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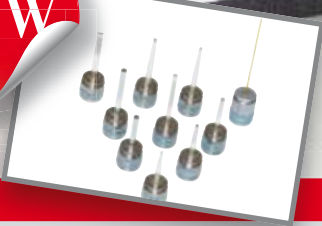


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Oral cancer: a "neglected burden" for dentists to shoulder

According to recent data from the World Health Organisation, the global incidence of oral cancer is increasing. The disease is now the sixth most common cancer in the US, and the seventh most common in the EU. Whilst the survival rates for many other common cancers have increased, at least in the West, the survival rate for oral cancer has either remained unchanged, as in the US, or is even falling, as in many EU countries, including Belgium, Denmark, Portugal, the UK and several countries in Eastern Europe. Over 2% of cancer deaths in the EU are currently due to oral cancer. What makes this trend more frustrating is that several risk factors for the disease are well-established, including some potentially modifiable risk factors. Tobacco use in all its forms is the most important of these. Heavy alcohol use is also important, and these two risk factors act synergistically: those who smoke and drink heavily have a fifteen times greater risk of developing oral cancer than people who don't smoke or abuse alcohol. As with other life-style related diseases (obesity-related diseases spring to mind), it has to be realised that the process of actually modifying human behaviour to such an extent that the incidence of a disease can be significantly reduced is unfortunately long and laborious. In practice, therefore the best hope for reversing the current trend of declining survival rates in oral cancer is early diagnosis, since, like many other cancers, this has a big impact on survival. Currently the chance of surviving the disease for more than five years is less than 50%; if detected early the chance of survival rises to 90%. However, pre-malignant changes, which cannot be detected by the naked eye, occur below the surface of the oral mucosa, and in the early stages oral cancer can be symptomless. In addition a later cancerous lesion may be ignored by the person affected because benign oral changes and soft tissue abnormalities are common. Several screening systems have been developed that allow oral cancer to be diagnosed sufficiently early for timely treatment. In addition to a thorough visual and tactile examination, technologies are now available based on the changes in tissue fluorescence that occur when cellular

abnormalities are present. Five years ago the Crete declaration on oral cancer prevention expressed its concern about this 'neglected burden' and affirmed its commitment to the effective control of oral cancer globally. If this goal

is to be realised, however, it is necessary for healthcare services not only to educate the public about the risk factors and early symptoms of oral cancer, but also to emphasise the need for regular dental check-ups so that those affected may be

diagnosed in a timely fashion. Such a policy can, of course, only succeed if there are sufficient, appropriately remunerated dentists globally to shoulder the neglected burden and provide adequate dental care for all.

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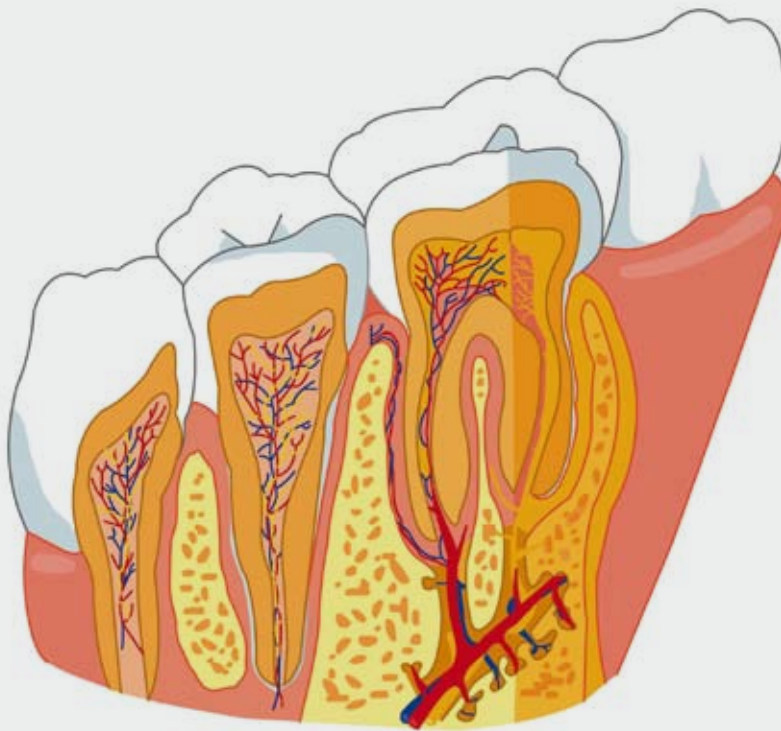


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Laser fluorescence for diagnosis of bacterial infections in the root canal

By Dr Laurence J Walsh

Already widely used in medicine, diagnostic devices based on the use of fluorescence are becoming more popular in dentistry particularly for the diagnosis of dental caries and oral mucosal abnormalities. This article describes recent developments extending the use of fluorescence techniques for diagnostic use to endodontics.



provides a simple, low cost but technologically elegant solution. The basic concept was that laser energy of the appropriate wavelength could be introduced into the root canal system using an optical probe. This laser energy would in turn induce fluorescence — i.e. the emission of light of a longer wavelength — from individual bacteria and from biofilms of bacteria remaining in the root canal. By choosing appropriate wavelengths of exciting light, the emitted light from bacteria could be discriminated from any light reflected back from the probe or generated by the uninfected areas of the root canal. We knew from earlier work that short wavelengths of light in the ultraviolet, visible violet and blue regions elicited fluorescence from bacteria, but did not penetrate the structure of the tooth

As the population ages and more teeth are retained into advanced age, there is an increasing need for root canal treatments (RCT). The clinical outcomes of RCT have been studied for over 70 years, and from the literature it is clear that in situations where persisting infection remains in the root canals of teeth the prognosis is poor and the treatment is likely to fail. There is therefore a need for techniques that can assess whether or not infection remains once the canals have been filed to the required shape.

Traditional technologies for detecting infection in the body are based on collecting a sample which is then cultured for several days in the laboratory. Unfortunately, culture-

based methods are not suitable for recovering anaerobic bacteria from root canals, because these are intolerant of atmospheric oxygen, and become non-viable during the sampling procedure. Culture-based methods are very technique-sensitive and are also time-consuming.

A more recent approach is to use molecular biological techniques for detection of specific bacteria. This is typically done by using the polymerase chain reaction (PCR). Such methods are capable of detecting bacteria that are difficult or even impossible to find using traditional culture-based methods. However, PCR is also technique-sensitive, is prone to technical errors, is time-consuming and

expensive, and can only detect a limited range of organisms. Moreover, it cannot be done within a dental practice environment. Because of these problems, PCR has not entered mainstream clinical use.

An alternative diagnostic method is fluorescence. The concept of fluorescence diagnosis in dentistry is well established, and today devices such as Vizilite, Velscope and DiagnoDENT exploit this light-generated reaction.

Principles of fluorescence

In an effort to identify infected root canals in real time at relatively low cost, our research group developed an alternative approach, which



Figure 1. Laser fibre with conical end inserted into the apical third region of the root canal.



Figure 2. Visible red laser light emitted from a plain ended fibre will induce fluorescence from bacteria in a forward direction from the end of the fibre.

modification of an existing commercially available laser fluorescence system designed primarily for detection of dental caries (the DiagnoDENT system). This has a diode laser emitting in the visible red region at 655 nm wavelength, and an in-built digital filtering and analysis system for detecting near-infrared fluorescence emissions from bacteria. The device was fitted with a prototype optical tip and was used to record fluorescence profiles for root canals in freshly extracted teeth that were known from clinical and radiographic signs to be infected. We also examined uninfected canals from third molar teeth, and developed a laboratory system to maintain bacteria and grow biofilms in root canals. This work demonstrated that the laser fluorescence method could detect infected canals with isolated bacteria as well as with dense biofilms, and that the signal was proportional to the extent of infection. When the infected teeth underwent root canal treatment, the specific signal from bacteria disappeared. The method demonstrated a high specificity in identifying those root canals that were uninfected. We confirmed this performance by splitting the roots and examining them in the scanning electron microscope for persisting bacterial contamination. From this initial study, it was clear that the use of a laser fluorescence approach for assessing the status of the root canal system of teeth was a workable concept.

