KEY WORDS
Drugs, xerostomia, pharmaceutical companies, corruption, prevention

LEARNING OBJECTIVES

- To alert practitioners to prescribed drugs inadvertently causing caries in aging compromised dentitions
- To encourage doctors to conduct a "BRAN analysis" prior to prescribing medications causing xerostomia
- To offer dentists practical ways of mitigating the xerostomic effects of prescribed medications

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DOCTORS' DRUGS AND THE DANGERS OF DENTAL DECAY

ABSTRACT

Many "anti-something" medications, which are prescribed by medical doctors for older patients, often for dubious reasons, result in a serious reduction in the quantity and quality of saliva. That drug-induced xerostomia can produce dangerous dental decay, particularly in already compromised dentitions.

This article suggests that doctors should undertake a personalised "benefits, risks, alternatives, nothing" (BRAN) analysis including an assessment of the possible dental decay risks, especially before prescribing combinations of "anti-" drugs for marginal conditions.

Doctors should consider carefully if alternative approaches are feasible which could produce acceptable outcomes without incurring those serious dental decay risks. Alternative approaches may include patients altering their diet and lifestyle to include more physical exercise for controlling conditions such as marginal hypertension, for example, or perhaps prescribing counselling/talking therapies for depression or anxiety.

If various "anti-" drugs really do have to be prescribed, this article describes cheap, pragmatic, and effective ways of mitigating the risks of already compromised dentitions developing new decay.

Introduction

People live longer in the UK than they used to, but not necessarily in good health.[1] The reasons for their increased longevity appear to include social improvements, lifestyle changes (such as habits and diet) and receiving appropriate healthcare.

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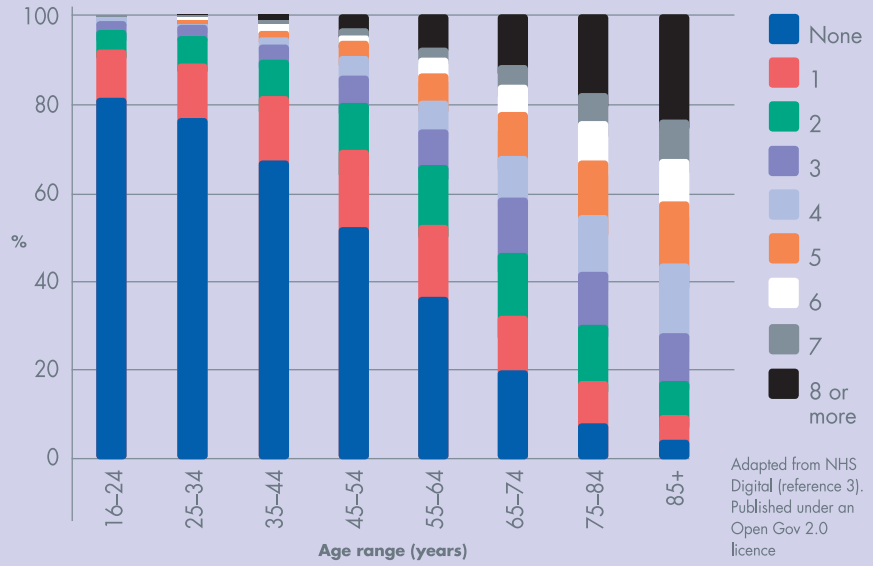
FIGURE 1

A BAR CHART SHOWING HOW THE NUMBER OF DRUGS TAKEN INCREASES WITH AGE



However, in pursuit of this longevity, polypharmacy is now very common in patients over the age of 50, with rising numbers of patients on many prescribed drugs in the next four cohorts (see Figure 1). For example, more than one in ten people aged over 65 years in the UK take at least eight different prescribed medications on a weekly basis.[2,3]

The majority of these are "anti-something" medications of some sort, i.e. anti-hypertensives, anti-coagulants, anti-cholesterol, anti-inflammatories, anti-depressants, anti-anxiety, etc. The combinations employed can be bewildering for patients and for their dental healthcare professionals alike. The long lists that healthcare professionals are expected to interpret correctly often include some "anti-" drugs to counteract the potentially bad effects of one or more of the other prescribed "anti-" drugs. For example, an anti-ulcer drug is often prescribed to reduce the chances of a dangerous gastrointestinal bleed in those patients prescribed anti-coagulants to reduce their *theoretic* risks of a heart attack or stroke, as will be described below.

