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Acute anterior open bite: Case report and review of the literature

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ABSTRACT

Acute malocclusion outside the setting of macrotrauma is rare and therefore difficult to manage. Although some cases of acute malocclusion have been reported in the literature, to the authors' knowledge, there has been only one report of an acute anterior open bite. The authors review the current literature on acute malocclusion, with a focus on anterior open bite. A case of an acute-onset anterior open bite is reported, where a systematic workup with an emphasis on patient function is performed to narrow the differential diagnosis to one of an intra-articular etiology. Arthroscopic lysis and lavage with maxillomandibular fixation was performed to achieve restoration of the permorbid occlusion, which was maintained for at least 1 year.

Introduction

Acute malocclusion can be caused in many ways, including mid- and lower facial fractures. Even when there is no fracture, traumatic injuries to the face occasionally produce intracapsular temporomandibular joint (TMJ) effusion or hemarthrosis. Other etiologies of acute malocclusion include repeated subluxations of the mandible, internal derangements of the TMJ, rapidly progressing condylar degeneration, and very occasionally, masticatory muscle spasm [1]. In addition, significant occlusal changes can occur as a result of iatrogenic causes such as inappropriate use of partial-coverage oral appliances. Malocclusions can occur immediately after the triggering event, or progressively within days to months. They can manifest in different forms, and the specific features are generally dependent on the underlying etiology.

While the etiology of an acute malocclusion is usually easily identified, some can be elusive and present challenges in diagnosis and management. We present a case of an acute-onset anterior open bite with equivocal clinical findings that required extensive workup based on a combination of historical report, imaging, and functional analysis in order to reach a diagnostic conclusion.

1. Case report

A healthy 23-year-old female presented with a sudden-onset anterior open bite after a prolonged dental procedure. She denied any prior history of symptoms in the TMJ or muscles of mastication, known parafunction or any treatment since onset of symptoms. She denied any particular alleviating or aggravating factors. On examination, she had normal and symmetrical mandibular range of motion with soft end-feel during passive opening. Palpation revealed no joint noises and no tenderness of the bilateral TMJ lateral poles or

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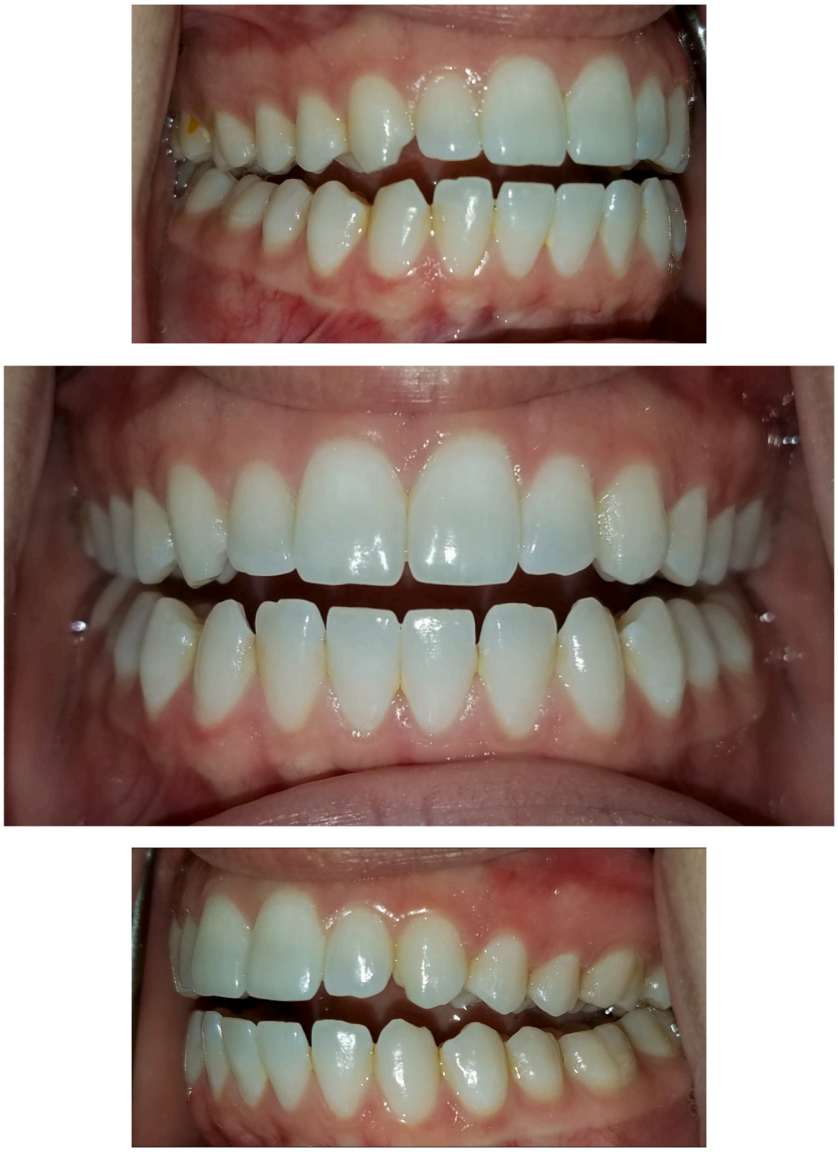

