

# Unintended changes to the occlusion following the provision of night guards. Part two: management

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## Key points

Highlights methods of managing unintended changes to the occlusion, ideally by minimum intervention.

Discusses importance of thorough planning and consent process when considering adjustments to the occlusion.

Describes specific cases of unintended changes to the occlusion which may present in general practice and aims to address the possible aetiology.

## Abstract

There may be unintended changes to the occlusion following the provision of guards and splints. This article describes the management of anterior open bite as an unintentional, iatrogenic occlusal change in patients who have worn a night guard or occlusal splint and one case caused by an orthodontic retainer.

## Introduction

Anterior open bite is characterised by lack of vertical overlap of the incisors when the buccal segment teeth are in occlusion.<sup>1</sup> It is a relatively rare clinical finding, with an incidence of 2–4% among children in the UK and 4% in adults.<sup>2</sup> Anterior open bite may be associated with:

- Sucking habits, such as thumb, fingers or dummy
- Soft tissue issues, for example, lip positioning or endogenous tongue thrust
- Tooth wear, without dento-alveolar compensation
- Airway obstruction
- Increased vertical skeletal proportions
- Intracapsular temporomandibular joint (TMJ) deformities<sup>3</sup>
- Inappropriate prescription and use of night guards, occlusal splints and over-the-counter dental appliances
- Prolonged wear of dental ‘grills’.

Bereznicki *et al.* described unintended changes to the occlusion following the

provision of night guards.<sup>4</sup> Anterior open bite featured among these changes. A subsequent search of the literature failed to identify any articles, let alone guidelines, on the management of anterior open bite of the type reported by Bereznicki *et al.* To help address this apparent void in existing dental literature, the present paper describes and discusses the management of the cases presented.

## Management options

The management options available to each patient, either individually or in combination, include:

- Continued use of guard/splint. The continued use of a guard or splint which has caused unintended occlusal changes is likely to, sooner or later, result in further derangement of the occlusion
- Discontinue use of guards/splint only. This option assumes that displaced teeth may move back to their original position, or rearrange to create an acceptable, stable occlusion once the cause of the displacement has been removed. The movement of displaced teeth is unpredictable. While observation of the initial response of displaced teeth to the removal of the appliance which has caused unintended occlusal changes may aid subsequent management, it is considered unlikely that an established anterior open bite linked to the wearing of a guard or splint will self-correct

- Orthodontics. Subject to patient acceptance of orthodontic treatment, orthodontics may be an option for the management of a guard/splint-induced anterior open bite. Treatment may be complex and might include the necessity for mini implants.<sup>3,4</sup> A review of orthodontic approaches to eliminate anterior open bites highlights the difficulties which may be encountered in relation to stability, particularly in the presence of excessive lower anterior facial height<sup>5</sup>
- Additive techniques. The use of bonded composites, or possibly ceramics, to build up teeth which are out of occlusion and thereby eliminate an anterior open bite and provide appropriate guidance is a further option. Such an approach, which may be technically difficult and challenging in terms of aesthetic outcome, commits the patient to a lifetime of restorative maintenance and care
- Subtractive techniques. Occlusal equilibration or extraction to manage an anterior open bite involves the irreversible loss of tooth tissue or teeth, which may further result in new unintended changes to the occlusion. If this option is contemplated, it requires systematic diagnostic occlusal equilibration,<sup>3,6</sup> careful consideration of the possible consequences, and detailed explanation to the patient in the process of obtaining informed consent
- Provision of a replacement guard or splint. The effectiveness and efficiency of an appliance designed to reverse the occlusal changes caused by the original appliance are difficult to predict

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- Orthognathic surgery. This may carry significant risk and is almost invariably undertaken in combination with orthodontics. Rarely, the provision of splint

therapy and occlusal equilibration may be also be required postoperatively to manage the resultant temporomandibular disorder (TMD) problems and bruxing.<sup>7,8</sup>

**Case one**

A 54-year-old male, FC, had self-modified an upper soft night guard prescribed to help prevent further tooth wear, with the result that it only extended to the second premolars. Despite night-time only usage, the molars, left unopposed when wearing the modified guard, had over-erupted, possibly together with some degree of intrusion of the lower teeth in contact with the guard. The clinical presentation is illustrated in Figure 1.