Most prescribed drugs have good effects, but also potentially bad effects especially when used in combinations. The more drugs that are taken in later life, the higher the statistical chance of there being some adverse reaction at some time.

Figure 2: Caries in a female who had been prescribed ten different "anti-" drugs. The majority of the decay problems could be prevented with "aggressive prevention", as this article outlines

Most drugs are tested for safety singly and in healthy patients. However, many now get used in combinations for much older patients, many of whom have co-morbidities, and often have a decreased capacity to metabolise or excrete those drugs. In these much more complex scenarios, the possible bad effect on salivary secretion takes time to be reported and evaluated. Some of those bad effects might well go unreported by patients or be regarded as being too unimportant to be reported to, or by, doctors, or may be concealed for commercial or legal reasons.

The euphemistic term "side-effects" was invented by "Big Pharma" to trivialise undesirable bad effects when, in fact, those *bad effects* are often worse than the disease that some drugs purport to cure or to alleviate. One of Big Pharma's mantras when promoting their own discoveries, or those made by others which involve them selling copy-cat drugs, is "a pill for every ill. . . and an ill for every pill". However, the production of a significantly drier mouth by many of those "anti-" drugs is now of serious concern for many dentally and medically compromised patients, and for those compassionate clinicians caring for their oral health.

What is the scale of the problem?

In the UK, the number of prescriptions issued in the last 25 years has more than tripled.[4] Many of the prescribed "anti-" drugs, particularly when taken in combinations, affect both the quantity and quality of saliva being secreted. Saliva is the main protector of teeth against developing new caries.

The consequential dry mouth ("drug-induced xerostomia") is very uncomfortable for many patients. That frequently leads to those affected sipping lubricating drinks to alleviate their discomfort. If what is being sipped regularly contains even small amounts of sugar, especially when coupled with suboptimal plaque control, that is a recipe for developing new caries (Figure 2). Not having good quality saliva available means a lack of buffering, as well as salivary calcium and phosphate ions not being readily available to protect the often structurally weak and vulnerable teeth.

Adverse effects of drugs

In his elegant 2018 book *Too Many Pills*,[5] Dr. James Le Fanu described many of the very concerning causes for this increased and arguable over-prescription of various drugs. He traced the reasons for much of the polypharmacy in the UK and exposed some very worrying issues involved. Le Fanu drew attention to many of the problems associated with those prescribed drugs, albeit without much emphasis on the deleterious effects on many older patients' already compromised dentitions.

Figure 3: A fully paid-up member of the "heavy metal brigade" 35 years after treatment, featuring a stable dentition but with only small amounts of sound tooth structure remaining. These usually produce few problems – until the patient is prescribed multiple "anti-" drugs

Why should changes in doctors' prescription patterns worry dental healthcare professionals?

Developing new caries can be catastrophic for older patients, many of whom are long-standing members of the "heavy metal brigade".[6] These patients have many old fillings in "semi-preserved teeth" which are often partly root-filled with metal restorations or sometimes made of ceramic, often bonded to some unknown non-precious metal alloy. Many such teeth are structurally weak because they are missing their marginal ridges, but many have been stable for years and brutally functional (Figure 3).

They would probably have remained without significant problems until some doctors, possibly influenced by the pharmaceutical industry, and/or by the NHS Quality and Outcomes Framework (QOF), prescribed some "anti-" drugs to comply with arbitrary, but well remunerated, NHS targets. The QOF-related payments, which were introduced in 2004 as part of the General Medical Practice (GMP) new NHS contract, are based on a complex points system but, when achieved, can account for about 25% of a medical practice's income. In effect, general medical practitioners are induced contractually and financially, to screen their patients to see if they exceed arbitrary values in order to hit their NHS GMP practice targets. While there have been changes in some ailments being screened or being tested for, that QOF contractual framework could be a factor in some doctors' prescription patterns.