Fig. 1. Occlusion on presentation. A. Right side view. B. Frontal view. C. Left side view.

retrodiscal areas. There was mild to moderate tenderness to palpation of the right masseter muscle near the insertion along the mandibular angle. Intraorally, there was an anterior open bite of approximately 4mm, with contacts only in the second and third molars (Fig. 1). A panoramic radiograph was unremarkable except for very mild flattening of the bilateral condyles, and both condyles showed a distinct cortical outline. A cone-beam computed tomography (CBCT) scan from an outside provider demonstrated minimal to mild degenerative changes of the bilateral condyles and no other remarkable findings. Hand-articulation of the study models demonstrated that prior to this incident, the patient had stable bilateral posterior occlusal contacts with an anterior vertical overlap of 1mm (Fig. 2).

Given the history of a prolonged dental visit immediately prior to the onset of symptoms, demonstration of normal and symmetrical mandibular range of motion with no intra-articular pain or TMJ sounds, and an absence of acute changes on imaging, a presumptive diagnosis of malocclusion of muscular etiology was made. A trial course of muscles relaxant (cyclobenzaprine) was prescribed. Two months after her initial presentation, the patient continued tolerating cyclobenzaprine poorly and showed no improvement of her inter-occlusal relationship. The results of her initial examination remained unchanged, as she continued to have normal, symmetrical, and painless mandibular range of motion without any joint sounds, and with a 4mm anterior open bite.

The patient grew increasingly distressed about the lack of progress with management of her condition, and with the lack of a clear diagnosis. She also expressed fear of receiving any further dental treatments as a result of the incident. Given the lack of response to therapy directed to the masticatory musculature, further investigation into an intra-articular etiology was made utilizing magnetic