FC's priority was relief of pain related to the upper left molar region (Fig. 2). Root canal therapy was carried out on both the first and second molars. FC accepted that full veneer crowns would be required on these teeth subsequent to successful completion of root canal therapy. This created a restorative dilemma as to whether to provide the new crowns to the existing occlusion, a conformative approach, or to reorganise the occlusion before the provision of the new crowns.

The patient returned free of any pain or discomfort following root canal therapy. He had no TMD associated with the occlusal changes that had occurred. FC complained, however, of limited ability to chew and indicated that he felt that his dental appearance was compromised by his anterior open bite. The patient's preference was to have his original occlusal scheme restored, with the elimination of his anterior open bite before the provision of new crowns. He was not prepared, under any circumstances, to undergo orthodontic treatment or contemplate any extractions to rectify these occlusal problems.

Initially, FC was advised to discontinue the use of his self-modified guard. Stabilisation of the root-treated teeth was achieved by the provision of long-term temporary crowns. Some occlusal equilibration was carried out on the crowns to achieve simultaneous bilateral contact (Fig. 3a). The anterior open bite was not reduced by these occlusal adjustments.

As the patient remained symptom-free, he agreed to discontinue wearing his guard and to return for review every four to six weeks, in the hope that his occlusion would improve through possible intrusion of his load-bearing molars and eruption of his unopposed anterior and premolar teeth. After 18 months, most of the anterior and premolar teeth had opposing tooth contacts, the anterior open bite had largely been eliminated and the occlusion was greatly improved, with the return of some anterior guidance (Fig. 3b). Following further

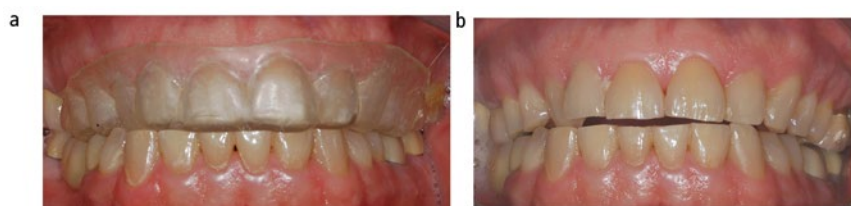


Fig. 1 (a) The self-modified guard in place; (b) the resultant anterior open bite



Fig. 2 The root treated teeth – endodontics - courtesy of Shanon Patel

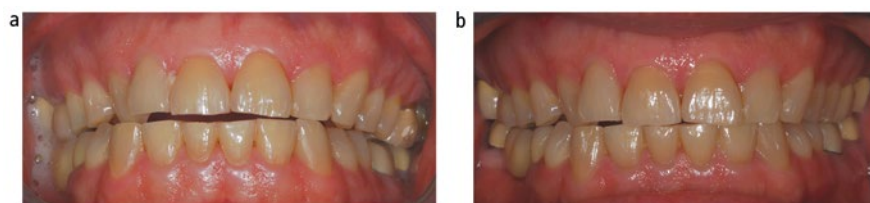


Fig. 3 (a) The occlusion following equilibration; (b) the occlusion following 18 months of review



Fig. 4 The hard acrylic anterior discluding night guard provided for BH



Fig. 5 (a) On the day of fitting the replacement crowns; (b) on presentation, 18 months later; (c) BH's anterior open bite

improvements in the occlusion over time, the long-term temporary crowns were replaced with porcelain fused to metal crowns. There were no indications for a replacement guard.

### Case two

A 36-year-old male, BH, was referred for a second opinion following the provision of crowns in the management of severe anterior tooth wear with incisal edge chipping. The patient had been provided with an upper full-arch soft guard to wear at night to help protect the crowns. He returned within a few months with multiple porcelain fractures on the new crowns. BH indicated that he had experienced difficulties sleeping with the soft night guard in place and had discontinued its use.

Once replacement crowns had been provided, BH asked whether a different type of night guard was available for him to wear. An upper, hard acrylic, anterior discluding guard was provided for night-time use only (Fig. 4). The patient found this appliance extremely comfortable to wear, to the extent that he did not sleep well without it in place. Eighteen months following the provision of the replacement crowns and the hard acrylic discluding guard, BH presented with discomfort of his posterior teeth. He felt his bite had changed, resulting in his front teeth no longer touching when he brought his back teeth together. On questioning, he strongly denied wearing his night guard during the day. The clinical picture on presentation is included in Figure 5.