Many patients do not realise that they are sometimes being prescribed drugs for marginally excessive levels of cholesterol or blood sugar, or for largely theoretical conditions that are not troubling patients very much. However, the NHS contract for GMP doctors requires patients in certain groups to be screened to check if any of those measurements are outside of the supposed "normal" (and often changing) ranges. If they are – even marginally – then the "Big Brother" monitoring practice computer indicates that some of the recommended drugs should be prescribed. By doing so, medical practices are able to hit specified NHS targets for monitoring things like marginally high blood pressure, slightly elevated cholesterol of the "wrong type" or ratio, or for supposed "pre-diabetes" or some other government chosen targets, which can often be influenced by the pharmaceutical industry's persistent lobbying.

Patient consent in the post-Montgomery era

How many trusting patients realise that some of the issues mentioned above are potentially relevant factors for them being prescribed different drugs?

In light of the implications of the Montgomery case on UK law of consent, which protects patients' rights to make decisions about their treatment, various issues of consent arise from such practices.[7-9] For example, are patients appropriately informed of *their* material risks in advance of the likelihood of some prescribed "anti-" drugs being really helpful for *them*, as opposed to possibly causing them salivary flow or long-term dental, or other, oral health problems?

A "**b**enefits, **r**isks, **a**lternatives, **n**othing" (BRAN) discussion with each and every patient would take scarce and precious surgery time. In a highly time-pressurised doctor's surgery a BRAN analysis might well not be undertaken before drugs are prescribed or before prescriptions are repeated. For instance, Le Fanu describes how the objective scientific evidence-base for prescribing drugs for *mild* hypertension is poor.[5] Encouraging these patients to eat more healthily, lose some weight and take more exercise would accomplish a better dental and physiologic outcome for them, without drugs.[5] However, the prescription of drugs is rewarded by the QOF inducements. Conversely, the surgery time required to explain the options and issues fairly, and/or to give the advice persuasively enough is not available in the current NHS general medical practice system. In other words, just like the controversial NHS units of dental activity (UDA) system, there is no reward for giving compassionate and effective preventive advice.

In advance of being put on an anti-hypertensive drug(s), many mildly hypertensive patients might not be told that an objective 1980's Medical Research Council (MRC) trial of 17,000 patients with mild hypertension (i.e. not influenced by drug companies) found that 850 patients with mild hypertension would have to be treated to avoid one heart attack or one stroke.[10] That tiny benefit needs to be balanced against the plethora of bad effects reported with calcium channel blockers, ACE

inhibitors, beta blockers or thiazide diuretics.[5]

Le Fanu asks the penetrating question, *"If potential patients realised that such medications for mild hypertension have about a 3% chance of preventing a stroke, but a 97% chance of them doing no good, how many would be pessimistic enough to think they would be in the unlucky few?"*[5] He also questions how many with marginal problems would risk getting those bad effects (not "side effects"), which range from dry mouth, gingival overgrowth, heart failure, kidney failure, gout, or erectile dysfunction, to sudden death?

Controversies about statins

Le Fanu describes how the evidence base for statins is also poor but emphasises that to appreciate the real issues one must distinguish between "relative risk reduction" and "absolute risk reduction".[5] The West of Scotland Coronary Prevention Study (WOSCOPS) was a randomised, double-blind, placebo-controlled clinical trial involving 6,500 Glaswegian men with elevated cholesterol levels. The *relative* risk reduction was 27%, which sounds impressive, but the *absolute* risk reduction was 0.4%.[11]

The Prospective Study of Pravastatin in the Elderly at Risk (PROSPER), another randomised placebo-controlled trial which is of relevance to many older patients, showed that taking statins reduced the *absolute* risk of a fatal coronary thrombosis in elderly men by less than 1%.[12]

Major concerns have been expressed about how representative the many statin trials have been of the issues in females and in the elderly, and whether the reported bad effects (e.g. debilitating muscle pain) were scrutinised as carefully as the purported benefits of statins reducing marginal cholesterol levels.[5]

In the UK, Oxford's Professor Collins' synthesis of 27 statins trials is frequently quoted as evidence for the benefits of statins.[13] However, Dr. Abramson of Harvard Medical School, writing in the *BMJ*, was highly critical of those interpretations by Collins et al.

