Preventive (Evidence-Based) Approach to Quality General Dental Care

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Dental caries · Dental practice · Dental treatment · Evidence-based dentistry · Periodontal diseases · Repeat dental restorations · Repeat restoration cycle

Abstract
Restorative and scaling treatments have not generally provided an effective method for managing dental caries and periodontal diseases. Rather, restorative treatment has often covered up the disease processes in the short term and created a new problem: that of maintenance and re-restoration of restored teeth. Thus, standard invasive dental treatments that are commonly provided failed to address the fundamental bacterial nature of the diseases. Indeed, these treatments rather readily generate and perpetuate a totally unacceptable chain of events. This chain embraces many shortcomings, which themselves nurture what may be described as the repeat restorative cycle. The time has come to correct this iniquity. Dental caries and periodontal diseases are dynamic conditions which need ‘managing’ with a focused cocktail of preventive and refined restoration care. Much more emphasis should be placed upon the assessment of each and every caries or periodontal lesion, with a view to implementing specific preventive measures and allowing the natural arrest of disease processes to occur. The universal adoption of a preventive (evidence-based) approach to making dental treatment decisions could be by far the most powerful factor in reducing the restorative burden of dental services. It is clear that dental education and practice need to rise proactively to the challenge, or changes will be forced upon them while they are in a defensive position. There is a need to move wholeheartedly and contentedly into the preventive era.

Introduction

Traditional restorative dentistry has had a strong influence on dental education and practice in many parts of the world, and invasive restorative treatment has tended to take precedence over non-invasive preventive measures. It appears that many dentists erroneously presume that dental caries can be ‘treated away’ with restorations and that periodontal diseases can also be ‘treated away’ by regular scalings. Indeed, many dentists seem to believe that traditional dental treatment automatically results in oral health [1].

Dental caries and periodontal diseases, both bacterial in nature, are largely preventable from the start. But they are not always prevented: rather, the forces leading to the diseases are allowed to remain in balance with those that lead to health. The situation prevails today whereby the scientific basis of these diseases has largely been established [2, 3], but the services providing appropriate dental care to manage them remain out of date and fail to be properly evidence-based.

Thus, much of the profession appears still to be wedded to the traditional invasive ‘treatment’ that fails to address the causes of the diseases. When the diseases occur, there is a need for a real and responsible commitment by the dentist to help the patient revert to a disease-
free status by restoring the balance so that the forces tending to prevent the diseases outweigh the forces contributing to their progression.

Caries

Caries is not simply a one-way process. All carious lesions involve both demineralisation and remineralisation phases [4]. A lesion increases in size only when the calcium and phosphate ion exchange between the tooth and the saliva, mediated by bacterial plaque, favours net mineral loss over long time periods. Such lesions may be described as active. On the other hand, if and when the conditions are such that the calcium and phosphate ion exchange favours mineral gain over time, the lesion may be described as arrested. Causing carious lesions to arrest should be a primary preoccupation of dentists.

Caries is very much related to environmental and lifestyle habits such as bacterial plaque, dietary patterns, and fluoride usage, which are themselves very much linked to things like living conditions, economic factors, education levels, school routines, work routines, home and leisure routines, social habits, and personal whims and fancies.

Consider the patient who has an active class II carious lesion that has extended well into the dentine. Most clinicians would agree that when this stage of caries development has been reached, it is necessary to excise the diseased tissue and make good the defect with a restoration [5]. But that is just one phase. It is also necessary to bring about a change in the environment of the tooth and of the rest of the dentition so as to prevent further caries, including the development of new primary carious lesions [6]. Thus, proper caries management is all about identifying the main aetiological factors, and selecting and targeting specific efficacious preventive measures to help overcome specific imbalances. It is also about causing patients to make relevant adjustments, in a highly focused manner, to their dietary patterns, oral hygiene habits and fluoride (and chlorhexidine, xylitol, etc.) usage as appropriate. Fissure sealants may also be necessary. The whole process will need monitoring and perhaps fine-tuning over time [7].

So, in addressing the question ‘How should the profession be managing caries?’ the answer has to be by establishing regimens with patients, such that the diseases are arrested and prevented from recurring through environmental and lifestyle measures (though backed up by procedures to restore form and function where appropriate). It is essential that the regimens advised are tailored to the individual, and that they are sympathetic to the individual’s environmental and lifestyle characteristics.

Caries prevention works, so once a preventive philosophy prevails, then the whole attitude to invasive procedures changes. Many carious lesions that would have been restored under the traditional model of dental treatment can be made to arrest, and many existing but morphologically deteriorated restorations can be allowed to continue to function satisfactorily [8].