Even though dentistry has always prized high diagnostic sensitivity (i.e. the ability to find disease), in recent decades the need for high, predictable diagnostic specificity (i.e. the ability to rule out disease) has also grown in importance. The difference in fluorescence readings between healthy and infected canals provides confidence that the cleaning of the root canal has reached a biological endpoint. Laser fluorescence threshold values for normal healthy root canals and normal healthy teeth have been determined, so that precise recommendations can be made for the interpretation of fluorescence scores.

effectively, and could not identify all species of bacteria. On the other hand, we also knew that light of certain visible red wavelengths did penetrate tooth structures effectively and could reliably detect all the bacteria of interest.

If a fluorescence method could be made to work, it would have the advantage of being able to localise the site of the infection, since the fluorescence signal would be topographically associated with the presence of bacteria within particular regions of the canal. The laser fluorescence signal could be quantitatively measured and the value recorded and used to track improvements as further cleaning, filling or other treatments were done to disinfect the canal. The ability to identify infected root canals in real-time, before they were filled, would allow the dentist to provide any necessary additional treatment, and re-measure the situation to ensure that all bacteria were eradicated. This should increase the overall success rate of RCT in dentistry.

Design and performance of new system

The starting point was the

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We have since gone on to develop flexible tips that can penetrate into furthest reaches of the root canal, as well as special modifications to these optical fibres so that the fluorescence light could be delivered and collected from a wide viewing angle. When tested on sectioned extracted teeth, the optical fibres were in most cases able to reach the apical third of the root canal space without fracturing. This was possible even when the canals were curved, with the light able to reach the end of even severely curved canals. Thinner fibres and fibres with conical rather than flat ends were shown to be better at negotiating the small spaces in root canals. Small diameter optical fibres are needed to gain entry into the apical third of the root canal. This region is where persistence of bacteria is most likely to occur after cleaning and instrumentation.

Disinfection system

A further development was to link the detection function to a laser cutting or disinfection system, so that an autopilot was generated for detecting and destroying bacteria in the root canal. Bacteria within root canals are known to resist both physical cleaning approaches and chemical agents. For this reason, we developed several different systems which could be "laser-guided".

The first used a light sensitive, laser-activated dye which bound to and killed or inactivated bacteria, including even the most resistant species known. This system was shown to work on isolated bacteria and on dense biofilms of resistant bacteria. The second system which can be laser-guided is based on the use of shockwaves which are generated in water-based fluids by laser pulses. The formation of water vapour and its implosion cause cavitation, which in turn creates massive shear forces on

the walls of the root canal, which disrupts bacterial biofilms. Different types of optical fibre tips alter the fluid dynamics involved. The laser-generated shockwaves move at over 90 km per hour and eject bacteria and debris from the root canal. We were able to show that several different laser systems could be used for both approaches, and importantly that some or all of the desired effects could also be created with very small compact diode laser devices, when operated under the right conditions.

A caveat to using feedback for the selective removal of bacteria is that endodontic irrigants and medicaments, which because of their chemical structure actually produce inherent autofluorescence themselves, must be avoided because of the clear risk of the generation of false-positive results. For example, of the materials that are commonly



Figure 3. Visible red laser light emitted from an optical fibre with a special surface modification projects 360 degrees in a spherical pattern from the end of the fibre, allowing detection of bacteria in a lateral direction.

used, both MTAD and Ledermix are problematic because their tetracycline component in their structure gives a false positive fluorescence signal. Fortunately, alternatives to these products exist which do not suffer from the same problem; indeed, all common endodontic materials such as calcium hydroxide, sodium hypochlorite and chlorhexidine do not fluoresce with the technology we have used.

Conclusion

In summary, from our work, we believe that an autopilot approach would offer considerable advantages over current treatments, by increasing the effectiveness of removing debris and bacteria, and giving a firm biological endpoint for treatment. This should lead to more predictable clinical treatment and fewer treatment failures.

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The use of single or double gloves in dentistry

By Dr Maria I. Chatzoudi and Dr Dimitrios I. Chatzoudi

The wearing of gloves is now considered to be essential in dentistry. However, particularly when dealing with patients at high risk of carrying blood-borne infectious agents, the use of single gloving may not be enough to provide adequate protection, which is why double gloving is sometimes suggested. This article describes the results of a study designed to evaluate and compare the relative protection provided by either single gloving or double gloving use and to highlight special cases where double gloving is particularly advisable. It was found that a small proportion of even unused gloves had some defects such as holes or tears, while as many as nearly 40% of single gloves showed such defects after 30 min. of use in normal dental procedures. This level of defects was found to be significantly reduced in the inner glove of a double gloving pair. The increased protection provided by double gloving appears to be worth the extra cost; double gloving is particularly recommended when high risk patients are treated in everyday dental care.



The use of gloves in dentistry is nowadays a key component of the health and safety regulations in all developed countries. The use of gloves was first proposed as long as approximately 70 years ago and has been increasingly applied in dental practice over the last few decades, culminating in the current situation where double gloving is being put forward as a serious suggestion [3]. The reason behind this trend is the increasing awareness of infection risks, not only from patient to dentist and *vice versa* but also eventually from one patient to another via the dentist. Blood-borne infectious agents such as the various forms of hepatitis virus, HIV, syphilis, tuberculosis, etc. are particularly dangerous [2]. Faced with these challenges several preventative measures have been adopted in general dental practice including

the use of latex gloves, which have proven to be very effective [4,5].

However, although the risk of contamination has been significantly reduced through the use of single gloving, the question still remains as to whether single gloving is good enough, since tears and small pin-holes invisible to the naked eye have been found to occur in a significant number (nearly 40%) of used gloves [1]. The purpose of the study described in this article was to evaluate and compare the relative protective merits of single and double gloving during routine dental operations.

Study design

The gloves used in the study were all made from latex and were of the same size, supplied by the same manufacturer, had the same brand name, and had the same expiry

date. They were stored under identical conditions, namely in a dark, dry storage room at a temperature of 15°C. All the gloves were used by the same ten dentists; the survey was blinded since the dentists were unaware that subsequent analysis of their used gloves would be carried out. The study involved two test groups of gloves and a third, control group. The first test group comprised 1000 latex gloves used in single gloving mode during 30 min. of standard general dentistry work. The second test group comprised 1000 latex inner gloves of a double gloving pair also after being used during 30 min. of standard general dentistry. The outer glove of the double gloving pair was discarded. The control group comprised 1000 unused latex gloves. All gloves were examined for small tears and holes using a 50 X magnifying glass. The survey was carried out

at the undergraduate clinics of the Dental School of the Aristotle University of Thessaloniki, Greece.

Results

The results of the study are summarised in Table 1. It can be seen that even unused gloves are not always absolutely safe, since nearly 5.1%, had defects that could be categorised as being potentially dangerous from the point of view of infection risk. Although the majority of the gloves used in single gloving did provide adequate protection, there was still a significant percentage (38%) where the gloves dramatically failed to meet the desired goal of providing safety from infection. In the double gloving group, the percentage of the inner gloves which showed infection barrier failures was less than half (16.7%) of that found in the single gloving group.

The majority of the defects found on the gloves were small in diameter: generally less than 0.5 mm. The number of defects greater than this size was much lower. This was true for the defects in all three groups. The differences between the single and double gloving groups in terms of both absolute numbers and percentages of gloves with defects was so significant that it appeared that double gloving could be justified despite the additional costs.

Discussion

Although many health and safety organisations consider double gloving in dentistry to be an extreme and exceptional measure, this attitude is not supported by our data. Single gloving can in fact be quite ineffective. What's worse, the illusion of protection given by the wearing of the glove may actually lead dentists to be less careful than they otherwise would be. The consequences of the combinations of even small lesions on the dentist's hands, torn or defective single gloving and bleeding generated by the dental treatment are potentially dramatic if the patient has a blood-borne infectious agent.

Although double gloving cannot totally eliminate the risk of infection, it can, at least, reduce it by approximately 50% [6]. This is of course of particular importance when treating patients at high risk of being infectious [2]. In such cases, in addition to the use of double gloving in the first place, more frequent changing of the gloves could provide an even higher protection by reducing the time during which the potentially defective gloves are actually in use [7,8].

The expense of double gloving is of course twice that of single gloving but given that the actual cost of gloves is still very cheap, the additional expense of double gloving seems justified. Furthermore, double gloving is not recommended for every single patient but only for high risk patients.

