Although in terms of operating time, no significant difference was reported between conventional and virtual surgical planning [7], digital technologies have improved the efficiency and accuracy of surgical treatment and reduced the planning time, resulting in reduced costs and improved clinical outcomes [6]. In recent years, alongside the conventional treatment plan, where

the surgical intervention is generally performed between a preparation and a finalized orthodontic phase, a surgery-first approach (SFA), performed before starting the orthodontic treatment, has been proposed [8]. The majority of orthognathic surgeries require a combined maxillary and mandibular intervention, and despite the diffusion of such approaches, the risk for either surgical or occlusal/orthodontic unsuccess is not negligible [2,9–13]. Interestingly, not much focus has been placed on the potential role of predetermined condylar or neuromuscular strategies to determine long-term clinical success. This seems to suggest that individual adaptation skills and neuroplasticity, more than positional ideality, play an important role in favoring function after major occlusal changes, such as those occurring in the case of orthognathic surgery.

The present paper describes the case of a female patient undergoing a failed orthognathic surgery intervention with detachment of the surgical plates after a Le Fort 1 procedure and fibrotization of the palatal suture. Full-mouth prosthodontic rehabilitation was adopted as a strategy to fix the subsequent occlusal instability and ease a surgical reintervention. Although the choice of the proposed prosthodontic approach is questionable, not representing the first choice in the case of reintervention, the aim of this case report was to point out that the stomatognathic function was restored independently on any temporomandibular joint (TMJ)-related planning and that the patient never reported any temporomandibular disorder (TMD) symptoms, thus offering an interesting background for discussing the reasons for such neutrality of effects.