Thus, modern quality dentistry requires the dentist to have the wisdom and courage to ‘go modern’ with restorative treatment decision making – substituting preventive care for some invasive procedures. Where restorations are required, they will necessarily be minimally invasive and of high technical quality [9]. Thus the routine use of rubber dam, magnification, sharp hand instruments, well-adapted contoured matrix bands, all used with finesse at every stage, becomes integral with modern prevention-based restorative dentistry.

Periodontal Diseases

Plaque-induced periodontitis is believed to involve periods dominated by tissue destruction and periods dominated by tissue repair [10]. Between these fluctuations of activity there appear to be periods of quiescence and stability. Net loss of epithelial attachment and alveolar bone destruction occur when the interactions between the bacteria and the patient’s responses are out of equilibrium such that they favour pathological destruction and loss of structure [11].

Consider the patient who has gingivitis and destructive periodontitis, in whom plaque-induced inflammation has led to apical migration of the gingival epithelial attachment to the root surface of the tooth. The aim of treatment is to arrest attachment loss and cause a reduction in pocket depth; indeed, the aim is normal-looking gingival tissue with pocketing no greater than about 4 mm which does not bleed or discharge pus on probing. The treatment should take the form of effective daily oral hygiene carried out by the patient, plus professional scaling and removal of noxious elements in the periodontal pockets, including the removal of the complex subgingival mass of bacteria which may be adhering to the root surfaces. Other treatment, such as the reshaping of restorations, may also be necessary. As with caries, the prevention phase is critical. However, whatever the patient does, plaque may return to the deeper parts of the gingival crevice, so ongoing professional care may be needed at specific sites.
It is necessary to ask, and where necessary address in depth, some questions regarding the treatment and prevention of destructive periodontal disease. For example:

(a) How well does the patient remove visible plaque on an ongoing basis?

(b) Is the patient still using the non-favoured ‘roll’ technique of brushing as opposed to a method involving cleaning of the gingival crevice?

(c) Has the dentist or hygienist effectively taught the patient a realistic method of plaque control, tailored to his or her individual needs?

(d) Has the patient unwittingly implied that multiple daily toothbrushings are desirable or indeed a panacea for oral health (which they are not)? Certainly, such multiple daily toothbrushings are irrational with respect to caries as well as periodontal diseases, for it is well known that disease-causing plaque takes longer than 24 h to become established.

(e) Has flossing advice been sufficient?

(f) Is the patient or the professional incorrectly assuming that antibacterial mouthwashes used in the long term are able to make up for deficiencies in mechanical plaque control and that they can therefore be relied upon to prevent further disease [12]?

(g) And, worst of all, is the dentist living under the illusion that a ‘quick scale and polish’ from time to time itself constitutes appropriate care/treatment? Often it does not.

It is easy to fail with preventive care and treatment against periodontitis, on the false basis that it can be accomplished by means of a regular ‘scale and polish’, along with a few minutes of instruction about oral hygiene and some general advice given every now and again. Several experts have indicated that proper subgingival scaling and root planing take some 5–7 min per tooth [13], or more [14]. Further, ineffective scaling and polishing may actually do more harm than good, in that while failing to achieve its objective, it may cause damage to the attachment and to the hard dental tissues, even to the extent of taking away some of the high-fluoride outer zones of the teeth [15].

By far the most important thing to do is to inform the patient that it is his or her success with daily plaque control that is the vital factor in determining the long-term outcome. And if the patient is a tobacco smoker, then attempting to convince him or her to quit the habit should be seen as an important component of the preventive dental package, since smoking has a markedly adverse effect upon periodontal inflammation and healing [16].

Dental professionals should appreciate that giving preventive advice in the form of oral hygiene instruction is not of itself a preventive measure. The preventive measure succeeds when the patient actually achieves excellent daily oral hygiene; it is this latter which must be the objective.

**Why the Problem?**

Why does evidence-based quality general dental care constitute a challenge to the profession? Surely it should naturally form the basis of all dentistry, shouldn’t it? After all, dentists are professionals, and professionals should, by definition, avow to offer the best for their patients. The old adage ‘Prevention is better than cure’ is well known, but if dental diseases do occur, it is important to treat them as non-invasively as possible. Ask the World Health Organization or any health minister whether or not it is better to have diseases such as polio, yellow fever, cholera or AIDS in a community or to prevent their occurrence.

The answer does not need stating, so why do large segments of the dental profession appear to ‘accept’, as if it were inevitable, the occurrence of avoidable dental diseases such as dental caries and periodontal diseases?