Sample	Defects		Number of holes and tears								Total	
	No holes or tears		<0.5mm diameter		0.5mm<hole or tear<1 mm		>1 mm in diameter		Total of defective gloves			
Gloves of single gloving	620	62.0%	189	18.9%	134	13.4%	57	5.7%	380	38%	1000	100%
Inner glove of double gloving	833	83.3%	96	9.6%	55	5.5%	16	1.6%	167	16.7%	1000	100%
Unused gloves	941	94.1%	32	3.2%	15	1.5%	4	0.4%	51	5.1%	1000	100%

Table 1. Results of examination for holes and tears of all three groups of gloves for as well as approximate dimension of holes and fissures found. In the fissures, the biggest dimension was taken into account.

Conclusion

It can be seen that, although providing much better protection than no gloves at all, single gloving still does not ensure absolute hand safety in routine dental practice. Although the size of defects observed was quite small, the number of defects in the gloves is frightening and emphasises the clear need for extra measures to be taken. The simplest of these is double gloving which, although not totally eliminating the danger, at least reduces it significantly in an affordable way.

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Children more likely to visit the dentist if their parents do too



Whether or not children receive regular dental care is strongly associated with their parents' history of seeking dental care. A new report in the journal *Pediatrics* is the first to analyse the relationship between parents' and children's dental visits in a representative sample from the USA.

According to the study's lead author, Dr Inyang Isong OF the MassGeneral Hospital for Children (MGHFC) Center for Child and Adolescent Health Policy, USA, when parents don't see the dentist, their children are much less likely to see the dentist. In addition children of parents who have put off their own dental care for financial reasons are more likely to have their care deferred due to cost as well. Strategies to promote oral health should thus focus on the whole family. The study's authors note that dental caries is of one of the most prevalent childhood diseases and is particularly common among minority and low-income children in the USA. Previous studies have associated factors including insurance coverage, parents' income and education, and the availability of dental care in the local community with the likelihood that children will have regular dental visits.

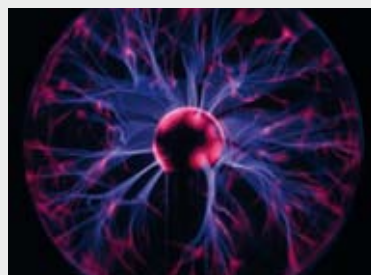
Earlier investigations of the impact of parents' accessing dental care focused on particular demographic groups. In order to see whether associations from those studies applied more broadly, the current investigation analysed data from the 2007 National Health Interview Survey and its Child Health Supplement, which are designed to collect basic health and demographic information, along with answers to questions on health topics of current

interest, from a cross section of the U.S. population. Survey responses including data regarding dental visits for both a child and parent in the same household were available for around 6,100 matched pairs. Among parents who reported seeing a dentist during the preceding year, 86 percent of children had also seen a dentist; but only 64 percent of the children of parents with no recent dental visit had seen a dentist during the previous 12 months. In addition, among parents who put off their own dental care because of financial considerations, 27 percent of their children also had dental care deferred. In contrast, only 3 percent of children whose parents had not put off their own care had their dental care deferred.

Dr Isong concluded that even when children are covered by medical insurance, it appears that financial barriers are influencing parents' decisions about accessing dental care for their children. The group is now in the process of looking at the impact of dental insurance and other enabling resources on the relationship between parents' and children's receipt of dental care.

<http://tinyurl.com/kids-dentists>

Painless plasma jets could replace dentist's drill



Plasma jets capable of obliterating tooth decay-causing bacteria could be an effective and less painful alternative to the dentist's drill, according to a study published in the February issue of the *Journal of Medical Microbiology*.

Firing low temperature plasma beams at dentin was found to reduce the amount of dental bacteria by up to 10,000-fold. The findings could mean that plasma technology will be used to remove infected tissue

in tooth cavities, instead of the conventional process that involves drilling into the tooth.

Scientists at the Leibniz-Institute of Surface Modifications in Leipzig, Germany and dentists from the Saarland University, Homburg, Germany, tested the effectiveness of plasma against common oral pathogens including *Streptococcus mutans* and *Lactobacillus casei*. These bacteria form films on the surface of teeth and are capable of eroding tooth enamel and the dentin below it, resulting in cavities. If left untreated this can lead to pain, tooth loss and sometimes severe gum infections. In this study, the researchers infected dentin from extracted human molars with four strains of bacteria and then exposed it to plasma jets for 6, 12 or 18 seconds. The longer the dentin was exposed to the plasma, the greater the amount of bacteria that were eliminated.

Plasmas are known as the fourth state of matter after solids, liquids and gases and have an increasing number of technical and medical applications. Plasmas are common everywhere in the cosmos, and are produced when high-energy processes strip atoms of one or more of their electrons. This forms high-temperature reactive oxygen species that are capable of destroying microbes. Such hot plasmas are already used to disinfect surgical instruments.

Dr Stefan Rupf from Saarland University, who led the research, said that the recent development of cold plasmas that have temperatures of around 40 degrees Celsius showed great promise for use in dentistry. The low temperature meant that they could kill the microbes while preserving the tooth. The dental pulp at the centre of the tooth, underneath the dentin, was linked to the blood supply and nerves and heat damage to it had to be avoided at all costs. Using plasma technology to disinfect tooth cavities would be welcomed by patients as well as dentists. Drilling was a very uncomfortable and sometimes painful experience. Cold plasma, in contrast, was a completely contact-free method that was highly effective. Huge progress was

being made in the field of plasma medicine and a clinical treatment for dental cavities could be expected within three to five years.

<http://tinyurl.com/plasma-jets>

Studies advise on fluoridated toothpaste use in children



Parents should use toothpastes that contain fluoride with a minimum concentration of 1,000 parts per million to prevent tooth decay in their children, says a new report. Preventing tooth decay can help reduce the need for extensive and costly dental treatments, including extractions. But the authors, in a second related study, suggest that parents concerned about the risk of fluorosis should consult their dentist to discuss the benefits and risks.

Researchers for the Cochrane Oral Health Group, based at the School of Dentistry in the University of Manchester, UK have previously shown that fluoride toothpastes reduce dental decay by 24% on average compared to non-fluoride products. The group's latest research, which involved 79 trials on 73,000 children worldwide, examined the effect of different children's toothpastes and found that those with fluoride concentrations less than 1,000 parts per million were only as effective as non-fluoride toothpastes at preventing tooth decay. Children's toothpastes range from 100ppm to 1,400ppm fluoride concentration. The report suggests that brushing a child's teeth with a toothpaste containing fluoride before the age of 12 months may be associated with an increased risk of developing mild fluorosis. Swallowing large amounts of toothpaste may still cause fluorosis in children up to the age of six years when the permanent teeth are still developing, but careful use of a small amount of toothpaste will reduce these risks. After the age of

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six years, the teeth are fully developed and toothpaste can be used without fear of fluorosis.

Dr Anne-Marie Glenny, one of the authors of the review, said that it was very confusing for parents to know how to strike the right balance, which wasn't helped by the fact that different companies used different concentrations of fluoride in their toothpastes aimed at children. From a public health point of view, the risk of tooth decay and its consequences such as pain and extractions was greater than the small risk of fluorosis. Children would have to swallow a lot of toothpaste over a long period of time to get the severe brown mottling on the teeth, as opposed to the more typical mild white patches.

For children that are considered to be at a high risk of tooth decay by their dentist, the benefit to health of preventing decay is likely to outweigh the risk of fluorosis. In such cases, careful brushing of their children's teeth by parents with a small amount of toothpaste containing higher levels of fluoride would be beneficial. If in any doubt, parents are advised to speak to their family dentist.

www.cochrane.org

Poor oral hygiene among 19-year-olds in Sweden

Swedish 19-year-olds need to improve their oral hygiene habits. Seven out of eight youths have unacceptable oral hygiene, which increases the risk of future dental problems. These are the findings of a new study from the Sahlgrenska Academy at the University of Gothenburg. The results have been published in the Swedish



Dental Journal. The study examined 500 randomly selected adolescents from the Västra Götaland region which includes the Fyrbodal and Skaraborg areas. According to doctoral student Jessica Skoog Ericsson, on average these youths had plaque on half of all tooth surfaces, which is certainly too much. Seven out of eight had more plaque than is currently deemed acceptable. Gingivitis was also identified as a common problem resulting from poor oral hygiene. This can generally increase the risk of future dental problems as well as tooth-loosening.

