

## KEY WORDS

Preserving tooth tissue, additive techniques, resin composite

## LEARNING OBJECTIVES

- To challenge occlusal philosophies that destroy sound teeth inappropriately in order to justify obsolete occlusal dogmas
- To question whether those occlusal philosophies have a biologically sound rational or a proven scientific basis for the management of tooth surface loss
- To highlight alternative additive approaches for managing tooth wear and leaving patients with their residual sound tooth tissue and healthy pulps

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# FACTS AND FALLACIES ABOUT RESTORATIVE PHILOSOPHIES FOR THE MANAGEMENT OF THE WORN DENTITION

## ABSTRACT

This article addresses facts and fallacies about managing worn teeth and challenges some traditional concepts and beliefs about occlusion. Whilst it is accepted that many of the historic occlusal concepts were well intended, closer examination reveals that many were unnecessarily destructive of sound tooth tissues and did not deliver all of their purported benefits. Those fallacies make them less appropriate in the litigious environment of contemporary dental practice. This paper discusses the disadvantages of 'subtractive' dental procedures for the management of tooth wear, and highlights the benefits of proven minimally destructive 'additive' techniques.

## Introduction

Subtractive dental procedures, i.e. removal of sound tooth structure as part of elective tooth preparation to receive multiple indirect restorations, are often undertaken in order to provide an "ideal" occlusion. Precise sound dental tissue destruction is an inherent part of preparation for traditional full coverage crowns required for many "full mouth rehabilitation" philosophies.<sup>1</sup> Those traditional dogmatic views need to be challenged more vigorously now,

particularly following the recent heavy promotion of digital dentistry and zirconia.

More biologically sensible concepts and proven adhesive materials are now readily available to solve a lot of dental problems by bonding direct resin composite, ideally using a total etch and a three bottle adhesive system. Direct resin composite can be inserted in stages from a wide variety of paths of insertion. In marked contrast, indirect restorations

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can only have one path of insertion. To provide this single path of insertion, the structurally sound tooth often has to be milled using a high speed drill. In order to achieve the idealised tooth preparation for full coverage bonded crowns, between two thirds and three quarters of the tooth can be destroyed.<sup>2</sup>

Indirect restorations are often cemented with poorly filled resin cement. Unfortunately, there are three possible sources of contamination with indirect restoration, such as ceramic veneers or zirconia veneered full coverage crowns. They include contamination of the prepared tooth by saliva, crevicular fluid or frank blood at any point in the cementation stage before the adhesive cement has set. Similarly, the fit surface of the restoration can be contaminated by any of those fluids at any point, thereby making it much less retentive. Thirdly, any of the contaminating fluids can get into the setting cement and thereby considerably reduce its cohesive properties.

In basic bioengineering terms, if someone is already short of tooth tissue from their wear, drilling off what little they have left makes little sense.

It is in most patients' best interest to avoid unnecessarily *subtractive* techniques in the pursuit of occlusal fallacies. Instead, the goal should be to retain their remaining enamel halo as well as their sound ring structure and pulpal health by the use of *additive techniques* for the restoration of reasonable dental appearance and decent function. The emphasis now needs to shift from the survival of the restorations to the survival of the teeth in the long term.

Numerous prospective clinical studies have reported on managing anterior tooth wear problems satisfactorily by means of pragmatically adding direct resin composite to worn teeth at an increased anterior vertical dimension, without incurring long term structural or biologic damage.<sup>3-8</sup>

Poyser et al. demonstrated satisfactory outcomes in a prospective randomised clinical trial, which involved adding direct resin composite to worn lower anterior teeth.<sup>5</sup> A follow up study on the same patients reported on the continued service

of most of the restorations in that trial.<sup>7</sup> There were some patients with minor chipping which required repairs. However, none of these additive restorations caused even one tooth to lose vitality or to require root canal treatment or extraction in the following six years.<sup>7</sup>

That stands in marked contrast to the numerous studies reporting on pulpal and periapical problems in bonded full coverage crowned teeth.<sup>9-11</sup> For example, pulpal deaths were recorded by Felton et al. as being around 13% in teeth restored with full coverage crowns as compared with 0.5% of unrestored controls during the up to 30 year follow up period.<sup>11</sup>

No temporomandibular disorders (TMD) or periodontal problems were associated with the 'additive' restorations bonded on the worn lower incisors in the studies by Poyser et al.<sup>5</sup> and Al-Khayatt et al.<sup>7</sup> Furthermore, all the teeth survived and were healthy - but some restorations on those high-risk teeth chipped a bit and needed to be repaired on a pragmatic basis. The benefits of, and the procedures for, composite restoration repairs have been described elsewhere.<sup>12-14</sup>

It is important to remember that the tips of worn lower incisor teeth are about as extreme a test as direct resin composite is ever likely to face. This is because of the greatly reduced surface areas of the worn incisal tips, and the direct resin composite built-up tips on lower incisors that continue to act like chisels. Those direct composite restorations had been subjected to serious and ongoing shear and tensile forces destructive enough to wear down enamel. Resin composite performs much better in laboratory compressive strength tests than it does in shear or tensile tests,<sup>15</sup> but reports on the results of long term clinical testing also provide valuable information.