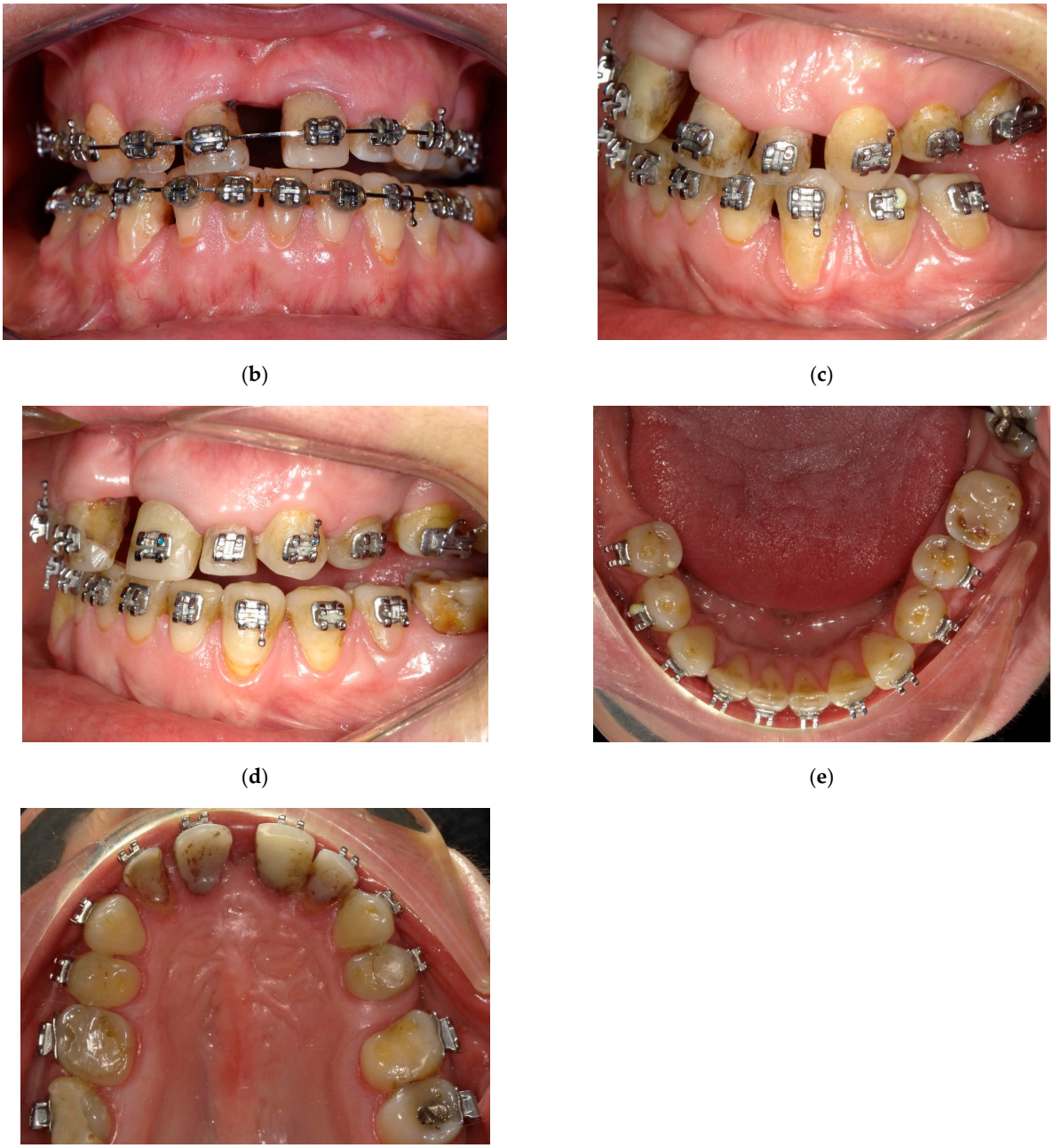
2. Case Report

2.1. Patient's Complaint

In January 2023, a 42-year-old female came to our observation unit at the School of Dentistry, Department of Medical Biotechnologies, University of Siena, Siena, Italy. She complained of occlusal instability after undergoing bimaxillary orthognathic surgery in October 2019 for the correction of skeletal class III followed by orthodontic treatment (Figure 1a,b).

(**a**)

Figure 1. *Cont.*



(**b**) (**c**)

(**d**) (**e**)

(**f**)

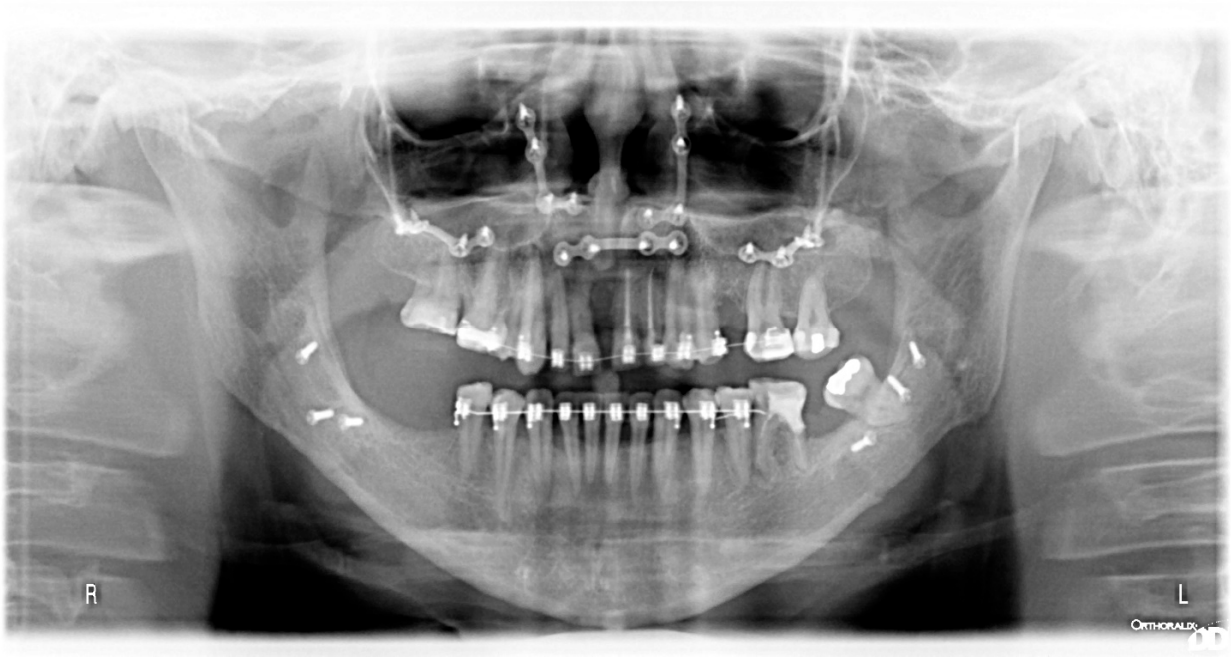
Figure 1. (**a**) The patient before undergoing bimaxillary orthognathic surgery to correct class III. (**b**–**f**) The patient three years after the orthognathic surgery. The patient had severe instability of the maxillary bone, with two hemiarches that seemed partially mobile with respect to the rest of the cranial bones. There was occlusal contact only on the left canines.