This study shows that the vast majority of adolescents, 76 per cent, brush their teeth at least twice a day. Four per cent of adolescents also use dental floss daily, but just as many don't clean their teeth at all some days. There may be some who are less than honest and say that they brush their teeth more regularly than they actually do, but other studies have shown that adolescents do generally brush their teeth on a regular basis. Poor oral hygiene is probably therefore due to them not brushing correctly and not using dental floss according to Kajsa Henning Abrahamsson, a senior lecturer in odontology at the Sahlgrenska Academy.

Oral hygiene was slightly worse among the males in the study, compared with the females. The youths from Skaraborg had, on average, less plaque and gingivitis than those in Fyrbodal. However, socioeconomic factors, based on an index for the dental practice to which the youths belong in the region, had no impact on adolescents' oral hygiene. This is not the first scientific study to show poor oral hygiene among Swedish young people. Kajsa Henning Abrahamsson considers that it is lamentable that so many adolescents have poor oral hygiene despite considerable investment in information and preventive measures. The dental profession as a whole now

needs to look at the reasons why it is not getting through better to this group.

Oral bacteria in a mother and her stillborn baby



Yiping Han, a researcher from Department of Periodontics at Case Western Reserve University School of Dental Medicine, USA, has reported the first documented link between a mother with pregnancy-associated gum disease to the death of her foetus. The findings are discussed in the article, "Term Stillbirth Caused by Oral *Fusobacterium nucleatum*," in the February issue of *Obstetrics & Gynecology*.

An internet search in 2008 led a friend of a mother, who had just delivered a stillborn baby, to Han's research lab—one of the few in the world working on understanding the role variations of the oral bacteria, *Fusobacterium nucleatum*, have on pre-term labour and stillbirths. The mother delivered her fullterm baby at Saint John's Health Center in Santa Monica, California at 39 weeks and five days. During the 35-year-old mother's pregnancy (her first), she told Han she experienced excessive gum bleeding, a symptom of pregnancy-associated gingivitis. Approximately 75 percent of pregnant women experience gum bleeding due to the hormonal changes during pregnancy. Bleeding associated with the gingivitis allowed the bacteria, normally contained within the oral cavity because of the body's defense system, to enter the blood and reach the placenta.

Even though the amniotic fluid was not available for testing, Han suspects from work with animal

models that the bacteria entered the immune-free amniotic fluid and were eventually ingested by the baby. Han says that normally a mother's immune system takes care of the bacteria in the blood before they reach the placenta. But in this case, the mother also experienced an upper respiratory infection and a cold and low-grade fever, just a few days before the stillbirth. He said that the timing was important because it fit the time frame of haematogenous spreading that has been observed in animals.



Postmortem microbial studies of the baby found the presence of *F. nucleatum* in the lungs and stomach. The baby had died from a septic infection and inflammation caused by bacteria. After questioning the mother about her health during the pregnancy, Han arranged for her to visit a periodontist, who collected plaque samples from her teeth. Using DNA cloning technologies, a match was found between the bacteria in the mother's mouth and the bacteria in the baby's infected lungs and stomach. A vaginal or rectal source of the bacteria was ruled out by testing bacteria from these areas, which were negative for *F. nucleatum*.

Han, who has spent the past decade taking her oral bacteria research from the lab to the bedside, said that this pointed again to the growing importance of good oral health care. In addition to this direct link from the mother to her baby, oral bacteria have been associated with heart disease, diabetes and arthritis. The researcher suggests that women who are considering a pregnancy should seek dental care to take care of any oral health problems before getting pregnant. If pregnant, she encourages expectant mothers to practice good oral health and to alert their doctor if they experience any gum bleeding.

<http://tinyurl.com/oral-bacteria-pregnancy>

Proline repeats strengthen tooth enamel

A simple amino acid that is repeated in the center of proteins found in tooth enamel makes teeth stronger

and more resilient, according to new research at the University of Illinois at Chicago, USA. The researchers compared proline repeats in amphibian and animal models and discovered that when the repeats are short, such as in frogs, teeth will not have the enamel prisms that are responsible for the strength of human enamel. In contrast, when the proline repeats are long, they contract groups of molecules that help enamel crystals grow. The findings were published online in the Journal PLoS Biology.

Tom Diekwisch, professor and head of oral biology in the UIC College of Dentistry, and lead researcher on the study, said that proline repeats held the key to understanding the structure and function of many natural proteins, including mucins, anti-freeze proteins, Alzheimer amyloid, and prion proteins. He hoped that these findings would help many other important areas of scientific research, including the treatment of neurodegenerative diseases.

When tooth enamel is grown it is bathed in bubble-shaped groupings of proteins. The size of the protein bubbles varies in different animals, from 5 nanometers in cows to 20 nanometers in mice and 40 nanometers in frogs. Diekwisch's team discovered that the longer the stretch of proline repeats, the more the protein bubbles contracted. The study also showed that the smaller protein bubbles were associated with longer enamel crystals. According to Diekwisch, the new discovery will give new clues to enable tooth enamel to be engineered, so that ultimately lost parts of the tooth may be replaced with a healthy layer of new enamel.

<http://tinyurl.com/proline-enamel>

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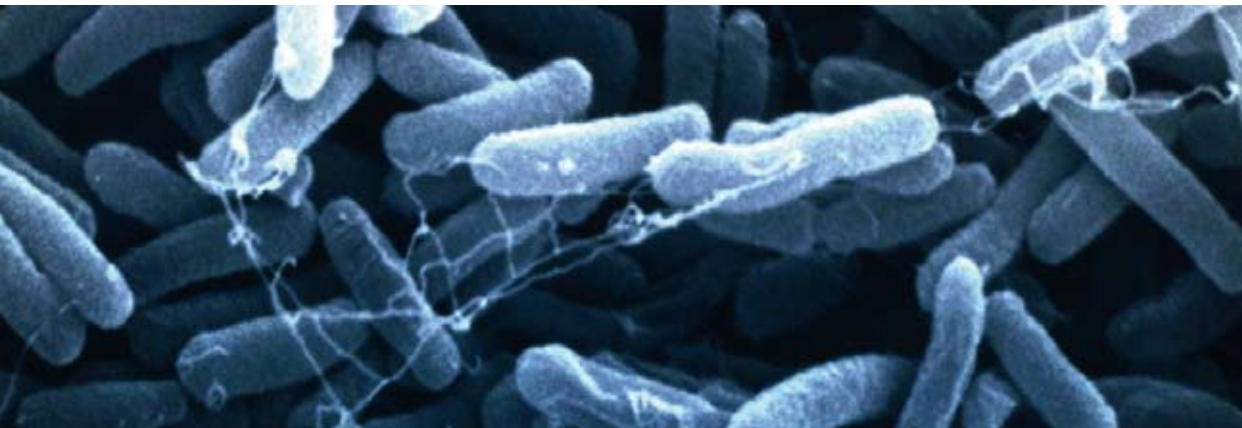
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Manipulation of the microbial ecology of the periodontal pocket

In this article we describe the use of the "biofilm potential" method to assess the ecological status of periodontal sulci with respect to the health and spreading tendencies of the biofilm communities growing in them. The data suggest that the biofilm potential is an accurate indicator of the microbiological health of the sulcus, and further suggest that the efficient delivery of antibacterial oxidants via the PerioProtect system, which uses an oxidative chemical strategy rather than physical removal of the biofilms by scaling and root planning (SRP), is an effective treatment for periodontitis.*



A biofilm disease

As microbial ecologists struggled with the dawning realisation that only a very small proportion (approximately 1 %) of the bacteria present in natural ecosystems actually gives rise to colonies when plated on agar media [1], they gradually abandoned culture methods in favour of direct observations [2]. In even the earliest of these publications [3, 4] it was noted that the predominant microbial population of all the aquatic ecosystems studied was attached to surfaces, and that the best way to study these populations was to insert a clean slide and observe the communities that developed on its surface. Microbial ecologists adopted the biofilm potential as a measure of the health of microbial communities in the ecosystem in question [2]. This approach is based on the colonisation of clean surfaces introduced into the ecosystem, and on the fact that healthy biofilms

shed planktonic cells that colonise these surfaces in a finite length of time, and reproduce the sessile communities that are dominant in the ecosystem. If the ecosystem is healthy, and there are sufficient nutrients, freshly introduced surfaces are fully colonised by mature communities in 24 – 48 hours [5]. If the ecosystem is compromised by the lack of nutrients [6], or by the activity of biocides that kill planktonic cells and the most vulnerable cells of the biofilm communities [7], then the colonisation of the freshly introduced surfaces is retarded and incomplete [8]. Wecke *et al* inserted both plastic and gold "carriers" into periodontal pockets, to obtain biofilms that replicate the sessile bacterial populations on the tooth and gum surfaces [9], and demonstrated that these *ex vivo* communities closely resemble those seen on extracted teeth [10]. In this study we extended the use of this technique to monitor the effects of anti-biofilm therapy on the biofilm

populations that colonise surfaces within the infected sulcus.

