

Occlusion: is there a third way? A discussion paper

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Key points

Invites a discussion on whether modern restorative techniques enable dentists to change occlusion when restoring worn dentitions without giving too much thought to jaw relationship.

If the consensus of opinion within the profession considers this an acceptable approach, then some pre-treatment requirements, such as finding terminal hinge axis and the use of mounted study models, may not be needed.

Suggests that if a new occlusion is developed in this way, a dentist still has an obligation to monitor the patient for any adverse reactions and, if necessary, to modify the restorations.

Abstract

This paper does not set out to describe the reasons why a new concept of dental care should be deemed as acceptable and recognised as mainstream. Rather, the starting point of this paper is the belief that some dentists who are increasing the overall vertical dimension for worn dentition patients are not using the protocols of the traditional 're-organised approach'. If adhesive direct restorations are used, there seems to be anecdotal indication that despite not restoring in the terminal hinge axis, it can have a successful outcome.

So, while not criticising this approach simply because it does not follow orthodoxy, the paper has two objectives. It hopes to stimulate some debate and research on this subject. Furthermore, by suggesting some parameters for what might be considered a new approach, it aims to improve patient outcome.

Background

Any treatment that involves the occlusal surfaces of the teeth and has the potential to change a patient's occlusion has traditionally presented the clinician with two choices. There has traditionally been a rigid binary choice in restorative dentistry.

The treatment could either be provided to a tooth, some teeth or a sextant of the mouth without changing any of the existing occlusal

contacts of their 'habitual bite' (synonymous with centric occlusion, intercuspation position). This is known as the 'conformative approach'^{1,2,3} and it is the justified aim of the vast majority of restorative treatment plans. Commonly, most dentists will follow this approach without too much thought, simply checking at the end of their treatment that pre-treatment occlusion has not been changed. It is easy, safe and sensible, with very few exceptions or conditions – although one consideration might be to examine the occlusion before the start of treatment.^{4,5}

Sometimes, the treatment requires a change in the pre-existing occlusion, and the extent of the treatment means that the 'tooth-determined', 'engram-controlled', 'muscle-guided' jaw relationship of the patient's pre-existing occlusion cannot be reproduced.

Then, the restorative dentist must decide which jaw relationship is going to be the starting point for the new occlusal prescription.

It is generally accepted that the safest jaw relationship to adopt is that of the 'terminal hinge axis' (synonymous with centric relation, retruded contact position). This is known as the 're-organised approach'.^{6,7} In defining the ideal occlusion that the re-organised approach

aims to provide, dentists will refer back to criteria that have been established for many years.⁸ These can be summarised as follows:

- The new (centric) occlusion will occur in centric relation
- The anterior guidance will be towards the front of the mouth; that is to say, there will be no posterior interferences⁹
- There will be freedom in centric (occlusion).¹⁰

These are tight restrictions on the new occlusal prescription, but conventional wisdom suggests that they are most likely to provide the patient with a consistent and comfortable bite. Many dentists who work in a referral capacity, either in primary or secondary care, will have had experience of trying to help patients who have had significant adverse reaction to occlusal change.

The consequential dysfunction and discomfort can be life-changing. Somewhat harshly, this unplanned approach could be parodied as the 'un-organised and I hope the patient can adapt approach'.¹¹

However, not all patients with significant change in their occlusion and jaw relationship fail to adapt; in fact, it is probably a small

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minority. This is well recognised and has led to a new definition of ideal occlusion.¹² This can be summarised that an occlusion is ideal if the patient can tolerate (or adapt to) it.

This concept can be extended to the argument that the term malocclusion (literally ‘bad bite’) is too didactic.¹³ A better term would be ‘maladaptive occlusion’,¹⁴ because using this term implies that an occlusion should be judged by the patient’s reaction to it, not by a set of arbitrary ‘rules’.