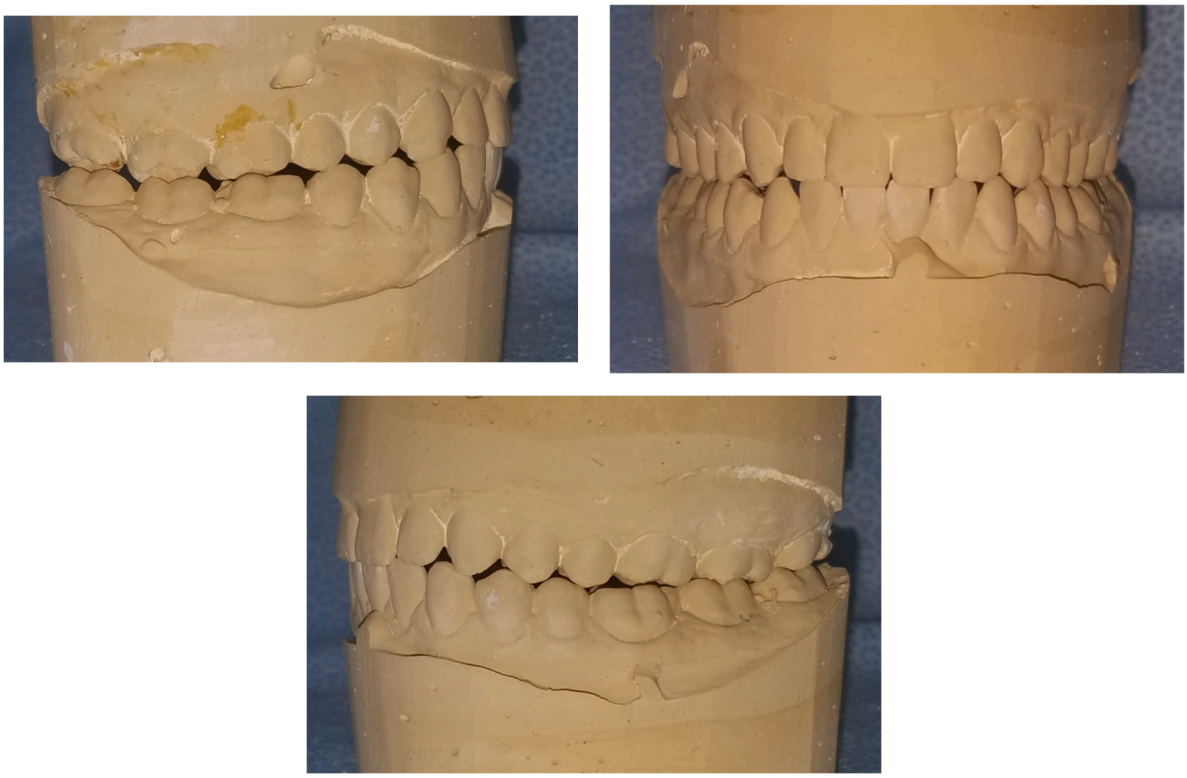

Fig. 2. Hand-articulated study models showing stable intercuspation and positive anterior vertical overlap. This occlusal relationship was consistent with the patient's recollection of her premorbid occlusion. A. Right side view. B. Frontal view. C. Left side view.

resonance imaging (MRI) of the TMJ. Those images showed minimal bilateral anterior displacement of the articular discs (Fig. 3), with normal mandibular translational movements and no effusion. There were no significant findings that would satisfactorily explain her anterior open bite.

Since no source for this acute anterior open bite had been established, it appeared that management options would need to be directed at the persisting malocclusion. The conventional approach would therefore be to first ensure that the malocclusion was stable before taking any action to correct it, which would preferably require a period of several months. Then it could be possible to correct the inter-occlusal relationship with either nonsurgical or surgical procedures such as enameloplasty, orthodontics, mandibular orthognathic surgery, or some combination of these modalities. However, before proceeding in that direction, it was decided to perform a "functional TMJ examination" under anesthesia to further explore the possibility of an intracapsular etiology. This procedure included occlusal examination under anesthesia to further rule out a muscular etiology. If no resolution was observed, this would be followed by an arthroscopic bilateral TMJ examination with lysis and lavage. Because an intra-articular cause was suspected, direct observation of the superior joint space would enable the surgeon to determine what might be the anatomical problem preventing complete closure of the mandible. The patient agreed with this approach.

After induction of anesthesia, the patient's inter-occlusal relationship was immediately assessed and was noted to be unchanged. This observation strongly suggested a non-muscular cause, as the patient was fully induced with neuromuscular blockade. While this didn't necessarily rule out soft tissue scarring (which wouldn't be expected to resolve with neuromuscular blockade), the immediate onset of the anterior open bite with no subsequent changes (as may be expected during the scarring and contraction process) lowered the probability of soft tissue scarring as a primary cause. Also, because positive ruling out of soft tissue scarring (especially in the absence of obvious findings on MRI) involves surgical exploration, the authors deemed this approach impractical due to the anticipated risk versus benefit, especially in the setting of low clinical suspicion of scarring. The next step involved bilateral arthroscopic examination including lysis and lavage. The purpose of this procedure was to carefully inspect the superior joint space for any intracapsular derangements that could explain the observed malocclusion, and also to see if any occlusal change would be observed as a result of the procedure. Inspection of the superior joint spaces revealed normal to mild anterior displacement of the articular discs, minimal to no hyperemia, and no obvious tenacious adhesions or deformities that could readily explain the malocclusion.