In their comprehensive review of chronic bacterial infections, Costerton *et al* presented evidence that the bacteria that cause these infections grow in matrix-enclosed biofilms, within which they are protected from host defenses and antibiotics [11, 12]. Direct microscopic evidence that periodontitis is caused by biofilm bacteria is presented in this paper, in Costerton's book [13], and in other publications [14-17]. This places this chronic bacterial disease squarely in the category of biofilm diseases that currently constitute 65 – 80% of infections treated by health professionals in the developed world [11]. This perception offers a plausible explanation for the fact that a bacterial infection affecting 85% of adults in the USA is inherently resistant to intact host defenses and to antibiotics, even though it involves tissues that are

open to physical intervention and to systemic vascular access [18].

Therapeutic strategies

If we take a global view of all biofilm infections, from simple gingivitis to device-related infections of the bone surrounding complex orthopaedic reconstructions [19], two therapeutic strategies have emerged that promise relief to desperate patients. The first of these strategies involves the physical removal of the bacterial biofilm from the colonised biomaterial and/or from the infected tissues, and the prevention of recolonisation, by the use of antibiotics to kill residual planktonic cells of the infecting species. This approach always gives a measure of relief in orthopaedic infections, but its success depends on the complete removal of the biofilm [19] and the selection of antibiotics so that all planktonic cells are killed, and in practice it gives complete resolution



Figure 1. The position of the Thermanox carrier in the periodontal sulcus sites 26 mesio-buccal, 26 disto-buccal and 36 mesio-buccal.

of the infection in only approximately 50% of device-related infections [20]. The scaling and root planning (SRP) treatment for periodontitis is very similar, in that residual biofilm left in crevices and on occluded surfaces will re-grow and spread to cover mechanically cleaned areas, and planktonic cells that escape post-SRP treatments will colonise newly available surfaces [21].

The second strategy involves the use of non-specific chemical agents to kill all of the planktonic cells, and some of the biofilm cells, in a particular ecosystem. This strategy, which has proven to be very successful in industrial applications [22], and in the protection of various catheters from bacterial colonisation and consequent infection [23-25], depends on the alteration of the microbial ecology of an ecosystem so that biofilm formation is minimised. Biofilm bacteria show the same susceptibility to non-specific oxidising agents as their planktonic counterparts [26], so that industrial biocides [27] and "catheter lock" solutions [23-25,28] kill all of the planktonic cells and as many of the biofilm cells as their stoichiometry allows. The regular application of 0.5 % bleach in the "Y" sets used to protect Tenchoff catheters from colonisation and infection has been successful for several years [25], in spite of the extreme susceptibility of the peritoneum to bacterial incursions. The PerioProtect therapeutic system uses this concept, because it delivers peroxide and an anti-oxidant to the periodontal space at regular intervals, and kills the planktonic bacteria and enough of the biofilm bacteria to gradually

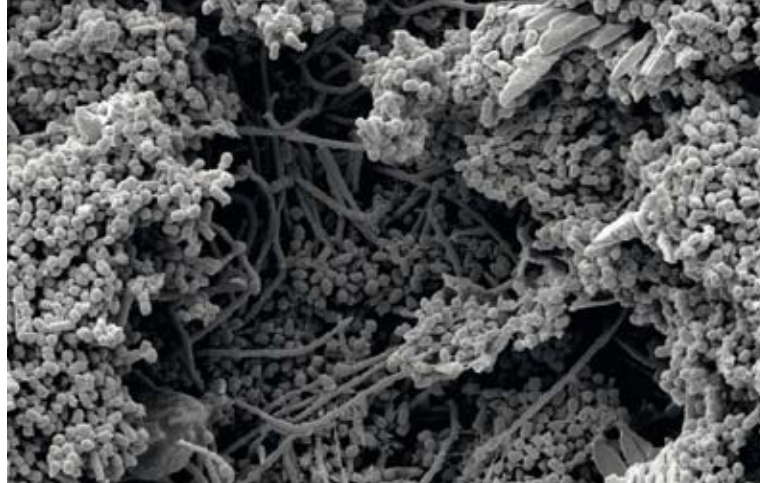


Figure 3. Scanning electron micrograph (SEM) of the tooth surface of a carrier recovered from the sulcus adjacent to the mesiobuccal (mb) aspect of tooth 26, showing the presence of a very thick biofilm within which several different bacterial morphotypes are evident. The bar represents 5 microns.

alter the microbial ecology of this ecosystem. The direct result of this alteration in the microbial ecology of the periodontal space is a sharp reduction in the rate at which available surfaces are colonised; the relevant measurement is the rate of colonisation of an inert carrier material introduced into the area for a specified length of time. This measurement is clinically relevant because it is the inflammatory response of the gingival tissues to the presence of planktonic and detached biofilm cells that lies at the base of the aetiology of this, and all other, chronic biofilm infections [11].

Study design

Sterile 13 mm Thermanox plastic coverslips were shaped with sterile razor blades so that they would fit into individual periodontal pockets. After this shaping, which was conducted in a laminar flow chamber, the inserts were dipped in 70% ethanol and stored in sterile 24 well plates until use. Thermanox (www.nuncbrand.com/page/en/303.aspx) is commonly used as an attachment surface for the

cultivation of mammalian cell lines. Based on the patient's impressions, perio trays were made, in accordance with FDA regulations for a laboratory registered with the FDA, to coincide with the specific disease conditions of the patient. The tray was worn in accordance with the scope and magnitude of disease, and wearing instructions were modified as healing occurred. The patient shown in Figure 1 was instructed to wear the trays for 20 minutes, four times a day. Prior to the tray delivery, small, sterile polycarbonate carriers (Thermanox) were inserted in three periodontal pockets: 26 mesial buccal, 26 distal buccal and 36 mesial buccal and supragingivally attached to the tooth surface with PeriAcryl (GlueStitch Corporation, Canada) for 48 hours. New sets of carriers were placed for 48 hours at the same sites after 2, 7, 12 and 17 days, respectively [Figure 2]. During the time the carriers were inserted the patient did not use the Perio-Tray but was allowed to brush and floss except at the indicated sites. When the carriers were removed the tooth side of each was identified with a score mark. The carriers were removed and fixed in 2.5% (v/v) glutaraldehyde in 0.1 M cacodylate buffer (pH 7) at 4° C for 24 hours, washed in PBS (pH 7.0) buffer, dehydrated in a graded ethanol line critical point dried (EMS 850), mounted on a stub, sputter coated with 20 nm platinum and examined with a scanning electron microscope. For bacterial enumeration, the morphotypes were

counted on an area of 10x10 μm² of each colony, and the counts were multiplied by the area and the height of the micro-colony. The counts of a certain morphotype, per carrier, were expressed as the sum of all micro-colonies on both sides of the carrier. The timetable for the periochart examinations, the placement and removal of the carriers and the application of the PerioProtect therapy is illustrated in Figure 2.

In the treatment period between days 0 and 2, 1.5 % peroxide was administered, using the PerioProtect trays, four times per day. In the treatment periods between days 4 - 7, days 9 -12, and days 14 - 17, 1.5 % peroxide was administered with a subclinical dose of Sumycin syrup, twice per day. At day 14 new PerioProtect trays were fitted, because the patient's gums were less swollen than at the beginning of the course of treatment.

Results before and after treatment

When the polyolefin carriers were removed from three sulci [Figure 1] in the patient's mouth, prior to any treatment [Day 0 in Figure 2], an SEM showed that both the tooth and gum surfaces were colonised by luxuriant biofilms composed of bacterial cells of many different morphotypes [Figure 3].