The patient was adamant that he wanted some form of treatment to restore contact between the anterior teeth as well as guidance to stop him grinding and traumatising his posterior teeth. With the loss of anterior guidance, he was aware of grinding on his back teeth. He would not consider orthodontic treatment. Equally, he did not want further restorative treatment. Furthermore, the patient was adamant that he required some form of night guard during the treatment to protect his posterior teeth from further chipping or fracture. He also refused, for work reasons, to consider wearing any form of appliance provided during the day.

Following detailed examination and consideration of mounted study casts, it was concluded that the anterior open bite had

been created by intrusion of the upper and lower canines and incisors, with little, if any extrusion of the premolars and molars.

The initial thought was to provide a Gelb lower hard acrylic appliance (Fig. 6) for night-time wear. It was felt that this design would allow the canines and incisors to erupt back into occlusion while protecting the posterior teeth. However, one possible side effect of this appliance might result in the posterior teeth opposing the hard acrylic, inadvertently and in uncontrolled fashion, intruding.<sup>9</sup> Consequently, it would be impossible to predict what effect this treatment option might have on the resultant occlusion.

The design chosen was a variation of the Gelb appliance but constructed as a soft



Fig. 6 Gelb appliance

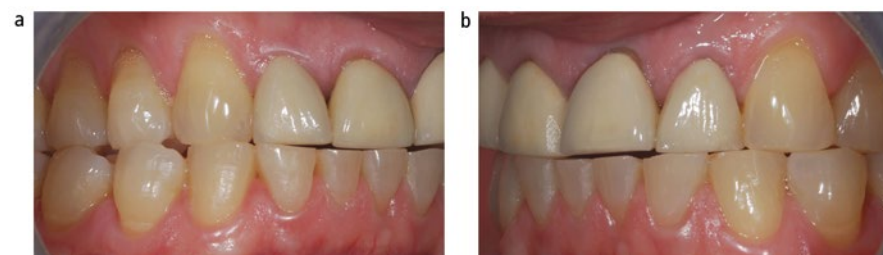


Fig. 7 (a) The modified soft Gelb appliance; (b) the modified Gelb appliance fitted on the working model; (c) the view of the appliance fitted in the mouth





**Fig. 8** Lateral (a and c) and frontal (b) views of MH's articulated study casts obtained at 15 month review. The anterior teeth are in contact in intercuspation



**Fig. 9** Clinical illustration of the restoration of MH's right (a) and left (b) canine guidance at 15 month review

upper night guard (Fig. 7). The anterior teeth were omitted from the appliance to allow eruption. It was hoped that the soft nature of the chosen material would be such that any clenching forces on the teeth opposing the appliance in the posterior segments would be cushioned and hopefully avoid their intrusion.<sup>5,9</sup> Although there was no evidence base for this, the patient agreed to proceed, accepting that frequent, short interval visits would be required to monitor changes to ensure that further untoward occlusal changes did not occur as a result of the atypical design of the appliance.<sup>9</sup> Photographs of study casts of BH taken after 15 months (Fig. 8) show the anterior and posterior teeth in contact in the intercuspation position. Anterior guidance with group function was re-established (Fig. 9).

The patient was delighted with the aesthetic outcome, the improvement in his occlusal function and the elimination of the discomfort which had caused him to seek help. The use of a soft, rather than hard acrylic appliance, was

considered to have had the desired effect of preventing intrusion of posterior teeth, while allowing the anterior teeth to re-establish contact. Following his 15-month review, the patient was provided with a full coverage Michigan splint to help protect his teeth from further possible damage linked to bruxing.<sup>10</sup>

### Case three

On presentation, AT, a 42-year-old female, gave a history of bruxism and anterior tooth wear in her teens. She did not recall having any TMD symptoms. Three years previously, she started to suffer neck pain and headaches, and attended a local dental practitioner who diagnosed parafunctional activity and recommended extraction of her lower left wisdom tooth, which he considered a trigger for bruxing and a possible cause of the neck pain and headaches. Following the extraction, the practitioner provided a lower Tanner-style appliance which, despite being uncomfortable,

the patient wore as instructed only at night. The neck pains and headaches initially disappeared. Sometime later, AT noticed that she could no longer bite her fingernails as her anterior teeth no longer incised. Subsequently, as AT's headaches and neck pains returned, as well as disrupting her sleep patterns, she discontinued wearing her appliance.