Despite the lack of any visible objective findings, after completion of the arthroscopic lysis and lavage the patient's dentition was noted to passively occlude into maximum intercuspation with a positive anterior vertical overlap identical to that achieved with hand articulation of her study models (Fig. 4). This did not involve or require any manipulation, and was completely passive. This suggested an intra-articular etiology involving soft tissues that were interfering with the ability of the condyles to reach full closure, although the exact anatomic details of the internal derangement could still not be determined. However, the findings did rule out soft tissue scarring

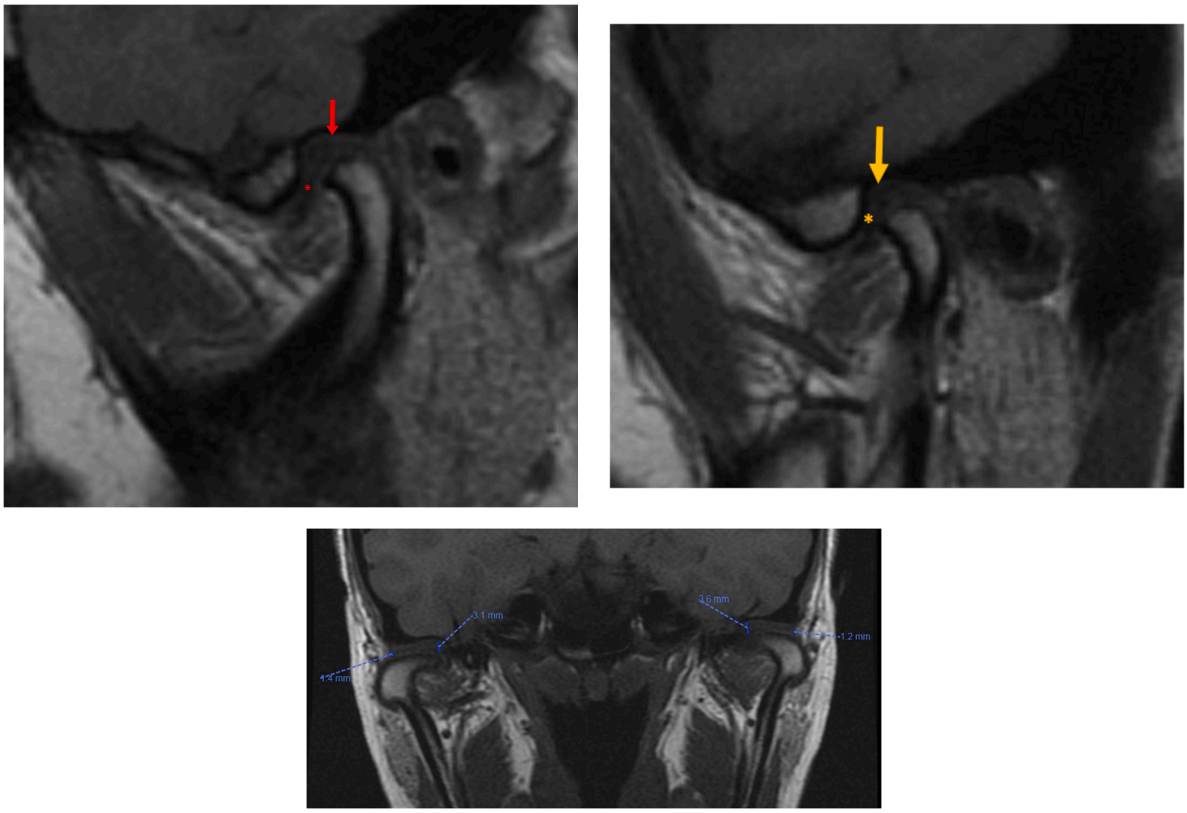

Fig. 3. T1 weighted MRI views. A. Right sagittal view showing mild anterior displacement of the disc (red asterisk). Junction of the disc and retrodiscal tissue marked with red arrow. Mild degenerative changes also seen in the condyle. B. Left sagittal view with similar findings as the right side (yellow asterisk on disc, yellow arrow pointing to junction of disc and retrodiscal tissue). C. Coronal view showing normal appearing position of the discs (measurements of thickness at the medial and lateral aspects shown).

as a cause of the malocclusion. Eyelet wires were placed and the patient was placed into elastic maxillomandibular fixation to maintain the achieved inter-occlusal relationship. This too did not involve any manipulation of the mandible and was completely passive.