When the biofilms on the carriers from sites 26 mb, 26 db, and 36 mb were analysed, in terms of the number of cells of six distinct morphotypes present on the 6 mm² surface area [Figure 4], it was obvious that the colonisation was very luxuriant and that the three sulci differed very radically regarding the communities that had developed. The biofilm on the carrier from site 26 mb was composed predominantly of cocci, with smaller numbers of short rods and fusiform cells, while the biofilm on the carrier from site 36 mb showed the same morphotypes in different proportions. The biofilm on the carrier from site 26 db contained spiral treponemas, and cells with the unique *Selenomonas* morphotype of curved cells with a tuft of flagella, as well as cells of

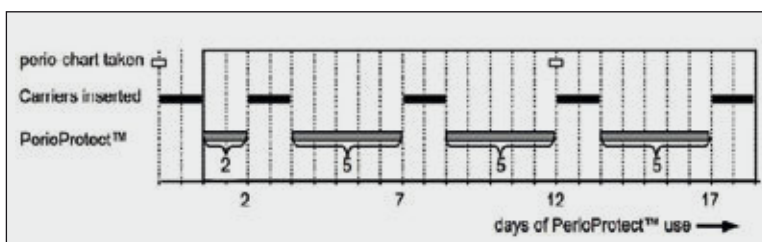


Figure 2. Timetable for periochart examinations, placement of carriers, and treatment using the PerioProtect system.

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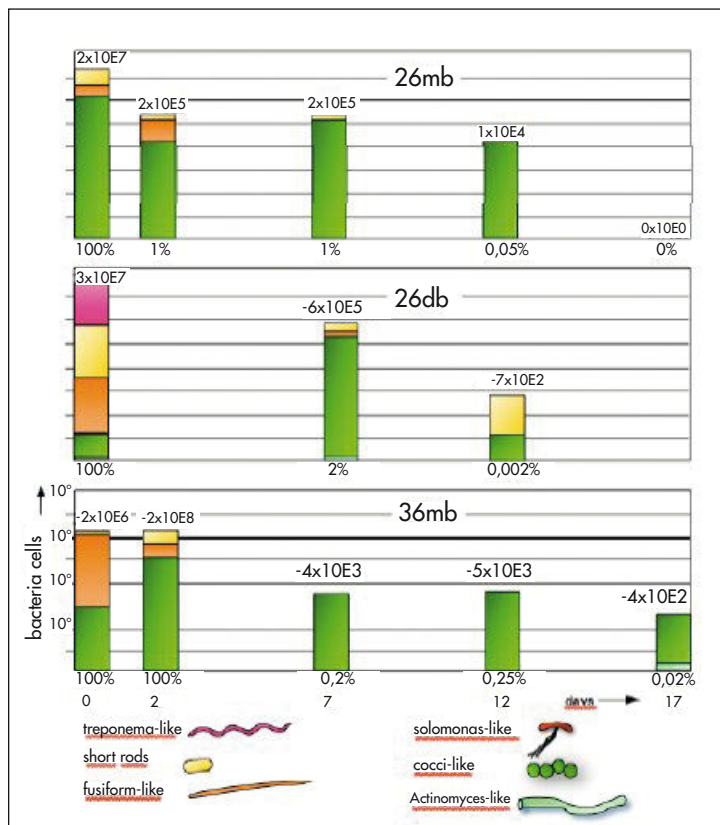


Figure 4. When the six different morphotypes that could be readily distinguished were tabulated for each of the carriers from the three different sites and were enumerated, the biofilms from different sulcuses were seen to be both very luxuriant and very different in species composition. Between 2x10⁶ and 3x10⁷ bacterial cells were seen on the 6 mm² surface of each carrier recovered before treatment, and the morphotypes present in the biofilms formed at each site differed significantly. The biofilms recovered from each site showed decreases in both cells numbers and morphotype diversity as the length of treatment with peroxide and sumycin proceeded from 2 to 7 to 12 to 17 days. Note that the carriers from site 26 db, at days 2 and 17, were lost due to failure of the tissue glue holding them in place.

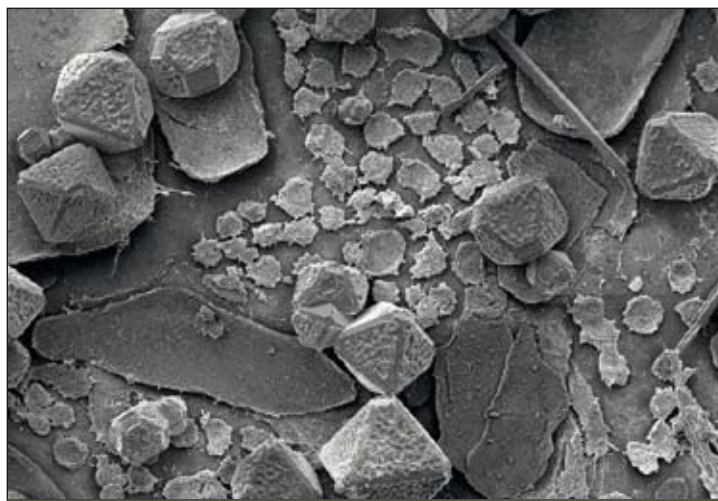


Figure 5. SEM of the gum side of the carrier recovered from the sulcus at site 26 mb, showing the absence of bacteria and the presence of human epithelial cells and the characteristic rhomboid crystals of Sumycin.

the three morphotypes seen in the other sulci. We noted that the microbial biofilms in sulci adjacent to the same tooth can vary, very substantially, in the bacterial morphotypes that constitute these sessile communities.

When treatment with peroxide was initiated, using the Perio-Protect delivery system, a 99% decrease in the number of colonising bacteria was seen at site 26 mb after two days of treatment. By day 7 [Figures 2 and 4] the biofilm potential at all three sites had decreased to between 0.2 % and 2.0 % of that of the untreated sulci, and the morphotypes present in these much less luxuriant biofilms were reduced to short rods and cocci. A further reduction in cell numbers was seen after 12 days of treatment. After 17 days of treatment the carrier from site 26 mb showed no bacterial cells, and only 0.02 % of the cells seen before treatment at site 36 mb were counted. An SEM of the gum side of the carrier from site 26 mb showed the complete absence of bacteria and the presence of human epithelial cells and rhomboid sumycin crystals, which indicated that the PerioProtect system had delivered this antioxidant deep into the infected sulcus [Figure 5]. An SEM of the tooth side of the carrier from site 36 mb showed that very large areas of the carrier remained uncolonised, and that the small micro-colonies that were formed consisted of coccoid cells and of a branched and polymorphic *Actinomyces* morphotype that had not previously been seen at this or at any of the other sites [Figure 6].

The periocharts that had been prepared prior to treatment and at day 12, by clinicians blinded to the experimental design, showed reductions from 6mm to 5mm at site 26 mb, from 6mm to 4mm at site 26 db, and from 5mm to 3 mm at site 36 mb [Figure 7]. It is also important to note that the PerioProtect trays used from day 1 until day 12

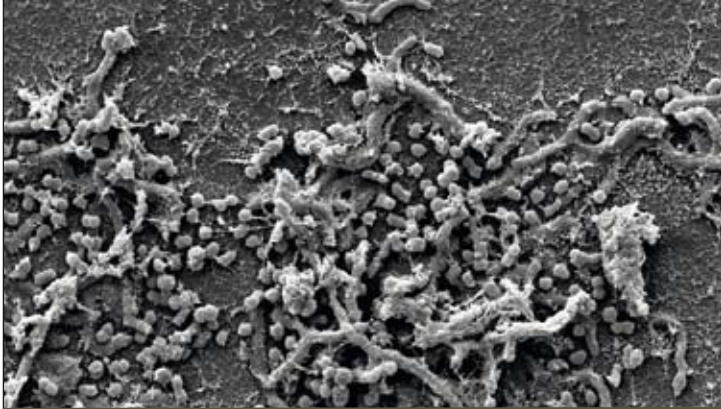


Figure 6. SEM of the sparse biofilm that formed on the tooth side of the carrier over a period of 48 hours in the sulcus at site 36 mb, after 17 days of treatment with peroxide delivered by means of the PerioProtect system. Note the presence of cocci and of cells of the *Actinomyces* morphotype in which the cells are branched and distinctly polymorphic.

were replaced by newly fitted trays (at day 13) because the reduction in swelling due to the treatment had caused the original trays to fit poorly.