What has contributed enormously to the present profile of traditional dentistry, including the teaching in dental schools, has been the widespread dissemination of G.V. Black’s principles of cavity preparation in the early part of the last century, followed by a phenomenal growth in operative dentistry over the years, particularly up to about 1975. The world saw a proliferation of dental schools with vast areas of clinical space devoted to operative dentistry. The clinics became powerhouses, dominating all other activities and engulfing large portions of curricula. Hume [17] has described the phenomenon as a restorative tiger that needs ‘taming and turning’. If G.V. Black, who has been described as the Father of Dentistry, were alive today, he would have been at the forefront of the taming and turning process [18].

A problem here lies in the fact that it is rather easy for both patients and dentists alike to naively believe that operative dental treatment automatically results in oral health. And many dentists have little experience of disease control (as distinct from providing operative treatment), even though they should, theoretically at least, have retained the necessary knowledge from their undergraduate training days. However, the stark facts of the matter are that patients in a low-risk category for caries can inadvertently be shifted towards a significant risk of ongoing replacement restorations once the first set of restorations has been placed in the teeth [19].
To illustrate this point, it is relevant to consider a prospective study of dental treatment provided to a large random sample of dentate adults in Scotland. It showed that the amount of operative treatment the patients received over a 5-year period related very much to their dental office attendance patterns and to the number of teeth which already contained restorations [20]. Indeed, it was found that the average number of tooth surfaces restored during any one course of treatment was approximately the same on average, regardless of the frequency of the courses. Thus the patients who went to the dentist more frequently received more restorations per unit of time (almost in direct proportion to the number of courses of treatment received). Further, the proportion of restorations that were replacements increased markedly as the total number of restorations present increased.

Somewhat inevitably, therefore, it was found that the more restorations a patient had, the more the patient was likely to receive. And the people who received the most restorations tended to be relatively well educated and conditioned to visiting their dentists regularly. Overall, it was found that 50% of restorations were placed in the teeth of just 12% of the population. This 12% therefore represents a group at high risk of receiving yet more restorations; after all, they had their restorations examined more frequently than those who attended more rarely, so the chances of a morphologically defective restoration being targeted for replacement were greater in these individuals. Certainly it cannot be assumed that dentistry, as widely practised, is necessarily good for the teeth. The corresponding figures for other countries may differ somewhat from those given above, but it is likely that equivalent scenarios are found elsewhere.

Table 1. The potential chain of events which leads to many shortcomings of traditional restorative dental treatment and nurtures the repeat restoration cycle

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
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<tr>
<td>The patient visits the dentist but</td>
<td>Clinical examination procedures are often rather simplistic and casual and Diagnostic tests (for caries and other lesions) are largely subjective [21–23], so it is not surprising that Caries diagnoses are often inaccurate [23–25].</td>
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<tr>
<td>At the same time</td>
<td>Caries status is not properly taken into account and Caries risk factors are not generally considered [26].</td>
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<td>Even in doubtful situations</td>
<td>Undertaking restorations is considered to amount to ’good dentistry’ [27], so it comes as little surprise that Restorative decisions tend to be idiosyncratic and somewhat aggressive [27–29].</td>
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<tr>
<td>Thus</td>
<td>Caries aetiological factors are not modified and Preventive backup is inadequate [8], i.e. Caries is not managed as a disease [6, 8].</td>
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<td>Indeed</td>
<td>Dentists appear to gain fulfilment by cutting away sound tooth substance (such cutting being a primary function of the high-speed drill). Thus The use of outdated concepts of cavity design (perpetuating Black-type cavities involving excessive cutting of sound tooth substance) is commonplace [30, 31] and Dentists fail to appreciate the exacting nature of restorative procedures.</td>
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15
It is no surprise therefore that
Restorations of mediocre quality are readily placed [30, 31].

Sadly
These restorations often contain characteristics consistent with inbuilt obsolescence.

In addition
Bur damage, for example, is imparted commonly to the adjacent tooth [32]

and
Non-physiological approximal contours frequently lead to plaque accumulation and periodontal disease.

In due course the patient is recalled but
Recall assessments of restorations tend to be idiosyncratic [33].

Thus, for example,
Ditched margins are commonly assumed to signal failure of the restoration [5, 30]

and
Existing restorations are readily deemed to have failed [20, 34], particularly if the patient has just changed from a previous dentist [35].

However
The matter of why restorations have failed is not questioned by the dentist or patient.

Nevertheless
Restorations are readily cut out and replaced
in spite of
The causes of failure often not being identified correctly [36].