Abramson et al. wrote, *"Those figures might sound good, but close examination raises questions about both benefits and harm. They certainly do not improve survival for those taking them for 'primary prevention', and as for strokes and heart attacks, 167 people need to take them for five years to prevent one or other of those misfortunes in just one of their number, leaving the remaining 166 exposed to the possible harms for no benefit"*.[14]

Practical implications for UK dental healthcare professionals

While NHS England, Age UK and many concerned general medical practitioners claim to be working towards a zero-tolerance approach to inappropriate polypharmacy, the sad reality remains that many older people are on a cocktail of saliva-reducing "anti-" drugs which are sometimes being prescribed for very dubious reasons. Some of the worrying issues involved are described below.

The "ménage à trois" in UK healthcare

There is a sort of "ménage à trois" going on around patients without many of them knowing much about it, with the drug companies, the government, and the medical profession each having "a bit on the side".

The drug companies

The drug companies pay for effective lobbyists to "whisper in the ear" of the government's policy makers, suggesting that they could take the credit from voters for improving voter/patient health (e.g. by lowering their blood pressure or cholesterol) and they just happen to have the drugs to do that. That idea was aided by an unproven assertion by a UK epidemiologist that, in essence, "the UK population is sick".[15] The argument used in that assertion was that the blood pressure, cholesterol, and glucose levels in the UK population were too high *on average* and that it would be beneficial to lower those measurements in millions of people rather than focussing on the relative few where the cholesterol, glucose or blood pressure were at very high levels and therefore where they would indeed be problematic. Illogical as that strategy seems, attempting to implement that population-based approach meant that many more patients were now included within the arbitrary, and potentially profit-driven, targets of the pharmaceutical companies, thereby producing many more patients possibly getting adverse outcomes.[15]

The government

The UK government likes simplistic measurable targets to show that it is doing something – even when those things they choose to measure may not correlate well with health benefits.

That is an example of a "McNamara's fallacy", which means *"to make important things one can measure rather than measuring the really important things"*.[16] Instead of measuring the important (but difficult to measure) things, the fallacy (which means an error in reasoning) is to measure something unimportant but which is easy to measure, and then claim that it is a valid surrogate for measuring something that is really important. It is apparent that this does not make any sense if that "McNamara's easy measurement" is not actually a valid surrogate for what it is supposed to assess.

For instance, an insidious lowering of the ranges for what should now be considered "normal" for blood pressure (BP) or for cholesterol, pulls more and more older patients in to having drugs prescribed for them to lower their BP or cholesterol (which can be easily and quickly measured), rather than persuading them to eat more healthily, lose weight appropriately and take more exercise (the results of which are very difficult to measure quickly). For the government, it is politically expedient to trumpet the amount of money that they spend on the NHS and how the reported reduction in heart attacks and strokes (at least in certain affluent areas, but not in very poor ones) is allegedly due to their wise, effective strategies and policies and inducing doctors to be more "productive" by screening more patients and prescribing various drugs whenever the measured parameter is outside of the arbitrary range for that age.

Factually, any reported improvements in the reductions in heart attacks and strokes and/or their long-term outcomes are probably multifactorial (and

therefore very complex to measure reliably). Many improvements are as likely to be due to patients changing their social and lifestyle habits, such as by stopping smoking.

The medical profession

For their part in this "ménage à trois", some general medical practitioners might be influenced by their practice managers drawing attention to 25% of their practice income which is dependent on them hitting the NHS QOFs. Worryingly, the government's manipulation of the medical profession in the 2004 GMP contract involved specified arbitrary "productivity" targets, to be judged by those QOFs, and achieving those targets then resulted in many more prescriptions of different "anti-" drugs. Some might argue that, from a moral or ethical perspective, this is not much different to accepting a bribe from a drug company to change their behaviours.

Those combinations of medicines can often be responsible for dangerous reductions in saliva which, over time, particularly when combined with frequent contact with small amounts of sugar, have the potential to produce extensive, often inaccessible new decay, in already heavily repaired teeth, which then require technically difficult and time-consuming treatments.