Discussion

If the biofilms in a system are robust, planktonic cells will be released from all of the communities that make up the sessile population, and the biofilms that form on the new surface will represent those that predominate in the ecosystem. If however the sessile communities in the system are compromised, by lack of nutrients or by the action of antibacterial agents, the biofilms will be stressed and very few planktonic cells will be available to carry out the colonisation of the fresh surface. The usefulness of the Biofilm Potential is indicated by the observation [Figure 3] that the biofilm that formed on the carrier in the sulcus at site 26 mb covers almost all of both surfaces of this device, and consists of a very thick community in which cells of three distinct morphotypes

are discernable [Figure 4]. Each morphotype may be characteristic of many different species of bacteria, and biofilms composed of the same morphotypes cannot be assumed to be composed of the same species, but the presence of different morphotypes in a biofilm is unequivocal proof that the communities are composed of different species. Manual counting of cells of each distinct morphotype [Figure 4] allows us to estimate the number of bacteria in the communities that have formed in 48 hours, and shows that different locations, even on the same tooth (tooth 26) may have very different sessile communities. The presence of very large numbers of cells of the spiral *Treponema* morphotype in the db position on tooth 26, and the absence of these inherently mobile 29 cells in the mb position of the same tooth, indicate that each site develops its own distinct biofilm population. Because different sites in the sulcus surrounding an individual tooth vary profoundly in their microbial population, and develop

different adherent communities, longitudinal studies of treatment efficacy must always examine the same sites.

If we consider the control of the mixed species biofilms that cause periodontitis, in the context of biofilm control in other medical conditions, the physical removal of these adherent communities by scaling and root planning (SRP) is consistent with other standards of practice. The transitory nature of the benefits that accrue from SRP are probably explained by the fact that this physical removal can never be complete, because of the local geometry of cracks and grooves in the tooth surface, and biofilm removal must be complete if re-growth is to be avoided [19]. In general terms, the persistence of periodontitis can be attributed to inadequate supragingival and subgingival biofilm control over time [30].

The alternative method for biofilm control is sustained treatment of these attached communities, using agents that kill planktonic cells and the most vulnerable of biofilm cells. In this sustained attack on biofilms, oxidative agents are most successful because they both kill and remove bacterial cells [31], and hydrolyse and remove matrix material [32]. Antibiotics and biocides like the quaternary ammonium compounds are much less successful, because they kill planktonic cells and some sessile bacteria, but the dead cells and pervasive matrix material remain on the surface [33], and provide an optimal conditioning layer for re-colonisation. In this study of three sites in the mouth of a single individual, the intensive use of peroxide in the first seven days of the trial reduced the biofilm potential, by 2 – 3 logs, the mainstay and reduced the number of morphotypes in the site (26 db) with the most diversity from five to three [Figure 4].

The general decrease in the biofilm potential can be attributed to the killing of planktonic cells, and of the most vulnerable sessile organisms. The elimination of the

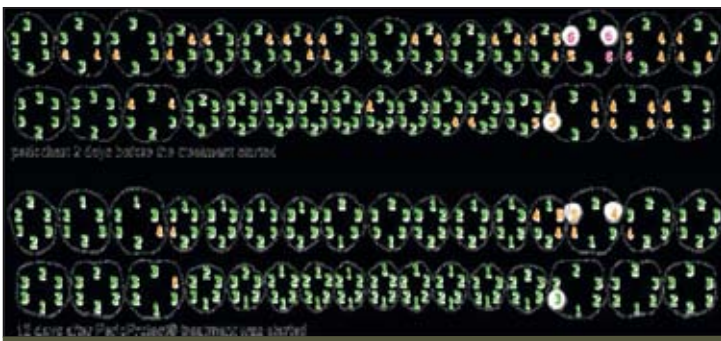


Figure 7. Periochart before treatment and after 12 days of treatment with peroxide delivered by means of the PerioProtect system. Note the reduction of the probing depths at sites 26 mb, 26 db, and 36 mb.

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Complete systems for personalised prostheses



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Treponema morphotype at site 26 db may have resulted from the fact that these very mobile spiral cells are not fully integrated into or protected by the biofilm community. Our detailed studies of *Treponema* in the bovine rumen showed that they move in and out of classic biofilms, harvesting metabolites as they move, but never remain in the structured sessile community or benefit from its collective protection [34]. The further 4 – 7 log reduction in the biofilm potential seen after a cumulative 17 days of treatment using peroxide in the PerioProtect regimen, is consistent with the proposed mechanism of this treatment, in that there are very few bacteria present in the sulcus that are capable of colonising the surface of the carriers. At site 36 mb the few bacteria that were able to form small microcolonies on the tooth side of the carrier [Figure 6] were either coccoid, or of the *Actinomyces* morphotype, whose presence in thicker biofilms at the same site may have been masked by the larger number of cells of other morphotypes at earlier stages of this treatment. The presence of human epithelial cells on the gum surface of the carrier recovered from site 26 mb at day 17 indicates that the tissue that lines the sulcus may proliferate, and shed its own colonising cells, when the bacteria in the ecosystem have been essentially controlled by sustained peroxide delivery. The presence of rhomboid sumycin crystals on all of the surface areas of this carrier offer direct proof that the PerioProtect system delivers its reagents to all areas of the sulcus.

Conclusions

We conclude that the PerioProtect treatment system delivers biofilm control agents to the infected sulcus very effectively. In this single case, in which peroxide was delivered using the PerioProtect trays, this oxidising agent was seen to reduce the biofilm potential very substantially, in the three sulci that were monitored using

the flexible plastic carriers. The tetracycline crystals viewed on the SEM analysis [Figure 5] demonstrate the capability of delivering medications to the gingival sulcus. Future studies, using this same biofilm potential measurement, will be used to "fine tune" the solutions chosen for delivery by this simple but novel technology to provide a non-surgical alternative that can be used in combination with scaling and root planning (SRP).

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Taurodontism and its dental management

By Dr Sadaf Khan and Dr Daljit S Gill

Taurodontism is a term derived from the Greek words 'tauros' meaning 'bull' and 'dontia' meaning teeth. It is a condition found in molar teeth where the body of the tooth and pulp chamber are enlarged vertically at the expense of the roots. Consequently, the floor of the pulp and the furcation of the tooth are moved apically down the root. The implications of this aberrant dental morphology for clinical dentistry need to be considered particularly with respect to treatment planning dental extractions and endodontic and orthodontic treatment.



Introduction

First described in 1913 by Sir Arthur Keith in multi-rooted teeth of Neanderthal man [1], taurodontism was further sub classified by Shaw [2] in terms of increasing severity into hypotaurodont, mesotaurodont and hypertaurodont. Hypotaurodontism refers to teeth with slightly enlarged pulp chambers, mesotaurodontism to teeth with more enlarged pulp chambers and finally hypertaurodontism with much enlarged pulp chambers. Taurodontism is most commonly found in the permanent dentition although it can also be found in the primary dentition and although traditionally applied to molar teeth it can also occur in premolar teeth.

Prevalence

The gender distribution of taurodont

teeth appears to be equally distributed between the sexes [3, 4] although exceptionally it has been reported as being twice as frequent in males as in females [5]. The reported prevalence of taurodontism is between 0.25-11.3% [3, 4]. If these figures are extrapolated to clinical practice then a dentist in general practice seeing an average of 100 patients a week may possibly expect to see five patients in that period with features of taurodontism [6].

Aetiology

The scientific literature cites several possible causes for the development of taurodontism but either the failure to invaginate or a late invagination of Hertwig's root sheath, which is

responsible for root formation and shape, causes an apical shift of the root furcation. The constriction at the amelocemental junction is usually reduced or absent. Other possible causes have been cited as external factors affecting the development of teeth, such as mandibular infection [7] or genetic factors such as a spontaneous mutation [8], an X-linked trait, a familial [9] or an autosomal dominant trait [10].