In 1975, Dahl described a means of changing the patient’s occlusion by an uncontrolled and unpredictable vertical axial movement.¹⁵ Some considered this approach to be a third alternative, while others were fixed on the idea that if it was not conforming, it must be re-organising, albeit by physiological means in contrast to the mechanical route of conventional crown and bridgework. Perhaps changing an occlusion through evolution (that is, physiologically, over a period of time) rather than through revolution (that is, mechanically, over a relatively short time span) explains the reduced risk associated with this technique – although some report that few adverse reactions were observed because an examination for them was not performed.¹⁶

Similarly, the discipline of orthodontics created changes in their patients’ occlusion, with very few reports of adverse reactions. Again, the changes are made slowly (considered evolutionary) and sometimes in a growing patient.¹⁷

The incidence of tooth surface loss is increasing.¹⁸ With this comes an increasing need for restorative intervention. Often, this is achieved by the use of adhesive composite material, commonly applied directly.

Whereas it is possible that some worn dentitions can be restored using the conformative approach, commonly, the need to increase the overall vertical dimension (OVD) precludes this option.

Many restorative dentists, especially those who have undergone formal specialist training in secondary care, will still adopt the protocol of a traditional re-organised approach. This will follow some or all of the following stages:

- Find and record centric relation
- Mount some models on a semi-adjustable articulator, after facebow record, to centric relation
- If an increase in OVD is needed, the articulator is opened up by the desired amount

- Design the new occlusion in a wax-up
- Use that occlusal prescription as the template for the restoration of the patient’s worn dentition, often using stents made from the wax-up.

The key component of this (re-organised) approach is that the models are mounted and the treatment is provided in centric relation. Because the models are in centric relation, the bite is being opened up from the terminal hinge axis. That is to say that the temporomandibular joints (TMJs) will be in the rotational, rather than the translational, phase of movement. This increases the chance of providing the dentist and patient with a consistent jaw relationship at the increased OVD, whereas if the increase in vertical height is provided from a starting point that is within the translational phase of TMJ opening, then the consistency is harder to achieve. This is because, as the mouth opens wider to increase the OVD, the head of the condyle will be moving further along its translational pathway.

However, as a profession, we must recognise that not all restorations of worn dentitions to an increase OVD will follow the protocol of the re-organised approach. In particular, not all dentists will start by finding and recording centric relation, then mounting study models to that position. The authors of this discussion paper work in referral practice either in primary or secondary care. It is their experience that they do not see a significant number of referred patients because they have failed to adapt to a new occlusion provided in adhesive composite material. This is, of course, anecdotal.

However, for the purpose of the discussion that it is hoped this paper might stimulate, we ask that the reader assumes that if a worn dentition is restored to an increase in OVD using directly bonded composite materials without using centric relation as the starting point, that the incidence and severity of adverse reaction is not as great as if that restoration was provided in traditional crown and bridgework.

If the reader is prepared to accept this, we would like to suggest some guidelines. In doing this, we are aware that we might be criticised from both sides of the argument.

Some may fear that we are suggesting that there is no need ever to follow the protocols of the re-organised approach. This is not the case; many of the authors still prefer to

provide their treatment of the worn dentition to an increased OVD by following the stages of the re-organised approach as set out above. They have this choice because they have had the training, and have access to the equipment and support facilities which the re-organised approach requires.

The authors would encourage all dentists involved in restorative work to seek further training through courses, mentorship or formal postgraduate training to develop and enhance these skills where possible.

Others may resent the guidance that we give below as being unnecessary, tending towards an ‘ivory tower’ dictate. It may be considered that we are adding complexity to what is, in their view, the simple matter of ‘opening the bite up a bit’. We hope that this is not the case; we feel that the suggestions given are not onerous, but instead are prudent and easy to adopt. In our defence, our aim is to improve something that we suspect is already happening, and we hope that may stimulate some well-designed clinical trials.

Finally, because this is only a discussion paper, it is not based upon any evidence. This will be an anathema to those who only adopt a practice after it has been proven safe and effective by a randomised controlled trial.¹⁹

The monitored developmental approach

In this approach, it is recognised that increasing the OVD will establish the jaw relationship of the new centric occlusion.

We suggest that there are two elements to this approach.

‘Monitored’

The patient is examined before treatment for any signs of:

- A temporomandibular disorder, including myofascial pain and TMJ dysfunction
- Occlusal trauma
- Active bruxism.

These examinations are continued during and after treatment for an adequate review period. So:

- Treatment can be suspended if indicated. This will allow extra time for the patient to adapt to the change. Splint therapy may be indicated
- Because of the monitoring, the second element becomes a possibility.