Skilled dental expertise is often very difficult to access for many older people and, practically speaking, it is often only available privately and at significant financial costs to them. Even then, such pragmatically repaired teeth will still have a very limited prognosis because those prescribed drug combinations will be causing ongoing xerostomia.

When some doctors prescribe drugs, they might have been influenced, possibly subconsciously, by some drug companies exerting subtle influences by supporting traditional medical journals with their lucrative advertisements and/or by them sponsoring many continuing professional development (CPD) courses and conferences, as well as supplying charismatic "key opinion leaders" (KOLs) to lecture at those meetings. Some KOLs' conflict of interests might include them having their research quietly sponsored or them being paid directly, or indirectly (e.g. by having their expenses paid – and sometimes those of their family/companions) to present their favourable "research findings" about some medicine, technique or protocol, sometimes in exotic locations used for such conferences.

Cynics might suggest that undeclared perks could influence the messages about the benefits of some drugs or devices being highlighted, while any associated dry mouth problems might become trivialised. The delegates attending those verifiable CPD conferences, where many of the social events/receptions are sponsored by the drug or device manufacturers, rarely interrogate the presenters aggressively, partly because they are often being well "looked after" by those generous pharmaceutical companies.

The old adage "there is no such thing as a free lunch" applies in such circumstances. Has anyone ever heard of the phenomenon of "reciprocation"?

The doctors' dilemmas and despair

Unfortunately, doctors have come under various competing pressures from the UK government, Professor Google-informed demanding patients, and some drug companies. There is simply not enough time to provide individual "personalised medicine" including a detailed BRAN analysis for every patient of every drug's benefit and potential risks, especially in patients with complex co-morbidities. Many decent, compassionate, caring doctors are increasingly fed up with being criticised if they don't prescribe drugs for those vociferous and demanding patients, and/or them having to do so to comply with some governmental or practice contractual diktat. Multiple, often unnecessary, prescriptions have become the unfortunate outcome, with a recent review in England suggesting that about 10% of items dispensed by primary care are probably inappropriate.[17,18]

Many decent, highly valuable, very experienced clinicians are retiring early, partially because of stress and/or their perceived loss of autonomy, security or their social status. Many report being exhausted by incessant, mutually competing irreconcilable demands or by complaints and/or threats, and this highly-pressurised situation being coupled with a punitive taxation system.[19]

Worrying behaviours of "Big Pharma"

The main aim of most big companies is to make profits for their shareholders. It was Milton Friedman, an American economist famous for his "shareholder theory", who wrote that *"the social responsibility of business ought to be to increase its profits"*.[20] In 2021, Big Pharma's sales worldwide totalled US$1.42 trillion (approximately £1.2 trillion).[21-23]

To put that in context, the UK spend on NHS dentistry was about £2,200 million in 2019. (NB: Patients' NHS charges contributed about £650 million to the supposed roughly £3 billion that the government PR department claimed went into NHS dentistry).[24,25]

Sadly, the headlong pursuit of profits in healthcare has had many adverse effects on wider society, as some examples will illustrate.

The best-selling book *Empire of Pain*, by Patrick Radden Keefe, described in detail the commercially-driven, unethical and grossly irresponsible, behaviours of Purdue Pharmaceuticals (owned by the Sackler Family) which influenced many USA doctors to prescribe an opioid called OxyContin. That wholesale corruption of doctors led to widespread addiction to those opioid drugs. Many doctors benefitted from a range of Purdue's subtle bribes and kickbacks, which induced some to prescribe OxyContin in increasing and more lucrative dosages for Purdue.[26]

Another book about the same scandal, entitled *Dopesick: Dealers, Doctors and the Drug Company that Addicted America*, written by Beth Macy, exposed the devastating health, social and personal problems caused by the doctor-induced epidemic of opioid addiction, but which made the Sackler family very rich indeed. It formed the basis for a popular television series called *Dopesick*. Many other television and radio programmes have also been made about the huge social, medical,

and financial problems that this widespread addiction caused, especially in poorer communities in the USA, such as in Tennessee.[27]

