Stop being boring: are there alternatives to the air rotor?
Nathan Myo

SCHOOL OF DENTISTRY
Liverpool, L69 3GN, UK. email: hnmno@liv.ac.uk

Introduction

Since its invention, the high speed dental handpiece: also known as an air rotor, air turbine or dental drill, has had a revolutionary impact on modern dentistry and on the removal of enamel and dentine. However in modern day, there has been a growing demand for different materials or procedures that could be beeth more efficiently. Over time, new techniques other than the air handpiece have been developed which have the potential to fulfil the same role in restorative dentistry but with new, added benefits. (1)

For example air abrasion for restoration preparation removes tooth structure using a stream of aluminium oxide particles generated from compressed air or bottled carbon dioxide or nitrogen gas (2). Photo-ablative methods use the erbium/neodymium-doped yttrium aluminium garnet (EN/Nd: YAG) lasers and/or CO2 lasers to perform highly controlled tissue ablation (removal of body tissue) (3). In this poster, these techniques will be juxtaposed against the air rotor to determine if there is enough evidence to support the feasibility of these techniques compared to the air rotor.

The air rotor will be evaluated in comparison to photo-ablative methods/lasers and air-abrasion

Research into alternative methods of treatment has concluded that there are 5 criteria that are generally viewed as important for the patient and operator/dentist (1).

The ‘perfect tool’ for use in restorative dentistry would ideally fit all of the following the criteria (Figure 1).

The local cooling instrument should fulfil certain factors to satisfy both operator and patient.

1. Comfort and ease of use in the clinical environment
2. The ability to discriminate and remove incremental layers of tooth only
3. Particles, air blast treatment, requiring only minimal pressure for optimal effect
4. No generation of abrasives hence reducing period of operational time
5. Affordability of cost to maintain

Figure 1: Table adapted from (1)

Air Rotor (Handpiece)
The positives and drawbacks modern air rotor are the most well-known:

It frequently requires local anaesthesia which can be difficult to administer for the dentist and uncomfortable for the patient; patients can perceive that drilling is generally unpleasant (4). Its ability to discriminate between healthy and diseased tissue relies upon the skill and experience of the dentist e.g. manual dexterity and ability to recognise carious dentine.

It is able to cut through enamel and dentine efficiently; however dentine is sensitive, pressure applied on the teeth, the burr/handpiece vibrates and a high pitched noise is created, which generally creates the feeling of discomfort and pain for the patient (5). Heat is produced at cutting surface, although there is water spray to offset this, it can reach high temperatures easily. (6)

Air-abrasion

In a study to find out patients’ preference for either the traditional air rotor and burr or air-abrasion, 10 adult patients were monitored; one premolar was treated with an air rotor and the other was treated with air abrasion. Patients were asked to complete an emotional status questionnaire before and after receiving treatment, and results showed that all of patients preferred air abrasion compared to the traditional air rotor. Subjects rated the perception of pain as lower when using the air abrasion in comparison to the air rotor (7).

Further research has shown that applications of air-abrasion include: better detection of pit and fissure caries (can effectively remove organic debris), more accurate removal of caries that affect a smaller area (class II cavity preparation), removal of old restorations, treatment without requiring local anaesthesia (2).

Drawbacks of air-abrasion include that: air-abrasion does not cut through soft material e.g. gross caries, although a spoon excavator could be used instead; cannot remove large amalgam fillings due to the risk of mercury poisoning; a rubber dam is always required as abrasive particles may be ingested; eye wear is also required by patients, the dentist, nurses etc. as flying particles may enter eyes; there is a general risk as particles may damage surrounding tissue; the depth of penetration cannot be controlled so it requires good judgment in order to use; and produces a round textured margin in the enamel/dentine so is unsuitable for restorations requiring definitive or sharp walls (2).

Studies showed that sound enamel is more susceptible to acid challenge (acid attack) so patients have to try to avoid eating for a few hours after treatment (8)

Lasers (Er: YAG, Nd: YAG)

A phase I clinical trial investigating the Er: YAG laser involved observation of a group of 60 patients over a year (9).

Discussion and Conclusions

Air abrasion creates new, different possibilities and applications to enhance cavity preparation and caries removal and have the potential to provide facilitated clinical treatment for both the patient and dentist.

The drawbacks posed by air abrasion are also now and different to the air rotor however, potentially creating health & safety hazards, and making treatment generally . There are also limitations to air abrasion to a greater extent than the air rotor, for example how the shape and depth of air-abrasion can be more difficult to control so requires more care and can present more problems (2). This indicates that further research should be done before solid conclusions can be drawn about the perception of air abrasion to the general public in comparison to the air rotor.

In summary, there is no complete alternative which can fully and reliably replace the air rotor. Even with the most promising methods, despite their potential to compensate for and succeed the air rotor, their disadvantages have not been thoroughly evaluated and so they are at present not safe enough for clinical use as a replacement to the air rotor.

References


Methods

Initial research was undertaken using Google to search for terms including and related to ‘air rotor’ to gain brief insight into the topic, then a mind map was created as a result to collate the knowledge obtained. This was supplemented by further research using PubMed and Google Scholar to find a range of primary and secondary resources, which were evaluated on their relevance and reliability. The BDJ article reviewing ‘current clinical techniques’ was an example of a useful source (1). Microsoft Word was used to create a draft for the text of the poster and Microsoft PowerPoint was used as a template for the design of the poster. Citations have been arranged using EndNote X7.

Figure 2: Image from (2) showing ease of debris evacuation using a sandtrap (air-abrasion technique) on a mandibular molar

Results

During this half, were treated with the Er: YAG laser; half acted as a control group, treated by the air rotor. Teeth that required extraction were examined afterwards and used to test the effect of low level microns radiation on pulp, morphology of the tooth, bond strength, then further testing the ability of the laser to remove caries and for cavity preparation. (9) It was found that overall, there was no significant difference between the laser and air rotor in terms of effectiveness for caries removal and cavity preparation. Blind assessment showed there were no significant differences in pulp histology, morphology or in visual/radiographic examination.

Considering the systematic reviews undertaken in (10) and (3) respectively, the overall outcome for both was that there is still insufficient scientific evidence to support the use of the laser as an alternative to the air rotor for caries removal. There was also insufficient evidence to determine whether the laser treatment may be harmful to pulp or for long term restorations.

Evidence did exist in favour of laser therapy for pain control, by reducing the patients’ discomfort and need for anaesthesia but there was still insufficient evidence in order to fully justify this (3). The most concrete evidence found was that a laser is just as effective at removing carious tissue, however it does require more time than the air rotor overall to carry out treatment. (10)