On examination, AT was found to be occluding on her last standing molars only (Fig. 10). The presence of wear facets on the upper and lower incisor and canine teeth was clear evidence of anterior guidance having been present at some time in the past. On questioning, the patient strongly denied wearing the appliance at any time other than at night. The design of the appliance was such that, when fitted, anterior guidance and posterior disclusion were absent. Guidance in excursions was in the posterior quadrants with anterior disclusion; the opposite to the arrangements recommended for such an appliance.<sup>11,12</sup>

Furthermore, the appliance did not cover the teeth beyond the first molars, leaving the second and third molars on the right side and second molars on the left side, which had presumably occluded at some point in time, out of occlusion. Despite only nocturnal wear of the appliance, the unopposed molars had over-erupted. It was difficult to determine whether there had been any intrusion of the teeth opposing the appliance. The degree of occlusal derangement is illustrated in Figure 11 a and b – complete loss of anterior guidance and posterior disclusion.



**Fig. 10** The clinical picture on presentation, flanked by the left and right lateral views of the mounted study casts

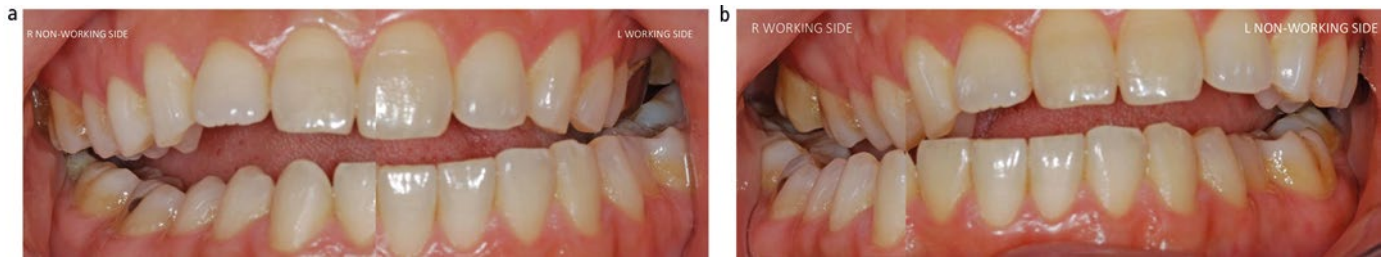


Fig. 11 (a) AT's left working side excursion; (b) AT's right working side excursion

Following a detailed consultation and discussion of the possible treatment options, the following conclusions and decisions were reached:

- The patient was not prepared to consider orthodontic treatment, let alone orthognathic surgery
- The degree of occlusal derangement was such that it would be impossible to resolve matters using additive techniques, particularly as aesthetics would be extremely compromised by the creation of excessively long teeth in the anterior region
- This left the option of adopting a subtractive technique to eliminate the anterior open bite and re-establish even contacts in the posterior quadrants and anterior guidance with posterior disclusion. The patient, unsurprisingly, was initially reluctant to undergo this treatment option without some form of guarantee of a successful outcome. Given, however, the possibility of at least partial relief from her symptoms, AT consented to this option.

As a first step, the patient was provided with a diagnostic upper, hard acrylic, anterior discluding appliance to re-establish anterior guidance and posterior disclusion (Fig. 12). AT was instructed that the appliance was intended for night-time usage only, even if her symptoms returned when the appliance was removed. She understood that day wear of the appliance could lead to further occlusal derangement. It was hoped that use of the appliance would



Fig. 12 AT's diagnostic anterior discluding appliance

indicate the extent to which AT's symptoms were related to the loss of anterior guidance. If the symptoms were to disappear, then treatment to re-establish anterior guidance with occlusal equilibration would be justified.

Having established that the patient's symptoms were relieved by re-establishing anterior guidance, a diagnostic occlusal equilibration was carried out to ascertain whether full occlusal interdigitation and anterior guidance could be predictably re-established. After numerous adjustments to the occlusion on the models, all the teeth, with the exception of the central incisors, came into even interdigitation (Fig. 13), giving a degree of predictability to the outcome were the same adjustments to be duplicated in the mouth. The opinion was formed that such adjustments would be unlikely to expose dentine, and if

they did, any postoperative sensitivity would be transient, with the possible exception of the lower right wisdom tooth.