Closer to home, a beautifully written if deeply troubling book by Seamus O'Mahony called *Can Medicine Be Cured?* exposed the gradual corruption of the medical profession as well as the consequences of multiple drugs being prescribed, particularly in older patients, where their bad effects often outweigh any putative benefits that they are supposed to have. O'Mahony was scathing about the various influences for some doctors' overprescribing, and of some of them being in thrall to drug companies or to various institutions, who often influenced them to prescribe or to do other things which were fundamentally bad for many older patients.[28]

O'Mahony's stinging criticisms included the malign effects of the pharmaceutical industry on the honesty, relevance, or usefulness, of much university research. He described how some vice-chancellors and university academics no longer consider their main purposes as being "searchers after objective truths", or of concentrating enough on teaching medical and dental undergraduate students the essential clinical skills. Instead, some universities have become the handmaidens of industry, constantly seeking grants for careerist, basic science-oriented academics.

Many senior clinicians share O' Mahony's views that this altered focus on grant applications for undertaking clinically irrelevant "research" has often come at the expense of effective clinical teaching and the honing of the important practical clinical skills, which would be of greatest benefit for deserving patients.[29]

Problems for older patients in accessing dental treatment for drug-related caries issues

The widespread collapse of NHS dentistry (mainly as a result of the contentious NHS UDA system, but also partly due to the General Dental Council [GDC] "terrorising"[30] many compassionate dentists) means that many older patients, now with drug-related decay, who require technically difficult, time-consuming and demanding dentistry, cannot access it predictably.

The UK government sometimes claim that, in theory at least, appropriate dental treatment is widely available, but in real life it is not, especially under the controversial NHS UDA system. Consequently, many patients have to find significant sums of money out of their already heavily taxed income (that many simply don't have) to try to keep a functional, pain-free dentition and an acceptable appearance for their older age. Little wonder that many people who have paid various taxes into the NHS all their working lives are angry. Cunningly, most of the blame for these problems of access, or their costs is often offloaded on to dentists by some slick government PR campaign. The government never mentions the 20% VAT on materials, or the high levels of tax that they receive out of those patient fees.

It is therefore unsurprising that the recent Health and Social Care Committee inquiry concluded that NHS dentistry is not "fit for purpose" and pledged to hold an inquiry into the crisis in dental services.[31] This news came just days after government announced only minimal tweaks to the widely discredited NHS UDA contract, in which dentists are supposedly going to be marginally better remunerated for hitting some targets. However, it is deceptive and probably dishonest to imply that any such minor changes will be adequate to compensate for all the time, technical and other skills now required to overcome such complex technical problems. Those tweaks change none of the fundamentals in an NHS system that provides access for barely half the population and puts government targets far ahead of compassionate patient care.[30]

Practical tips for the compassionate dentist

What can compassionate dentists do practically for those patients whose medical history reveals that they are now on multiple drugs? Here are four approaches that should be considered carefully:

1. **Gather the very relevant information**
   a. Check each older patient's medical history forms even more carefully. If someone is on lots of "anti-" drugs, ask the patient if they have a dry mouth.
   b. Check clinically (and radiographically, where appropriate) for caries or deterioration around existing restorations much more frequently, and more carefully, than one would do if they did not have those saliva-reducing drug-associated risk factors.
   c. Warn patients sensitively about the dental dangers of their reduced salivary secretion. Advise patients strongly, and in writing, **to avoid sipping sugary drinks**.
   d. Consider if it is feasible to address their problems and their prescribed drugs in a more sensible way. The patient ought to be encouraged to discuss their dry mouth/likely caries issues with whoever is prescribing their medications.
2. **Discuss "aggressive prevention"** including making them an effective record on *their* smartphone of their graphically disclosed teeth to show them what they need to do to get great cleaning results daily.
3. **Make them a video on their smartphone** showing their disclosed teeth, how to use long-handled tapering interdental brushes of various diameters from the *insides and outsides* of all of their teeth, and how to use a single tufted brush vertically (Figure 4).