2.2. Case History

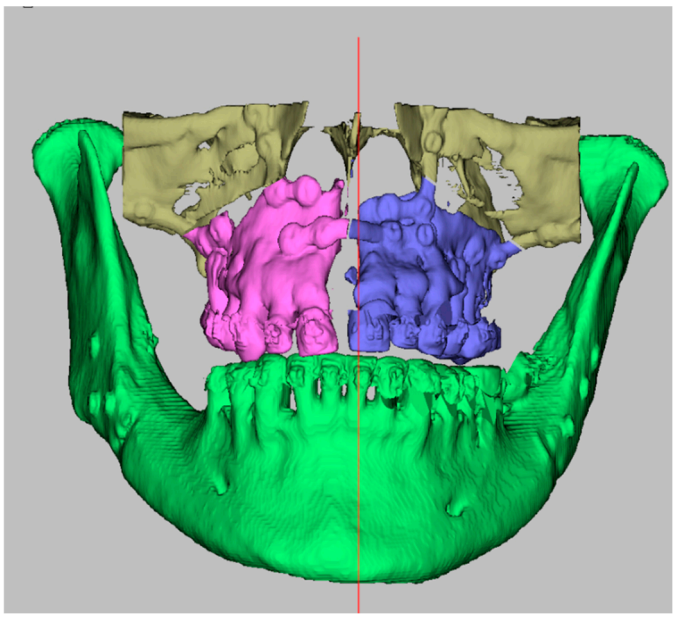
The patient presented a bilateral detachment of the surgical plates that were deemed to fix the surgical Le Fort I fracture and a lack of bone formation in the surgically fractured palatal suture. This led to maxillary instability. The treating orthodontist did not recognize the severity of the surgical complications and proceeded with bracket positioning anyway, likely in an attempt to stabilize the occlusion. Brackets were still in situ (Figure 1b–f). More than three years after the surgical intervention, the patient had completely unsteady occlusal contacts with a unique cusp-to-cusp contact on the right canines in maximum intercuspation (Figure 1b) and with an absence of contact in all of the left teeth (Figure 1b,c).

Upon touch, both hemimaxillae moved markedly and were still separated from each other and from the cranial bone. We can assume that the complete relapse was due to the failure of plate fixation screws, which then led to unstable positions of the maxillary hemiarches after surgery and the consequent fibrotization of the palatal suture.

At the computed tomography (TC) examination, it emerged that the upper central incisors were separated by 3 mm, and an area of fibrous healing was evident as a result of the sagittal midpalatal osteotomy (Figure 2a,b). The patient requested several previous consultations after realizing that the treatment had not been successful. However, she did not receive any reassurance about the possibility of reintervening with safety and predictability.



(**a**)



(**b**)

Figure 2. (**a**,**b**) The central incisors were separated by 3 mm, and an area of fibrous healing was evident as a result of the sagittal midpalatal osteotomy.

2.3. Prosthetic Phase

In February 2023, the patient accepted to receive a full-arch fixed provisional in the maxillary arch to help maxillofacial surgeons to reintervene and find a stable occlusal position in the surgical room (Figure 3a–c).