The outcome of the diagnostic occlusal equilibration was discussed with AT, together with the disadvantages of the irreversible adjustments, including the possibility of having to replace the crown on the upper left first molar and root treat, or possibly even extract, the lower right wisdom tooth if it gave rise to intractable, unacceptable sensitivity.

A limited number of adjustments at each of several appointments was performed, rather than complete the equilibration in one long appointment. This provided opportunity for some inter-appointment Dahl-type occlusal movements, possibly reducing the number and extent of the occlusal modifications required at subsequent appointments. After the first



Fig. 13 The casts in occlusion following diagnostic occlusal adjustments – frontal and left and right lateral views





Fig. 14 AT in intercuspation at one-year follow-up: frontal and right and left lateral views



Fig. 15 AT in protrusion (centre) together with views of right and left working excursions

appointment, the patient reported that she was comfortable, had not suffered any sensitivity, and felt, even without her diagnostic appliance, that her symptoms were much reduced. By the third appointment, the desired outcome had more or less been achieved, leaving only minor adjustments and polishing of the adjusted surfaces to be completed at the fourth appointment.

Even contacts had been established in the posterior quadrants and anterior guidance restored. In the absence of any symptoms, AT was happy to retain the wisdom teeth on her right-hand side. She returned to her referring practitioner for the provision of a Michigan night guard to protect her anterior teeth from future wear.

At the one-year follow-up, the patient had no recurrence of any of her symptoms and her occlusion felt stable. Clinical examination, involving the use of shim stock, revealed even contacts between the premolars, molars and canines. The incisors were just out of occlusion in intercuspation (Fig. 14). Canine/premolar guidance with posterior disclusion had been reintroduced (Fig. 15).

#### Case four

In the following orthodontic case, subsequent to the completion of active treatment, the patient (TD) was, for whatever reason, provided with a hard acrylic retainer in the lower arch only. The retainer provided incomplete coverage of the erupting third molars (Fig. 16).



Fig. 16 TD's lower hard-acrylic retainer with incomplete coverage of the molar teeth

The patient, a 26-year-old female, lived between London and North America. A variety of orthodontists had been involved in her orthodontic treatment and post-treatment review. Given the design of the hard acrylic retainer, which only covered up to and including the second molars, the unopposed wisdom teeth had erupted into occlusion, the retainer having been worn most of the time over a period of 11 months. Without the appliance, TD's occlusion was entirely supported by the wisdom teeth, in isolation (Fig. 17). The patient suffered from generalised discomfort but was mostly concerned with the post-orthodontic changes in her occlusion and the compromised aesthetics created by the increase in vertical dimension.

Following an initial consultation, TD was advised to discontinue the use of the retainer in

the hope that a reversal of changes may occur, with Dahl-style intrusion of the wisdom teeth and eruption of the teeth anterior to them. Relapse in the lower anterior region was prevented by fixed, canine to canine, lingual retention.

Unexpectedly, further eruption of the third molar teeth occurred in the interim ten weeks between appointments, with an associated increase in vertical dimension. The increase in the vertical dimension and associated open bite is clearly seen in the mounted study casts obtained at review (Fig. 18). TD continued to be free of any pain or discomfort. She did, however, feel increasingly uncomfortable being 'propped open on the back teeth', was experiencing increasing problems with chewing, and disliked the detrimental aesthetic effect of her increase in vertical dimension.

TD understood that she had a complex problem and felt that any treatment which might improve the situation would be better than none. She was, however, unwilling to undergo any further orthodontic treatment and would not consider any form of surgical intervention. A diagnostic occlusal equilibration was undertaken. With extraction of the continuously erupting wisdom teeth, there would, at best, be no further deterioration and some reduction in the increased vertical dimension, but the open bite would persist (Figs. 19a and b). TD was provided with a

detailed treatment plan, emphasising the limited occlusal improvement that would be achieved by extraction of the wisdom teeth and stressing the uncertainty of the long-term outcome. TD decided to proceed, if for no other reason than the likelihood of an improved facial appearance. Consent was obtained.

Given the patient's limited availability in the UK, only the upper wisdom teeth were extracted. Of interest, the extractions were extremely difficult, almost as if the teeth had become ankylosed. This may, at least in

part, explain why there had been no Dahl-style intrusion of these teeth when use of the retainer was discontinued. As TD returned to North America almost immediately following the extractions, no photographs or models are available to illustrate immediate postoperative changes in her occlusion. At five-month review, immediately following the patient's return to the UK, the clinical picture was as illustrated in Figure 20.