Figure 4: A single tufted brush (top) and a "rainbow" of tapering inter-proximal brushes of different sizes to be used from the inside and outside of the teeth

Figure 5: (a) A "selfie stick" being held by a nurse for the patient. (b) The patient using the long-handled interdental brushes with the correct technique. This is recorded on the patient's mobile phone device so that the patient can refer to it at any time prior to or during their future cleaning at home

That readily-available personalised video will remind them (and any partner/carer) of how to use those brushes correctly and that this interdental cleaning needs to be done twice a day, every day from now on (Figure 5).[32]

4. Get ahead of their potential problems: employ effective remineralisation strategies

a. Do not wait for new decay to appear.
b. Make them some customised mouthguards to hold fluoride toothpaste over the vulnerable teeth for prolonged periods of time.

The procedure and technical processes involved in the remineralisation strategy are:

i. Take an accurate alginate impression of all the teeth within the target arch or in both arches.
ii. Cast a model of the teeth and use blue resin to block out the cervical area (necks) and below the contact zones around all the teeth to act as reservoirs into which the normal fluoride toothpaste (1450ppm) will settle (Figure 6).
iii. Use the blocked-out cast to create a vacuum-formed 1mm thick, straight-line design, mouth guard. The mouth guard will have reservoirs in the most vulnerable areas cervically and below the contact zones, for the conventional (1450ppm) fluoride toothpaste to pool there selectively, for long periods of time, and thereby effect remineralisation there (Figure 7).
iv. Cut the mouth guard 2mm beyond the gingival margin to ensure the toothpaste is sealed effectively inside the mouth guard over the blocked-out areas. The drug-induced xerostomia means that the greatly reduced amounts of saliva will struggle to wash out the viscous toothpaste.
v. Discuss with the patient how frequently to wear the mouth guard containing fluoride toothpaste (e.g. for a couple of hours twice a week), which largely depends on their individual problems and their own assessment of their risk to reward. If they are at very high risk of developing medication-related osteonecrosis of the jaw (MRONJ), consider using the combination overnight three times a week, and discuss prescribing and the use of

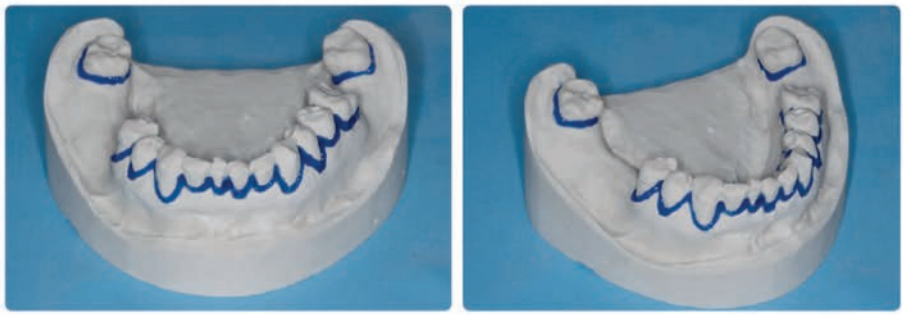


Figure 6: Model of the teeth with blue resin blocking out the cervical areas around all teeth

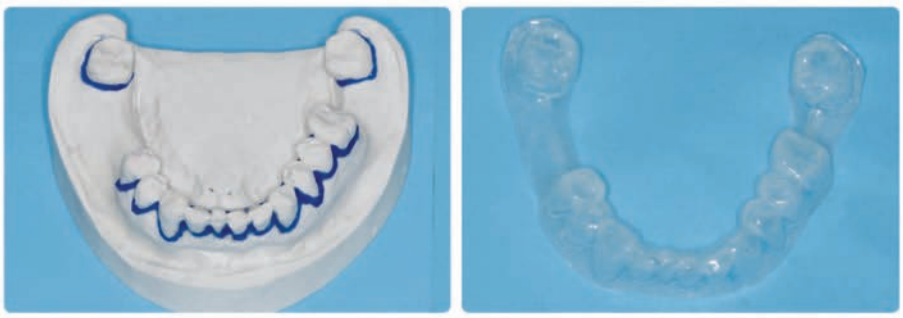


Figure 7: Mouth guard with reservoirs fabricated using the model of the teeth with blue resin to block out the vulnerable cervical areas below the contact zones on the insides and outsides of all the teeth

higher strength fluoride toothpaste, e.g. 5000ppm.[33]

vi. Make some dots using a waterproof black permanent ink marker pen (Lumocolor®, Staedtler GmbH, Nuremberg, Germany) on the *outside* of the mouth guard (available from retailers such as Amazon). Those black dots can direct the patient to where to apply the fluoride toothpaste inside the mouth guard just over those target teeth where there is a black dot.