(**a**)

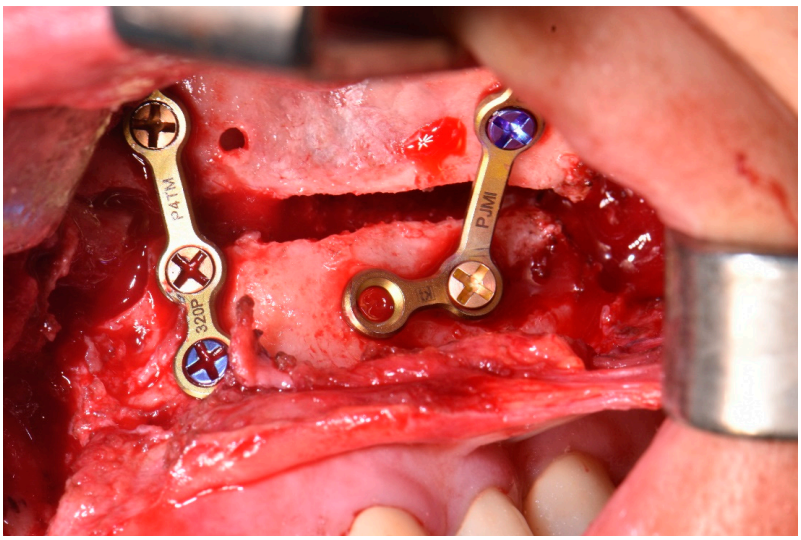
(**b**)

(**c**)

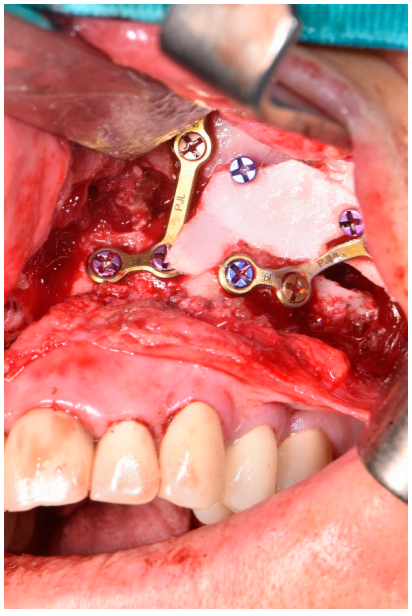
Figure 3. (**a**–**c**) The patient with a full-arch fixed provisional in the maxillary teeth to help the maxillofacial surgeon reintervene and find a stable occlusal position in the surgical room.

2.4. Surgical Phase

In July 2023, a surgical intervention was performed on the maxillary bone (Figure 4a,b). The bone defect, filled with fibrous tissues, was evident between the maxilla and the cranial bones as well as between the two hemimaxillae (Figure 4a). Autologous bone blocks with titanium screw fixation were used to partially close the gaps and ease the regeneration (Figure 4b). New titanium surgical plates were positioned to stabilize the maxillary bone segments by using the occlusion on the provisional as a reference guidance. The post-op course was uneventful. In September 2023, the inferior teeth were also prepared, and a new provisional was inserted in the upper arch. After uneventful monitoring for six months, definitive restorations were delivered by using the provisionals as templates (Figure 5a–f).



(**a**)



(**b**)

Figure 4. (**a**,**b**) Surgical intervention steps.

Figure 5. (**a**–**f**) The patient after a full-arch provisional in the lower area and a new one in the upper area were put in place to stabilize the maxillae after the surgery.

3. Discussion

The study of inter-arch relationships has always been a fascinating topic for dentists, who often focus on the search for occlusal perfectionism at the end of an extensive full-mouth rehabilitation. Occlusal theories are often accompanied by convergent theories on the corresponding condylar position according to the old precepts of form-to-function ideality [14]. For decades, dogmas centered on centric relation concepts have permeated teaching activities and clinical practice, until evidence in support of the lack of biological value of centric relation emerged [15,16]. On the other hand, extensive changes such as

the skeletal and occlusal modifications associated with orthognathic surgeries are usually accommodated well by the stomatognathic system, as testified by the well-established practice of combining orthodontics and surgery [17–20]. Indeed, patients normally adapt to the new inter-arch position without the need for instrumentally or manually driven planning procedures based on the identification of a specific centric relation. In spite of that, from a practical perspective, there are situations in which the lack of occlusal references makes it necessary to establish a new orthopedic reference position. As recently pointed out, these cases are mainly limited to situations of severely worn dentition and immediate positional shifts in the mandible, of which orthognathic surgery is likely the typical example. In these cases, growing evidence suggests that there is no superiority of any recording procedures over the others in terms of either technical reproducibility or clinical success [21].