The dramatic improvement in the occlusal scheme is difficult to explain. Why the extraction of the upper wisdom teeth only resulted in such a swift, dramatic improvement in the occlusal scheme can only be postulated. The authors, who believe that the patient's occlusion may improve further with time and the extraction of the unopposed lower wisdom teeth may be required, especially if these unopposed teeth begin to over-erupt, acknowledge that this case does not provide good justification to treat similar cases by means of extractions. That said, TD's case illustrates, under certain conditions, that extractions may be considered an option to manage an unintentional, iatrogenic anterior open bite.

## Discussion

Given the lack of information in the dental literature on the management of cases of the type presented, let alone the absence of any relevant evidence-based guidelines, the management of unintended changes to the occlusion caused by night guards is largely empirical, as was the case in the treatments reported. It is suggested that a good knowledge of occlusion and experience of well-established occlusal therapies is of advantage in managing unintended occlusal changes. Having established that there is good reason to intervene, typically the patient experiencing pain or discomfort, having difficulty chewing, or concerns about unattractive, possibly progressive changes to their aesthetic appearance, and following a

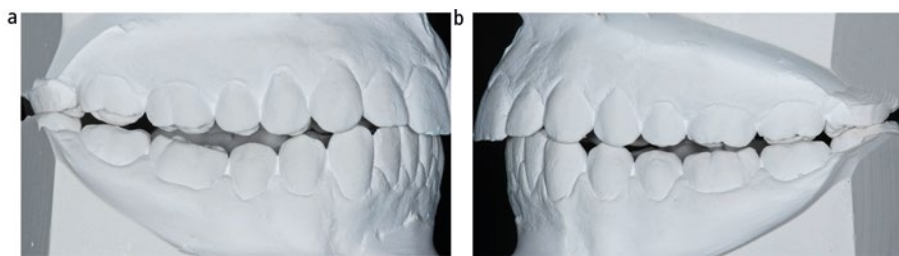


Fig. 17 TD's mounted study casts – left and right lateral views, illustrating the occlusal derangement caused by wearing the lower hard acrylic retainer

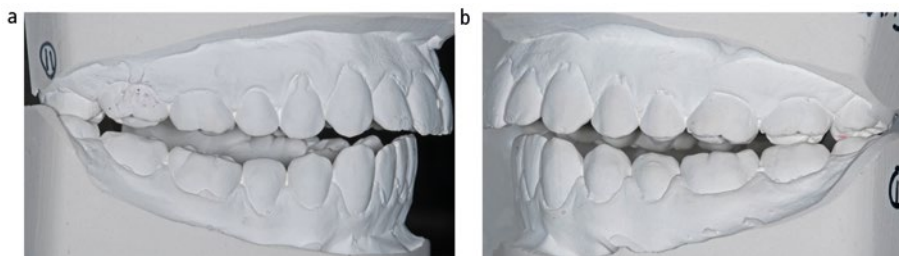


Fig. 18 TD's mounted study casts – left and right lateral views obtained at 10 weeks review

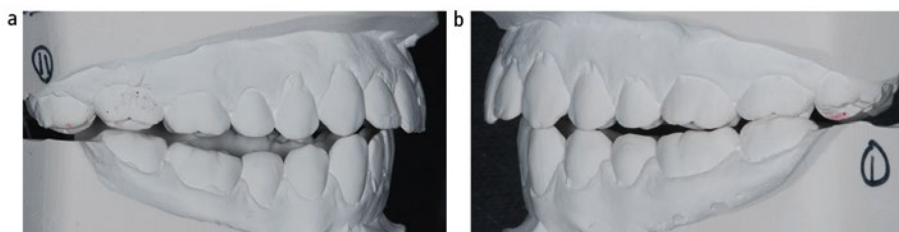
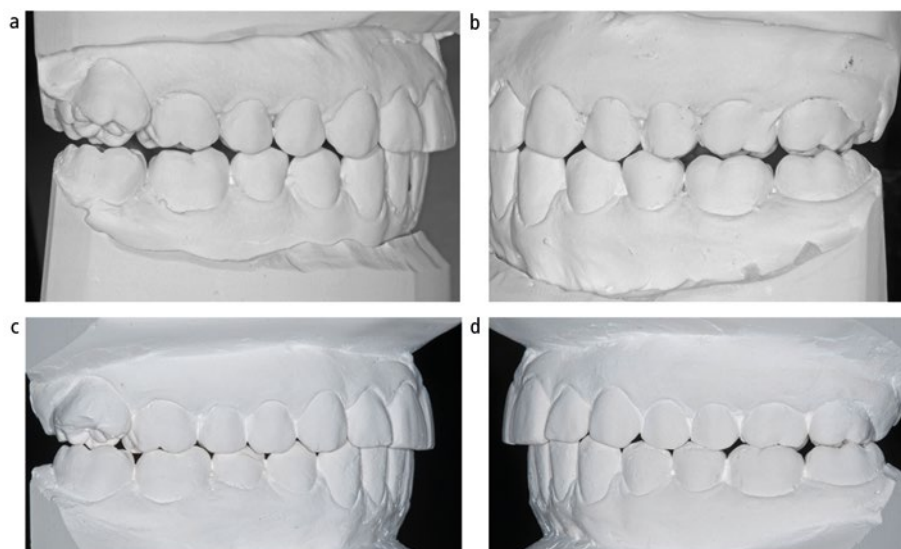