An Australian retrospective study<sup>16</sup> reported on the outcomes for patients with severe tooth wear who were treated either with bonded composite restorations or by ceramic bonded to metal crowns. If there were no complications, then the metal bonded to ceramic crowns performed somewhat better than the bonded composites in terms of the *restoration* survival. Conversely, in relationship to *tooth* survival, if there were complications then

the bonded composite required simple repairs and no teeth were lost, whereas the later complications with the crowned teeth required root fillings or extractions.<sup>16</sup> In other words, the long term biological consequences for the worn teeth treated in the different ways were very different.

### Validity of consent issues

It is important to recognise the paradigm shift in relationship to the validity of consent following the Montgomery ruling. It emphasised that clinicians (including dental professionals) have a duty of informing patients of any "material risks".<sup>17</sup> Most sensible patients would be interested in any pertinent "material risk" information before committing themselves to one line of management as opposed to another. Some patients, e.g. bulimics, might not wish to have ongoing questionable "monitoring" of their teeth whilst the invaluable matrix of their enamel continues to erode due to the frequent vomiting of hydrochloric acid with a PH. of about 1. If they really understood those "material risks", they might wish for early intervention by bonding protective direct resin composite to the palatal aspects of their vulnerable maxillary teeth. This is because resin composite is largely resistant to the vomited stomach acid.

One fundamental difference between dental erosion and caries is that with erosion, or other causes of tooth surface loss, the enamel matrix disappears. Thus, there is no matrix left to remineralise. This is a very different problem to caries where the enamel matrix remains, meaning that there is something left to remineralise.

Disclosing the relevant facts in advance, whether patients ask for them or not, is advisable for consent to be considered to be valid.<sup>18,19</sup>

Chana et al.<sup>20</sup> reported on a follow up study on managing tooth wear on posterior teeth using alumina blasted gold metal restorations, most of which had very simplified occlusal anatomy without causing any significant problems. Those restorations were placed "high" without any anterior composite being used first to create space. A 90% success rate was recorded over a five year follow up

period. None of the teeth had lost vitality or required root canal treatment or extraction.

The logical extension of the 'additive' rather than 'subtractive' concept is that direct resin composite can be employed to create occlusal space for any required posterior restorations by first adding resin composite to the structurally sounder anterior teeth, whether they are worn or not, *provided that their opposing teeth are also structurally sound.*

If appropriate, all the maxillary sound teeth from premolar to premolar can have direct resin composite added to them at whatever anterior vertical dimension increase that is deemed to be sensible in terms of function and appearance. However, both the teeth having the composite additions and the opposing lower incisors and canines need to be reasonably sound, meaning that they have not been restored with indirect restorations.

A clinical case will help to illustrate these points (See Figures 1a and 1b). The addition of resin composite was done *primarily to preserve and to protect* the remaining sound tooth structure. No real attempt was made to idealise the occlusion or the "anterior guidance". The molars were allowed to re-establish occlusal contacts, which they did within three weeks.

Adding resin composite resin can be appropriate in many cases of molar teeth erosion (See Figures 2a, 2b and 3), particularly if the material is being placed in a thick section and loaded mainly in compression. That is because composite resin has good properties when subjected to compressive loads.<sup>15</sup>

The problems shown in Figure 2 were caused by chemical erosion from the diet drinks and fruit juice being sluiced around the mouth. Therefore, the material used to repair and protect the teeth only needs to be resistant to chemical attack; it does not need to withstand excessive physical forces. Not having deep occlusal anatomy on the resin composite reduces the chances of vertical cracking of mandibular molars. The upper cusps cannot indent themselves deeply into the lower occlusal surfaces in order to produce the wedging forces often responsible for splitting teeth.



*Figure 1a: These eroded maxillary anterior teeth still have most of their strength left because their marginal ridges are intact. This type of tooth surface loss is common in bulimics although bulimia was not the cause here*



*Figure 1b: Direct resin composite was bonded free hand using a three bottle adhesive bonding system to the maxillary teeth from the upper left around to the upper right premolars*



*Figure 2a and 2b: Both lower first molars are eroded with their enamel ring structure still intact, thereby maintaining their strength. It is a fallacy that removing the marginal ridges for crowns as part of "full mouth rehabilitation" is either sensible or indicated*



*Figure 3: The eroded first molars were bonded freehand using a total etch approach using a three bottle adhesive system and a hybrid resin composite, with no particular attempt being made to create fancy occlusal anatomy. Preservation of the intact ring structure of the eroded first molar teeth is the much more important consideration*

One author of this paper (MGK) and various other pragmatic clinicians<sup>3,5</sup> have employed variations of the 'additive concept' very successfully in private practice and in hospital practice over a fifteen year period on thousands of restorations. Many seriously eroded teeth

were pragmatically bonded with resin composite without any serious attempts being made to produce idealised occlusal anatomy. The main reason for this was that the resin composite only needed to be resistant to chemical dissolution from dietary or gastric acids, rather than having to resist particularly heavy occlusal forces. Sadly, however, the biologically friendly 'additive' technique is not rewarded by the NHS UDA system.