It is almost ubiquitous that
The cavities increase in size when restorations are replaced [30, 37]

and consequently that
The teeth become weaker [39].

It is no surprise to find that
Errors in the previous restorations are often repeated in the new ones [30]
so that
The inbuilt obsolescence in the restorations is perpetuated.

Inevitably, as they increase in size
The restorations become more complex and difficult to carry out [38, 39]

and
Correct chemical treatment of the cavity, where necessary, becomes less certain.

Further, one cannot escape the fact that
Bacteriological, mechanical and chemical insult to the pulp is increasingly likely to occur.

Overall
The dentist fails to realise the iatrogenic nature of the ‘treatment’.

Indeed
The dentist genuinely believes he/she is making the patient more healthy.

At the same time
The patient is under the illusion that he/she is actually being made more healthy.

But deterioration continues such that, for example,
Gross fracture of the tooth may occur

and
Crowning may be effected as a ‘cure-all’ procedure.

However
The crown fails to properly fit the margins of the prepared tooth
and, if visible,
The crown looks artificial.
Table 1 (continued)

Inevitably
*Plaque stagnation, halitosis and periodontal disease (and perhaps caries also) increase.*

In due course
*The need or perceived need for endodontic treatment arises.*

However
*Root canal preparation is often inadequate* and
*Root canal obturation is often incomplete, leaving a nidus for continuing bacterial proliferation.*

Not surprisingly
*Periapical seepage of bacterial toxins occurs* so
*The periapical lesion persists.*

This may lead to
*Apicectomy and retrograde root filling taking place, though without first making the root canal filling adequate.*

Surprisingly, with this invasive procedure
*The dentist now feels he/she really is saving the patient’s dentition.*

But
*The tooth fails to settle and symptoms continue* so
Repeat compromised endodontic or apicectomy treatment takes place and inevitably
*Pain and sepsis remain ongoing.*

At some stage
*A post is liable to be placed, further weakening the tooth.*

Patronisingly
*The dentist blames the patient for having a weak tooth with unfavourable root canal morphology* so
*The tooth is extracted.*

Nevertheless
*The dentist feels overall that he/she has done a good job in providing ‘quality’ care over the years.*

To overcome the missing tooth
*A bridge is placed* but unfortunately
*The occlusion and aesthetics are altered unfavourably and the patient is dissatisfied.*

In due course
*The bridge gets replaced* but
*There is minimal accompanying anticaries or antiperiodontal disease advice.*

Next
*An abutment tooth fails and is extracted* so
*A larger bridge is made involving more teeth.*
Because the bridge morphology is compromised

Plaque accumulates and periodontal disease increases.

Indeed, from the very beginning, the following almost ubiquitous and vain scaling scenario is likely:

Each scaling results in clean teeth for a day

but

Bacterial plaque then returns, engendering further periodontal disease.

However

The periodontal disease is not properly evaluated or documented.

Indeed

The periodontal disease is not prevented or treated.

Instead

Further scaling takes place, leading to clean teeth for another day.

But inevitably

Bacterial plaque returns to continue the disease process and

Irreversible alveolar bone loss is liable to take place as periodontitis takes a hold.

At the same time

Halitosis becomes a real issue for the patient

but

The halitosis is not even considered by the dentist.

Over the years

The scaling cycle is repeated many times in the absence of proper periodontal care/treatment

so

The periodontal disease carries on, largely unabated.

Not surprisingly

Further tooth loss occurs.

In an attempt to restore appearance

A removable partial denture is made.

But somewhat inevitably

The periodontal disease continues to spread.

Whether privately or through third-party funding

Costs continue to spiral as the dentition deteriorates.

Looking at the wider scene, it is clear that

Dentists fail to appreciate that the public is not very satisfied.

Indeed

Dentists tend to forget that patients do not like having restorative treatment [40, 41].

Thus

The public is unhappy about dental services [42]

and

The dentist feels dissatisfied also [43].

Indeed

The dentist becomes increasingly disillusioned with dental practice

and

He/she loses any zest for quality care.

Sadly

Burn-out rather readily sets in and the dentist spirals downwards [43].

This inevitably means that

Any hope of quality dental care is gone forever.
The Repeat Restoration Cycle

Research over the last 20 years or so has made it possible to assemble a model of the potential chain of events that embraces many shortcomings of traditional restorative treatment, namely the repeat restoration cycle. This potential chain of events is given in table 1. The contents of this table form an integral part of the text of this paper and should be read at this stage.