Fig. 19 TD's study casts – right and left lateral views, following diagnostic removal of the lower wisdom teeth showing failure to resolve the anterior open bite



Fig. 20 TD's clinical anterior view and mounted study casts – left and right lateral views at five-month postoperative review



**Fig. 21** Lateral views of the study casts of an orthodontic case immediately following completion of orthodontic treatment (top) and two years later when the occlusion was finally re-established and became stable (bottom)

detailed examination, including the assessment of mounted study casts, all possible treatment options should be considered in a systematic option appraisal. This appraisal, which may include the option of an initial period of monitoring, with or without the provision of a diagnostic splint as indicated clinically, should involve the patient so that they can fully understand the limitations, risks and uncertain outcome of the various options and be able to give informed consent to treatment.

As with all disease and disorders, prevention is better than the cure. In addition to providing and prescribing the use of night guards which should not result in any unintended changes to the occlusion, it is important for patients with night guards to understand the need for regular review, the risks of self-modification to splints, and the use of a damaged splint which may have lost some occlusal coverage.

The cases considered in this paper did not have TMD, condylar resorption, diseased/damaged teeth requiring immediate attention, or periodontal conditions affecting tooth mobility. These conditions, which may coexist individually or in combination with unintended changes to the occlusion, might complicate treatment option appraisal and add to the uncertainty of the clinical outcome. As a

general rule, it is best to seek ways to treat the presenting conditions individually rather than concurrently as, in the event of complications, causation may be difficult to diagnose and management unnecessarily complicated. It is acknowledged, however, that there are cases where 'needs must'; for example, the concurrent management of pulpal or endodontic pain and persistent TMD discomfort.

Treatments of the type described in this paper must be carefully planned and, wherever possible, staged with patients being encouraged to report progress and any developments and to return for frequent review. For example, in case three, if all the occlusal adjustments had been made in one long appointment, rather than staged with opportunity for inter-appointment Dahl-style movements, excessive sound tooth tissue may have been sacrificed, with an increased risk of postoperative sensitivity. Again, it is acknowledged that in certain cases 'needs must'. Under such circumstances, the patient, in consenting to the treatment, must understand the possible disadvantages of completing extensive treatment in one long appointment. Also, patients must understand that the final outcome may take months, if not years to achieve. This is illustrated in an orthodontic case in which it took two years for

the occlusion to fully re-establish and become stable (Fig. 21).

In concluding, the authors are anxious to stress that the various treatments presented should be viewed as examples only of the ways in which unintended changes to the occlusion may be managed with minimal intervention means; rather than complex orthodontics, or possibly invasive orthognathic surgery, which, failing all else, may be indicated in certain cases, particularly in the presence of a skeletal aetiology.

## Conclusion

Unintended changes to the occlusion, specifically anterior open bite, caused by night guards, splints or orthodontic retainers, may be successfully treated by minimum interventive approaches which, in the absence of established methodologies, let alone relevant evidence-based guidelines, are largely empirical and of uncertain outcome. Good knowledge of occlusion and experience of well-established occlusal therapies is of advantage in managing unintended occlusal changes. Treatment may be prolonged and involve frequent review appointments to monitor developments.

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