vii. Although the permanent ink black dot is on the smooth outside, the patient can see it from the other side because the mouth guard is clear.

viii. Many toothpastes, including Sensodyne® Pronamel (GlaxoSmithKline Plc, Brentford, UK), have high resistance to flow, which is advantageous in this case because the viscous toothpaste will not be washed out of the mouth guard easily, partly because there is so little saliva available to do so. It is important to note that Duraphat® 5000ppm toothpaste (Colgate-Palmolive, New York, USA) is less viscous than standard 1450ppm toothpaste and that it contains sodium lauryl sulfate (SLS) (also known as n-lauryl sulphate) which can cause mild gingival irritation in some xerostomia cases. An alternative toothpaste which lacks n-lauryl sulphate, is Sensodyne® Pronamel, which has the added benefit of containing 5% potassium nitrate acting as a desensitising agent. (Incidentally, using toothpaste with 5% potassium nitrate, but without n-lauryl sulphate, within a customised mouth guard with just the sensitive necks of those teeth being blocked out, works well at desensitising teeth.)

ix. In theory, a wide variety of remineralising substances (e.g. casein phosphopeptides [CPPs], alpha tricalcium phosphate [α-TCP] and beta TCP [β-TCP], amorphous calcium phosphate [CPP–ACP], or others) could be used inside a customised mouth guard with appropriate reservoirs as described above, instead of using fluoride-containing toothpastes.[34]

x. While the authors have limited experience with those remineralising substances (which are much more expensive than the cost of standard 1450ppm toothpaste for the average older person), theoretically, prolonged contact with those substances on effectively cleaned teeth (as described above) should provide remineralising benefits. That approach might well appeal to those patients or to clinicians who are instinctively wary of any possible (if largely theoretic) ingestion of any fluoride in much later life in patients with very little saliva anyway. Anecdotally, one author (MGK) has used this approach for over thirty years, with various fluoride-containing toothpaste in mouth guards on head and neck radiotherapy patients and other patients at high risk of osteonecrosis of the jaw (ONJ), with no reported problems. As is often the case in pragmatic dental practice, some intuitive practical things work very well, but the science and the "evidence base" often takes a long time to catch up.

xi. Like many things in dentistry, various individual aspects need to be considered carefully and discussed with patients in an open and honest manner, possibly using the previously-mentioned BRAN acronym.

Patients' autonomy must always be respected. However, for their consent to be valid, they need to understand what their real dental and other risks are when taking various "anti-" drugs so that they are more aware of what *they* might be able to do to mitigate *their* personal material risks.

Conclusions

1. Many "anti-something" drugs which are prescribed by doctors, often in combinations and some for questionable reasons, result in a serious reduction in saliva. This reduction can produce devastating new caries in many older patients' already compromised dentitions.
2. A BRAN analysis should be carried out critically before prescribing or continuing with different "anti-" drugs.
3. The risks relative to benefits should be well worth taking (including the longer-term dental risks) especially if alternative approaches would produce better outcomes without incurring dental risks.
4. Pragmatic use of customised mouth guards, made with appropriately-located reservoirs, can hold standard or high concentration fluoride toothpaste for prolonged periods over the most vulnerable teeth, e.g. for a couple of hours, three times week – all depending on individual circumstances. Doing so is a cost-effective way of producing remineralisation and helps to compensate for the real risks of medically and dentally compromised patients developing new caries in difficult-to-access areas.
5. Disclosing patients' teeth and then making customised videos on the patient's own smartphone of *them* or their carer using different tapering long-handled interdental brushes, from both sides of all their teeth, helps to reinforce the benefits for them of effective daily interdental cleaning, prior to using their therapeutic mouth guards containing fluoride toothpaste (or possibly other remineralising substances) to help to protect their valuable, but now more vulnerable, tooth structure.

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