The repeat restoration cycle is driven by a culture of drill-related dentistry. Thus, many dentists have an urge to place and replace restorations, apparently feeling ‘comfortable’ when they intervene invasively [8, 20, 42]. Further, there is an apparent disregard for the inevitable weakening of the teeth in the process, especially as the restorations are placed and replaced over the years. After all, by virtue of the repeat restoration cycle, it is inescapable that restorations are often not very durable (many surviving only for a few years) [44–49]. And, of course, restorations do not cure caries anyway.

The characteristics of the repeat restoration cycle are totally unsatisfactory in an age of potential evidence-based dentistry and at a time of increasing accountability. Yet there is a strong implicit message to patients that any operative treatment suggested is both necessary and worthwhile. It is well known that most ‘treatment’ undertaken in dental practice is not at variance with what was taught in dental school. But the dental school was yesterday. Today’s patients require today’s care.

In light of the repeat restoration cycle, is it really surprising that the profession suffers from low morale and stagnant motivation, when mechanistic solutions to biological problems weigh so heavily in many dental practices?

Patients often do not understand what is going on – they do not understand the repeat restoration cycle – and as ‘consumers’ they have varying levels of faith, ranging from suspicion and distrust to acceptance of virtually anything the dentist suggests.

Moving Forward towards Evidence-Based Dental Care

It is essential that the dental profession breaks away from yesterday’s concepts in favour of dental care aimed at optimising oral health and maintaining the natural dentition in as intact a state as possible. Some members of the profession have made this break already and are providing excellent evidence-based quality dental care. In addition, they report a marked improvement in the quality of their working lives as a result. Sadly, it has to be noted that many dental school teachers have very definitely not made the break. It is clear that considerable changes are required in dental education [50].

By referring to restorations as ‘treatment’, the profession has drifted hopelessly away from evidence-based dentistry [6]. Yet the profession is steeped in the use of the term when often no treatment is in fact provided, just restorations that readily lock the patient into the repeat restoration cycle, each restoration being less prophylactic and more iatrogenic than the one before. Thus, to the patient who asks ‘Do I need any treatment?’ it is a very naive dentist who replies, ‘Yes, two fillings.’ A more appropriate reply might begin along the lines of, ‘Yes, you have two carious lesions, so we need to set about altering the nature of the chemical processes going on in your mouth in order to cause the lesions to arrest ...’

With the public’s increasing awareness of the shortcomings of traditional restorative dentistry and, at the same time, a heightened understanding of the possibilities for prevention, patients can be expected more and more to demand preventive ‘quality’ dental care. Indeed, it seems that the supply-and-demand forces of the marketplace will reinforce the scientific argument and put increasing pressure upon dentists to adopt a more preventive approach to the management of caries, defective restorations and periodontal diseases. Then the patient who attends regularly will become less ready to accept an apparently unending commitment to restorations and re-restorations, with scales and polishes thrown in from time to time.

As caring professionals, dentists should stop pretending that operative treatment is necessarily rational. Prevention and the promotion of health are becoming increasingly necessary in order to satisfy the requirements of today’s people, undertaken within a context of evidence-based oral health care. The real challenges for the future are: (1) for dental education to accept wholeheartedly the changes mentioned in this paper, and to ‘run with them’; (2) for dental practice to put the changes into action out in the field, and (3) for licensing bodies and remuneration systems to develop in sympathy.

Thus, there is a fundamental need for a reappraisal of dental education. But questions remain as to how university teaching staffs can be brought fully up to date so as to assist the change in emphasis towards prevention and thereby help tame Hume’s [17] restorative tiger [18]. Initiative and innovation are now required in order to bring about the necessary changes in dental education to suit it
to the needs of the changing world. There is a clear need for all those involved in providing oral health care, especially licensing bodies and those responsible for health care delivery, to widen their perceptions of the issues at stake and thereby enable forward-looking curriculum development. Either the profession stands up and says what good dentistry is, or the public and politicians will force their way, and the profession will then be in a defensive position and less ready to respond in an acceptable manner.

Conclusions

Standard, invasive dental treatments such as restorations and scaling are in general not an effective way to manage dental caries and periodontal diseases. Much more emphasis should be placed upon the assessment of each and every carious and periodontal lesion with a view to allowing a possible natural arrest of the processes to occur, aided by specific preventive measures as appropriate. Existing restorations should not necessarily be replaced just because there is a moderate degree of marginal breakdown. In view of the adverse potential of the repeat restoration cycle, the withholding of restorative treatment when appropriate may itself be considered a prime preventive measure. Indeed, the universal adoption of a preventive, evidence-based approach to treatment decisions could be by far the most powerful factor in reducing the restorative burden of dental practice.

References