After the procedure, the patient was followed on a regular basis. Maxillomandibular fixation was released 2 weeks postoperatively, but was replaced for an additional week because of partial relapse of the open bite. The patient was then transitioned to guiding elastics for 2 weeks, after which all elastics were discontinued. Subsequent postoperative visits showed restoration of her baseline overbite and maintenance of her baseline mandibular range of motion with no pain. On her 12-month postoperative follow-up, the patient maintained her baseline vertical overlap with no evidence of relapse (Fig. 5). In addition to the improved inter-occlusal contacts, the patient's fear of dental treatment has faded in comparison to her pre-operative visits.

2. Discussion

The positive outcomes that were obtained in this case by the above operative procedure were of course very gratifying to the authors. However, it then became necessary to consider some possible explanations for what had occurred, especially because neither pre-operative diagnostic testing nor intra-operative observations had provided a definitive diagnosis. Since it was clear that muscular or scar-related theories were not applicable in this case, we focused on looking for possible intracapsular etiologies.

In order to understand this patient's intracapsular pathology that produced her observed occlusal change, a focused comprehensive literature search on acute malocclusion was performed using MeSH terms "malocclusion", "acute", "temporomandibular", "joint", and "anterior open bite" in PubMed, Cochrane Library, Embase, and Google Scholar. There were no restrictions on publication period, language, and publication type. This search was complemented with manual searches of published peer-reviewed literature, and yielded only 8 pertinent results [1–8]. Dupont's article [1] was a narrative review that discussed various causes and patterns of acute malocclusion; however, anterior open bite was not discussed. Marinho's article [2] was a case report of 2 acute unilateral posterior open bite situations arising as a result of joint effusion. Fahmy [3] reported a single case of a sudden posterior unilateral open bite secondary to a spontaneous ipsilateral hemarthrosis, while Hes [4] described a malocclusion secondary to hemarthrosis without an anterior open bite. The latter 3 reports present a distinctly different mechanism compared to the present case in that a significant space-occupying entity (articular fluid or blood in these reports) caused an *ipsilateral posterior* open bite. Such space-occupying processes are readily identifiable on imaging as increased joint space, leaving characterization of the space-occupying entity (by history