Bonding to the intact sound anterior teeth increases the anterior guidance, which then protects the weaker and often heavily compromised posterior teeth. This is a version of a mutually protected occlusion, but it does not need any sophisticated articulator because the majority of the strength of anterior teeth is still present in their marginal ridges.

### The fallacy about "even anterior guidance"

Intact anterior teeth can easily take and adapt to increased loads, and the majority of patients readily settle in to a new intercuspal position (ICP).<sup>5,7</sup> In



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protrusion, the loads do not have to be exactly even. Maxillary central incisors are roughly twice the size and have a much greater palatal surface area than maxillary lateral incisors. Why should the smaller lateral incisors carry as much load in protrusion as the big central incisors to produce even anterior guidance? That might just about make some sense on extensively prepared teeth, although even then it is highly debatable. It should be pointed out that the requirement for 'even anterior guidance' is actually often being created by the elective destruction of about two thirds of the sound tooth tissue for full coverage bonded crowns. This causes a reduction in their stiffness, and risks causing irreversible damage to the pulpal health.<sup>21,22</sup> If a clinician has been unwise enough to destroy lots of sound marginal ridge tooth structure electively, they do need to be very careful and utilise the appropriate sophisticated articulators and use careful with protrusive loading, inter-occlusal records. However, it should be borne in mind that those problems were actually caused by the unnecessary dental destruction of load bearing marginal ridges in the pursuit of some antiquated, fundamentalist, occlusal ideals.

### A more biologically sensible occlusal idea: "addition beats subtraction"

Another occlusal fallacy is that occlusal contacts and fancy looking cusps on restorations are protective and matter more than the long term good health of the remaining sound teeth. It is a commonly believed fallacy that elective and seriously destructive approaches to sound teeth in order to achieve "an ideal occlusion" can now usually be justified. When considering the restoration of teeth with excessive wear or other restorative problems, pragmatic additive techniques using direct resin composite, possibly coupled with other adhesively retained restorations, are now often to be preferred to subtractive or destructive techniques. This applies even if the occlusal scheme outcomes might not find favour with some charismatic occlusal guru's teachings.

'Additive approaches' ensure that most of the structure and pulpal health will be preserved by using resin composite as a tooth protective and sacrificial material,

rather than enamel and dentine being sacrificed for some biologically dubious occlusal dogma.

In formulating extensive full mouth rehabilitation treatment plans that involve treating the damaged teeth and the virtually sound teeth alike, enough attention is not always drawn to the now well-known ability of most patients to adapt readily over time to changes in their occlusion, as demonstrated by Anderson over fifty years ago.<sup>23</sup> Declan Anderson was a polymath dental physiologist who worked in London and Bristol in the UK. His description and findings in 1962 about patients adapting readily to occlusal changes preceded the clinical reports by the Norwegian Bjorn Dahl who in 1975 successfully managed advanced localised attrition based on axial tooth movement and those patients' ability to adapt to changes in occlusal vertical dimension by crowning them.<sup>24</sup> An example of resin composite addition for the management of worn teeth resulting in occlusal vertical changes is shown in Figures 4–10.



Figure 4: A case of suspected tooth surface loss in a 37-year-old male patient



Figure 5: Light surface roughening ensures that no resin tags are left to interfere with etching. Placement of small sections of Komet serrated strips (Komet Dental, West One Dental, Croydon, UK) prevents etching of adjacent teeth and stops sticking of teeth together when bonding them



Figure 6: The marginal ridges have been left intact because that is where most of the strength of teeth actually is. No bevelling of the residual enamel was indicated or done



Figure 7: A paper point (size 80) placed inter-proximally stopped the phosphoric acid gel from starting any inflamed gingival bleeding. It was removed after washing the phosphoric gel off and a new paper point was inserted when dry to wick the hydrophilic resin and hydrophobic resin in order to cover the tooth



Figure 8: Surface roughened dentine is an island within the unvelled enamel. Enamel check - etched and turned frosty after washing and drying. The Dry Guard and the paper point are visible



*Figure 9: Single appointment free hand sculpted, non-layered, direct hybrid composite addition using a three bottle adhesive system resulting in a "good enough" appearance and improved function with no pulpal deaths along with maximum tooth structure preservation for the patient's future*



*Figure 10: Periodontal ligament proprioceptors have been termed the "lovely ladies in the ligaments"<sup>25</sup> because they do most of the work to produce the new ICP, but without very elaborate cusps. Preserving the maximum amount of enamel and the intact ring structure of worn teeth is much more important than sophisticated occlusal shapes or cuspal anatomy in preserving and maintaining the remaining worn teeth for the patient's long term benefit*

## Conclusion

Where restorative treatment is indicated, a pragmatic approach should be considered. Thought should be given to minimising further dental destruction and preserving the remaining sound tooth structure using additive techniques, with

minimal, or no tooth preparation, where feasible. With this in mind, the long term health of the worn teeth should be given priority over the longevity of restorations, which can be polished, re-surfaced, re-pointed or replaced as required throughout the patient's lifetime.

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