In the case under discussion, one of the worst possible combinations of orthognathic surgery complications occurred, i.e., a bilateral detachment of surgical plates that were deemed to fix the surgical Le Fort I fracture and a lack of bone formation in the surgically fractured palatal suture.

Such a severe relapse of bone segment fixation has been rarely described in the literature. Indeed, most reports on orthognathic surgery complications have focused on rare occurrences of vascular injures (e.g., hemorrhage, thrombosis, and false aneurysms), ophthalmic complications (e.g., oculomotor nerve palsy, abducent nerve palsy, and tearing alterations), nerve complications (e.g., cranial nerves disturbances, nerve exposure, and Frey's syndrome), osteonecrosis of the maxilla, and infective complications [2,9–13,22]. However, post-surgical stability and relapse may depend on a multitude of factors, such as pre-surgical factors (e.g., surgical first approach) [23,24], surgical factors (e.g., the magnitude of jaw movement, condyle position in the glenoid fossa, the method of fixation, and the surgeon's expertise) [25–27], post-surgical factors [28], and patient-related factors (e.g., psychological state and neuromuscular adaptation) [29–32]. Based on these premises, it is clear how multidisciplinary teamwork is fundamental to manage such a complicated surgery. In addition, it is worth mentioning that technological advancement in the field of orthognathic surgery works to improve both patient outcome and surgical planning and intervention. Virtual planning, 3D printing, and custom splints enable the creation of precise surgical models, achieve greater precision, and reduce the risk of complications and relapse [29].

Except for Bedor-Samuel et al., who reported a case of avulsion of the left hemimaxilla in a young male [33], to our knowledge, a complete relapse of both bilateral Le Fort and palatal fixations has never been reported. On the other hand, this undesired event does not represent the most peculiar feature of this case report. Indeed, in a standard orthognathic case, where the teeth are kept in position by the brackets positioned during the pre-surgical orthodontic phase, the orthodontically maintained inter-arch relationship can be used as a guide to fix the maxilla during the surgical reintervention. Such a possibility was not an option in this case.

This leads to the conceptual discussion of some important clinical issues. However, it is very important to bear in mind that the statements of this case report must be interpreted with wariness and do not allow for any generalizations as they have only been taken by a single case. First, it must be remarked that so-called surgery-first approaches to orthognathic cases should be appraised with care. An SFA has been proposed to treat skeletal class III dentofacial deformity [34]. The final long-term outcomes of the maxillofacial and dental relationship do not seem to be significantly different compared to the cases performed after an orthodontic-first approach, but with the advantage of potentially reducing time consumption [35]. Despite being fascinating and attractive for the potential favorable

outcome of the patient's compliance, especially due to the avoidance of the negative esthetic appearance that is often associated with the phase of orthodontic decompensation, the technique has a very tight margin of error and correction if something goes wrong with surgical fixation. Indeed, bracketing the teeth offers much more predictive post-surgical stabilization via dental occlusion [10].

Second, the patient came to our observation unit after three years of unsuccessful orthodontic treatment, which likely contributed to the instability, and we did not plan a team strategy with the surgeons to ease reintervention. The mobility of the bone bases was such that a precise occlusal stability key would have been needed. Occlusal stability did not exist because the patient only had contact on one canine, and it was not possible to proceed with new pre-surgical stabilizing orthodontics because all references had been lost. Therefore, the strategy of adopting a maxillary full-mouth provisional restoration seemed to be a potential option in this case to bypass the problem of occlusal instability. After the surgery, the occlusion was assessed with the aid of chewing papers in order to verify the presence of homogeneous contacts on the occlusal plane. The reason why we did not focus on a more detailed assessment of the occlusion is because the evidence does not support a correlation between the occlusion and TMD, and it also does not support the repeatability of occlusal analysis [36]. So, the improvement of the occlusal contacts to a more uniform and stable distribution was considered successful.