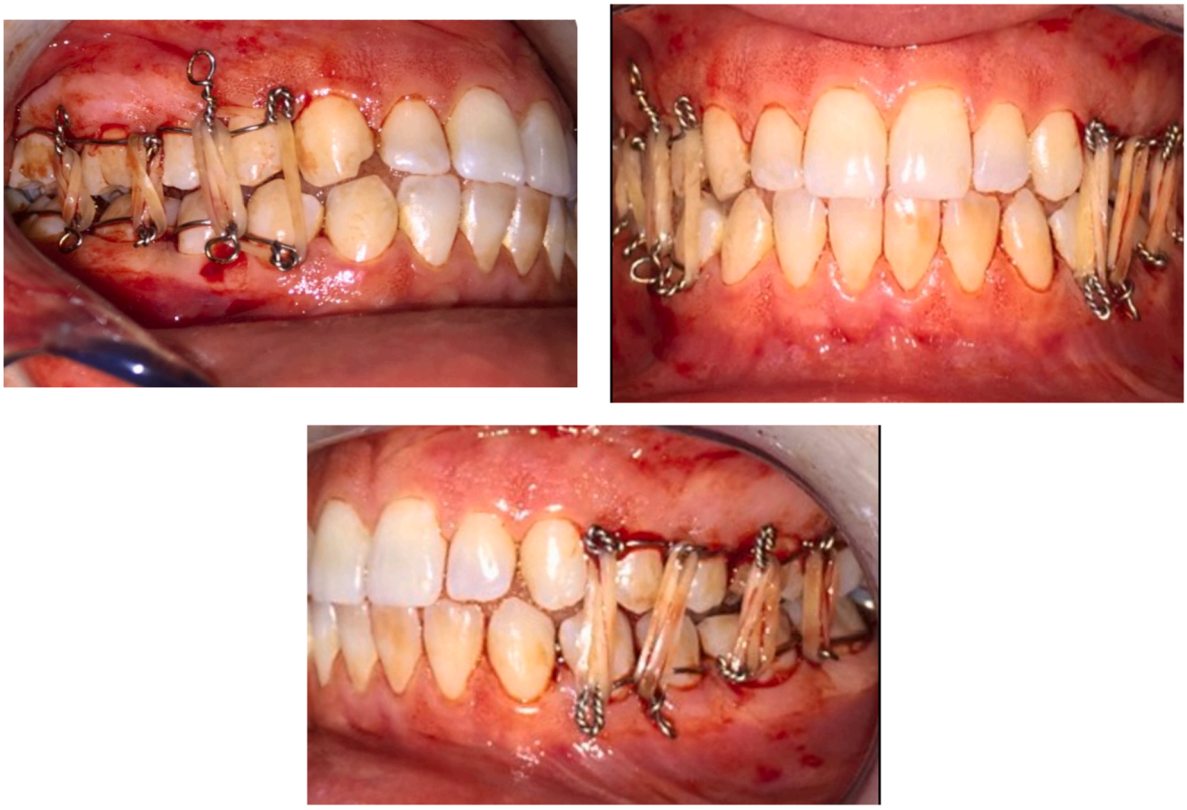

Fig. 4. Occlusal relationship immediately after arthroscopic lysis and lavage.A. Right side view. B. Frontal view. C. Left side view.

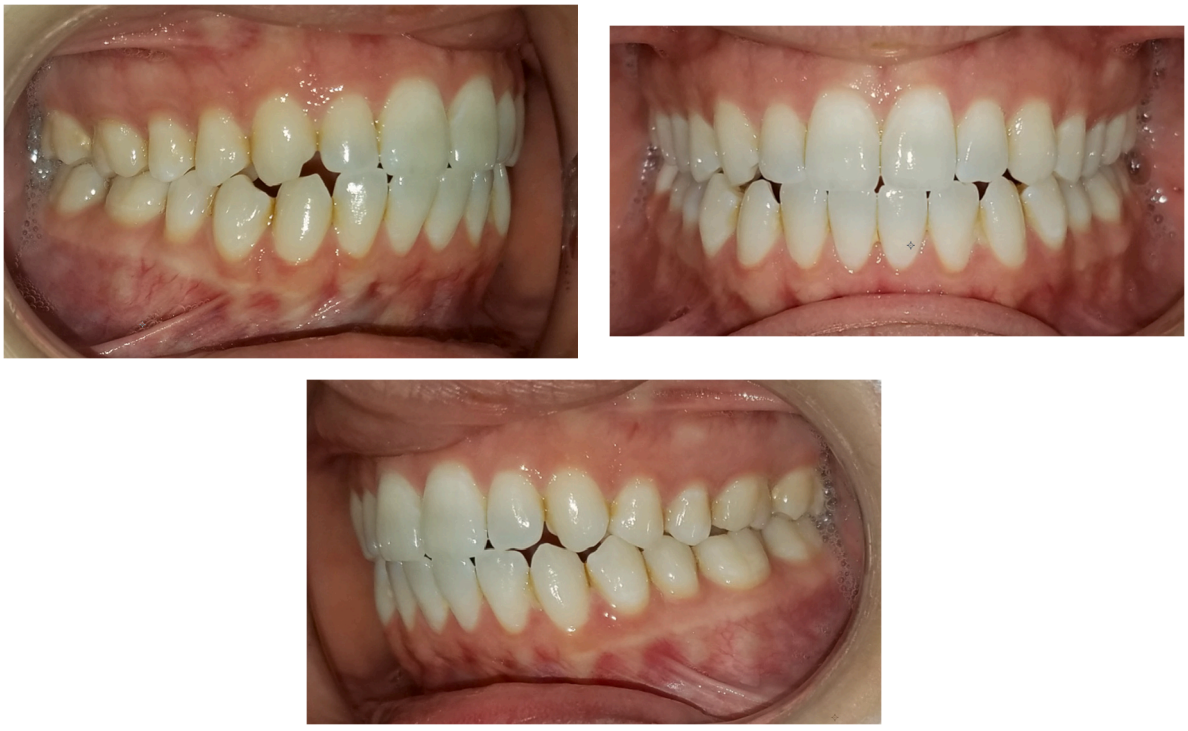

Fig. 5. Occlusal relationship 1 year after arthroscopic lysis and lavage. A. Right side view. B. Frontal view. C. Left side view.