'Developmental'

- The restorations can be modified because of the nature of the materials used
- Because there is minimal or no preparation of the teeth, the treatment is not irreversible or invasive
 - Note: 'not irreversible' is not the same as 'easily reversible'
 - Removing multiple well-bonded direct composite build-ups is not a simple procedure
- In effect, the restorations can be considered to be provisional, initially. These may or may not require some modification
- The patient gives consent on these understandings.

Summary

To summarise:

- There is an increase in the number of patients who consult their dentists for the restoration of teeth that have suffered non-carious tooth surface loss
- Not all dentists have yet acquired the skills and facilities to provide these restorations to the re-organised approach, which might still be the best approach (research is needed)

- By carefully monitoring the patient before, during and after treatment, and by using simple and adjustable materials on essentially unprepared teeth, it might be possible to provide comfortable and successful treatments for this growing number of patients without having to adopt centric relation as the starting point.

Conflict of interest

The authors declare no conflicts of interest.

Author contributions

All authors made substantial contributions in the conception of this article. Stephen Davies drafted the work and then all authors were active in developing, or agreed with, the opinions expressed. All authors have given final approval of the version to be published. All authors are of the view that the subject of this paper is worthy of a wider discussion within the profession.

References

1. Celenza F V, Litvak H. Occlusal Management in Conservative Dentistry. *J Prosthet Dent* 1976; **36**: 164–170.
2. Foster L V. Clinical aspects of occlusion: 1 Occlusal terminology and the conformative approach. *Dent Update* 1992; **19**: 345–348.
3. Davies S J, Gray R J M, Smith P W. Good occlusal practice in simple restorative dentistry. *Br Dent J* 2001; **191**: 365–381.
4. Davies S J, Al-Ani M Z, Jeremiah H, Winston D, Smith P W S. Reliability in recording static and dynamic

- occlusal contact marks using transparent acetate sheet. *J Prosthet Dent* 2005; **94**: 458–461.
5. Davies S J, Young P. The occlusal sketch technique: its importance in implant treatment. *Aesthet Implant Dent* 2006; **8**: 49–55.
6. Wassell R, Naru A, Steele J, Nohl F *Applied Occlusion*. London: Quintessence, 2008.
7. Davies S J, Gray R J M, Whitehead S A. Good occlusal practice in advanced restorative dentistry. *Br Dent J* 2001; **191**: 421–434.
8. Ramfjord S, Ash M M. *Occlusion*. 3rd ed. Philadelphia: Saunders, 1983.
9. Davies S J, Gray R J M. *A Clinical Guide to Occlusion*. London: BDJ Books, 2002.
10. Davies S J, Gray R J M. What is occlusion? *Br Dent J* 2001; **191**: 235–245.
11. Davies S J. Occlusion in Restorative Dentistry: Conformative, Re-organised or Unorganised. *Dent Update* 2004; **31**: 334–345.
12. Ash M M, Ramfjord S. *Occlusion*. 4th ed. Philadelphia: Saunders, 1995.
13. Davies S J. Malocclusion: a term in need of dropping or redefinition? *Br Dent J* 2007; **202**: 519–520.
14. Gremillion H A. The relationship between occlusion and TMD: an evidence-based discussion. *J Evid Based Dent Pract* 2006; **6**: 43–47.
15. Dahl B L, Krogstad O, Karlson K. An alternative treatment of cases with advanced localised attrition. *J Oral Rehabil* 1975; **2**: 209–214.
16. Poyser N J, Porter R W J, Briggs P F A, Chana H S, Kelleher M G D. The Dahl Concept: past, present and future. *Br Dent J* 2005; **198**: 669–676.
17. Davies S J, Gray R J M, Sandler J, O'Brien K D. Orthodontics and Occlusion. *Br Dent J* 2001; **191**: 539–549.
18. NHS Digital. Adult Dental Health Survey 2009. 2011. Available online at <https://digital.nhs.uk/data-and-information/publications/statistical/adult-dental-health-survey/adult-dental-health-survey-2009-summary-report-and-thematic-series> (accessed June 2021).
19. Smith G C S, Pell J P. Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials. *BMJ* 2003; **327**: 1459–1461.