Third, from the perspective of warranting a stomatognathic function, the adaptation to this new inter-arch relationship was uneventful. According to the best evidence consensus statement, a stomatognathic system has the ability to adapt to occlusal changes caused by orthodontic treatment, orthognathic surgery, and the use of a mandibular advancement device [17]. Moreover, brain neuroplasticity permits the adaptation of the stomatognathic system to a moderate change in the occlusal vertical dimension (OVD) [37] and complex prosthodontics rehabilitation, even in patients with edentulism [38]. However, how a patient reacts to such treatments is subjective. According to Imhoff et al., occlusal dysesthesia may occur as the result of maladaptive signal processing after extensive treatments [39]. However, a patient's reaction can even be influenced by the concurrent presence of orofacial pain (e.g., craniofacial neuropathic pain) [40], and psychological factors are able to influence pain perception and discomfort [41,42].

TMDs are a heterogeneous group of disorders affecting TMJ and masticatory muscles [43]. Therefore, this multifaced nature requires a multidisciplinary approach, and a detailed differential diagnosis is recommended [44]. The etiology is multifactorial, including biological factors, psychosocial factors, biomechanical factors, and systemic diseases [45–47]. However, current evidence confirms the absence of a proven causal correlation between TMDs and occlusal factors [48,49].

The clinical results of this case report are in line with the data in the literature which, on the one hand, highlight the absence of a correlation between occlusion and TMDs [14], and on the other hand, underline how orthodontics plays a neutral role in the onset and worsening of joint and/or muscle pathologies of the temporomandibular joints [15]. In an era in which the old dogmas on centric relation, ideal condylar position, and electromyographic parameters are being progressively abandoned [16,50–52], this case supports that neuroplasticity and the patient's psychological attitude and individual adaptation skills can be key factors to explain the clinical success of extensive rehabilitations in terms of the patient's complaints [53–55]. This concept aligns with the literature on the predictors for treatment success in dysfunctional patients [56,57].

Despite the significant clinical complications and the related inconsistencies in the treatment plan, the observation that the patient did not experience any signs or symptoms

of muscle or TMJ pain and dysfunction adds to the empirical evidence in support of a simplified approach to the management of dental occlusion in clinical practice [14].

The present study has some limitations. Firstly, our findings should be interpreted with caution since they are based on the observation of a singular clinical case that cannot allow for objective conclusions to be drawn, especially since it is such a peculiar case. Secondly, the use of a full-arch provisional as an appliance to find a stable position before orthognathic surgery is questionable. Thirdly, the assessment of TMJ adaptation was clinically based, considering the experience of signs and symptoms of pain and dysfunctions related to the muscle or TMJ. However, as supported by a recent international consensus on good clinical practice for the management of TMDs, the diagnosis of TMDs in clinical and imaging assessments "should only be performed when it has the potential to the impact of diagnosis or treatment" [52,58]. In this case report, the absence of any complaints and dysfunctions and the lack of TMJ-related imaging collected before the first orthognathic surgery did not justify the execution of further imaging examinations. Finally, it is worth mentioning that due to the limited scientific evidence available to support the claims of this case report, more comprehensive studies, which include a standardized approach of investigation and an instrumentally based assessment of TMDs, are recommended to improve the quality of understanding on this topic.

4. Conclusions

This specific case is a major example of a severely compromised scenario in orthognathic surgery. Three years after undergoing a surgery-first approach, the patient came to our observation with a split and mobile maxillary bone and severe occlusal instability. An in-mouth procedure to fix the inter-arch occlusion with provisionals was adopted to guide maxillofacial surgeons in fixing the new position during a reintervention. The patient adapted well to the procedure, featuring an uneventful post-intervention course. Within the limitations of this study and the lack of comprehensive conclusions, this case report shows how individual adaptation skills and neuromuscular plasticity, without ideal centric relation-driven occlusal planning, can explain clinical success in extensive rehabilitation procedures.

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Informed Consent Statement: Informed consent was obtained from all individual participants included in this study.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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