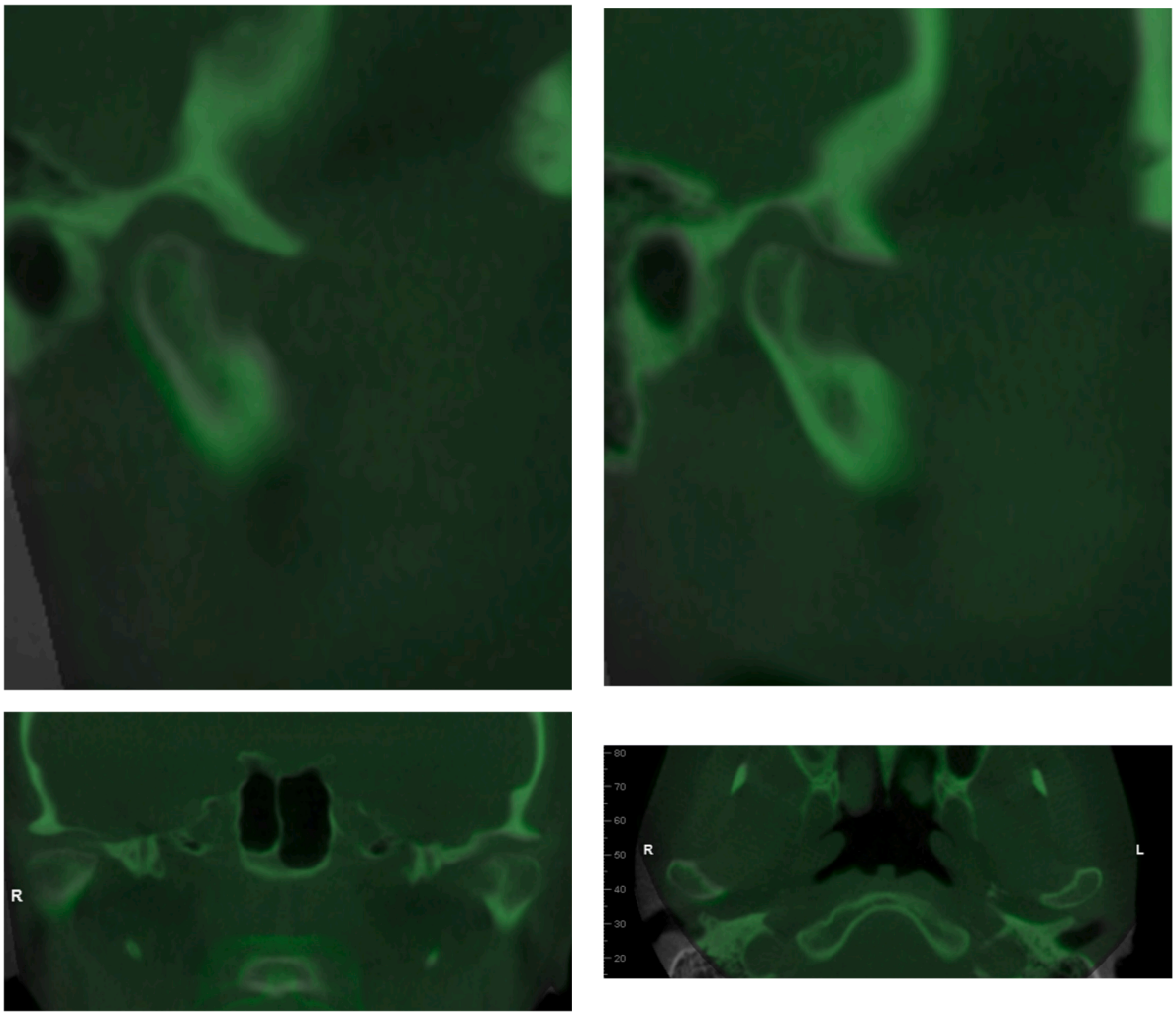

Fig. 6. Superimposition of initial presentation (gray) and post-procedure (green) CBCT. Post-procedure CBCT was taken with tight elastic intermaxillary fixation to ensure accurate analysis of post-procedural condylar position. A. Right sagittal view demonstrating inferior displacement of the condyle in the post-procedure CBCT. B. Left sagittal view showing minimal positional change. C. Coronal view showing inferior condylar displacement on the right, consistent with the right sagittal view. D. Axial view.

and specimen collection with or without histologic analysis) the only remaining diagnostic endeavor. Umebayashi [5] reported a case with a posteriorly displaced disc observed by imaging that was a reasonable explanation for the anterior open bite malocclusion. After conservative measures and arthrocentesis failed to resolve the anterior open bite, a discectomy was performed and resulted in restoration of the premorbid occlusion. Westesson [6], Engelke [7], and Blankestijn [8] described malocclusion (mostly posterior open bite) secondary to posterior disc displacement, with the latter 2 authors describing jaw manipulation under local or general anesthesia with temporary jaw immobilization as management strategies.

In our case, it was obvious that the malocclusion was not of dental origin since hand-articulated models demonstrated a stable premorbid occlusion. Therefore, after reviewing the above literature and re-analyzing our clinical findings, the authors concluded that there must have been some type of intracapsular soft tissue interference in one or both TMJs, explaining the patient's inability to close her mouth fully. The fact that the patient's inter-occlusal relationship immediately returned to normal after the arthroscopic lysis and lavage confirmed an intra-articular etiology. It is important to note that this resolution only occurred after the procedure, but not before, despite general anesthesia with full neuromuscular blockade.

One way to determine the specific biomechanics of this patient's internal derangement involved analysis of a postoperative CBCT that was superimposed over the preoperative image. The purpose of this was to deduce the position of the articular disc and retrodiscal tissues by comparing the pre- and postoperative joint spaces. Superimposition of these CBCT images showed slight anterior and superior displacement of the condyles in the preoperative malocclusion state (Fig. 6). During the arthroscopic lysis and lavage, the position of the condyles and discs may have shifted to a more favorable anatomical relationship that resulted in re-establishing maximal intercuspation without an anterior open bite.

In trying to explain the anatomical details of this phenomenon, the authors propose two possible theories. First, it is possible that the specific internal derangement that led to the anterior open bite occurred along a plane or planes other than just the antero-posterior. For example, medial displacement of the disc could position the thinner lateral portion of the disc over the condyle, thus allowing a superior repositioning of the condylar head, which could explain the anterior open bite. Furthermore, it is possible that in this case the internal derangement involved subtle displacement of the discs in multiple directions, e.g., rotationally in the antero-medial direction. While this type of change may have been too small to detect with arthroscopy or MRI, it may have been enough to create a functional shift of the articular discs, thereby moving their thinner lateral portion above the condyles to cause the anterior open bite.

An alternative hypothesis could be postero-medial displacement of the articular disc and its attachments, which may explain the relative anterior position of the condyles as seen on the CBCT analysis. This accumulation of tissue behind the condyles would produce a mechanical interference that could prevent full closure of the mouth.

While it is never satisfying for the clinician to be unable to establish either a clear etiology or a specific diagnosis, it must be emphasized that premature conclusions based on minimally significant or even incidental findings should be avoided. Examples of such findings in this case include the mild anterior disc displacements on MRI as well as flattening of the condyles in the panoramic radiograph and CBCT. A decision to perform either a major occlusal procedure or some type of TMJ surgical intervention would have been a regrettable choice in this case, as the ultimate outcome of our other more conservative procedure clearly demonstrates.

In this case, the use of hand-articulated models and a stepwise “functional examination” of the TM joints under anesthesia proved to be particularly useful in narrowing down the etiology and the diagnosis to being either an intra- or extra-articular one. This is in line with Clark’s algorithm for management of TMD, which follows a carefully planned sequence in which the results of one step – whether positive or negative - directs the clinician to the next logically sound step by ruling in or ruling out a particular etiology [9]. Such an approach is necessary for multifactorial conditions like TMD, and serves to improve pain control and function, while protecting the patient from iatrogenic harm. While the cost of a stepwise “functional examination” under anesthesia could be a concern, one could argue that the cost of unnecessary treatment or further (and most likely redundant or unnecessary) tests and time away from work or school would have been far greater.

3. Conclusion

Acute anterior open bites are uncommon findings except in mandibular or midfacial fractures. We report a case of an acute-onset anterior open bite which was revealed to be attributable to an internal derangement of the TMJ. The importance of a systematic diagnostic workup is emphasized.

Conflicts of interest

The authors do not have any conflicts of interest to declare.

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