Associated medical conditions

Taurodontism has been found to occur in patients with several medical conditions and syndromes. This may be related to its genetic aetiology. A close association of taurodontism and X-chromosomal aneuploid states has

been demonstrated. Klinefelter syndrome (also known as 47, XXY or XYY syndrome) is a genetic disorder affecting about 1.2 in 1000 males [11] and is characterised by tall stature, hypogonadism, androgen deficiency and female traits such as wide hips and sparse facial hair. The syndrome is caused by a non-dysjunction of the X-chromosome during parental gametogenesis prior to fertilisation of an egg by sperm. Although taurodontism is not pathognomonic for Klinefelters syndrome it is one of the anomalies frequently associated with it.

A number of other conditions that have been associated with taurodontism include:

Cleft lip and palate

Cleft lip and palate is a condition affecting 1 in 700 live births in which abnormal facial development during gestation causes a cleft of the soft palate, the hard palate and or the lip [Figure 1].

Orofaciodigital syndrome

Orofaciodigital syndrome type I (OFD1) is an X-linked disorder characterised by malformations of the face, oral cavity and digits with polycystic kidney disease and variable involvement of the central nervous system that can also manifest with taurodont teeth.

Tricho-dento-osseous syndrome

Trichodentoosseous syndrome (TDO) is an autosomal dominant condition that has been correlated with a DLX3 gene mutation. Mutations in this gene have

been associated with the autosomal dominant conditions trichodontoosseous syndrome and amelogenesis imperfecta with taurodontism.

Down's syndrome

Trisomy 21 is a chromosomal disorder caused by the presence of all or part of an extra 21st chromosome. It is associated with some impairment of cognitive ability and physical growth and a particular set of facial and dental characteristics, one of which is taurodontism.

Hypophosphatasia

Hypophosphatasia is a rare and sometimes fatal metabolic bone disease. Clinical symptoms are heterogeneous, ranging from the rapidly fatal perinatal variant to a milder, progressive osteomalacia later in life.

Ectodermal dysplasia

Ectodermal dysplasias are heritable conditions in which there are abnormalities of two or more ectodermal structures such as the hair, teeth, nails and sweat glands, cranial-facial structure, digits and other parts of the body. Patients with the condition also present with severe hypodontia [Figure 2], microdontia, aberrant dental crown morphology and taurodont molars.

X-Linked vitamin D-resistant rickets

X-linked hypophosphataemia (hypophosphatemic rickets, vitamin D-resistant rickets) is an X-linked dominant form of rickets (or osteomalacia) that can cause bone deformity including short stature and bow leggedness.

Smith-Magenis syndrome

Smith-Magenis Syndrome (SMS) is a developmental disorder that affects many parts of the body. The major features of this condition include mild to moderate mental retardation, distinctive facial features, sleep disturbances and behavioural problems. Smith-Magenis syndrome affects an estimated 1 in 25,000 individuals.

Thalassaemia major

This is an inherited autosomal recessive haematological condition in which a genetic defect results in a reduced rate of synthesis of one of the globin chains that make up haemoglobin resulting in

abnormal haemoglobin molecules, thus causing anaemia, the characteristic presenting symptom of the thalassaemias.

Clinical appearance of taurodont teeth

The clinical appearance of a taurodont crown has a normal structure and appearance except when associated with amelogenesis imperfecta. Taurodontism may also be associated with various dental conditions. These include microdontia and dens invaginatus, amelogenesis imperfecta and with dermatological conditions such as ectodermal dysplasia as outlined above. Taurodontism has also been reported to be more common in hypodontia [Figure 2] with a reported prevalence of 35% [12].

Radiographic appearance

Radiographs are the main method for the diagnosis of taurodont teeth as the clinical appearance of the crown appears normal and therefore does not indicate an aberrant pulp or root morphology [Figure 3]. However, much of the radiographic evaluation is subjective as the degree of taurodontism may vary. It has been described as pyramidal, cuneiform or fused. Some authors have suggested the use of metric measurements to calculate the degree of taurodontism from radiographic measurements [4]. However as root length may be affected by the degree of root formation, radicular resorption as well as apical deflection, an index of taurodontism based on linear measurements should be interpreted with caution.

Management

Albeit an uncommon occurrence, taurodont teeth can impact on clinical dentistry in a number of ways: Endodontic treatment is more difficult. Localisation and instrumentation of the root canals may be more difficult due to the apically positioned pulp chambers. The number of roots and root canals may be variable depending on whether the tooth is hypotaurodont, mesotaurodont or hypertaurodont. Bifurcation or trifurcation of roots may challenge the endodontist with pronounced curves of the root canal that make canal preparation very difficult. A



Figure 1. A baby with an unrepaired bilateral cleft lip and palate. Cleft lip is one of several medical conditions that can be associated with taurodontism.

modified obturation technique has been proposed as a result of the complexity of the inner root canal and the proximity of buccal orifices. In addition, there may also be an increased proportion of pulp stones (26.7%) in taurodont molars [13]. The use of magnification has been advocated in several case studies in order to overcome the difficulties posed by the altered morphology.

Dental extractions

These may be more complicated in taurodontism as the tooth furcation is located more apically. In addition the root apices may be shorter and thinner and therefore more liable to fracture during extraction. Extraction of taurodont molars may also pose a challenge to the clinician. Firm control of the tooth may be compromised due to the dilated apical third, and conventional molar extraction forceps designed to engage the furcation of the tooth may not be as effective in taurodont teeth due to the more apical position of the furcation. In addition, the conventional rotational force usually applied during an extraction is contraindicated [14].

Root resorption

The shorter thinner roots in taurodontism may be subject to root resorption during fixed appliance orthodontic treatment. Fixed appliance orthodontic treatment may cause root resorption in taurodont molars [15]. Root resorption is an inevitable consequence of orthodontic tooth movement and is as yet a poorly understood condition. It is thought to be related to the inflammatory response produced at a cellular level when an orthodontic force is applied to a tooth and tooth movement initiated. Root resorption may be affected by multiple factors such as the

age of the patient, medical history, previous trauma, tooth impaction and the morphology of the apical third of the root. A careful risk-analysis must be carried out prior to commencing orthodontic treatment. This should form the basis of a discussion for informed consent to be obtained at the start of the treatment.

Orthodontic anchorage

This is likely to be reduced by the shorter roots. The altered morphology of taurodont molar teeth also has an effect on the total root surface area. This may in turn affect the anchorage value of a taurodont molar during orthodontic treatment. This is another consideration that needs to be borne in mind at the treatment planning stage. The use of head gear to reinforce anchorage of taurodont upper molars is contraindicated [6] because of the increased risk of root resorption.

Restorative management

Post endodontic restorative management of such teeth is affected by the presence of a large pulp cavity located in a more apical position. Restoration of a taurodont molar maybe more difficult following endodontic therapy. This is because the crown of the tooth would have



Figure 2. A patient with severe hypodontia related to ectodermal dysplasia.

Dental chair for improved blood circulation



The Salli Swing saddle chair incorporates a rocking mechanism, which allows tilting of the chair while seated. This increases the mobility of the lower back area, improving blood circulation and metabolism. About 70% of dentists suffer from shoulder, neck and spinal problems. Long working hours and bad working ergonomics cause multiple problems. In addition, many male dentists suffer from genital problems due to poor circulation in this area. As well as improving posture, the chair ensures good ventilation and good circulation in the genital area, the pelvic area and in the back, legs and feet.

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The task of coordinating each particular patient case is significantly easier with the GEO Aesthetics Set, as the relevant shape, size and function can be rapidly identified. The individual teeth can be fabricated quickly to resemble excellent natural aesthetics. A wax-up is the first of many other steps in the laboratory and practice. Important fields of application include its use as a basis for planning and for subsequent processing, including conventional layering technique, temporary restorations and veneers.

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Figure 3. An orthopantomogram showing taurodont first permanent molars and primary upper molars. This patient also has hypodontia.

been more extensively compromised to gain access to the pulp chamber that is situated more apically. Consequently in order to support a full coverage crown for example, the coronal structure has to be extensively restored.

Summary

Although taurodontism is relatively uncommon, the general dental practitioner is well advised to bear in mind the clinical significance of this condition. Taurodont molars may complicate endodontic, restorative and orthodontic treatment as well as dental extractions. In addition, the diagnosis of taurodont teeth may lead to the identification of an underlying associated medical condition.

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Laser dentistry: the ideal solution for faster treatment of more patients

By Stef Harley

Currently many dental surgeries are considering how they can increase practice revenue and patient turn-over. The pressures of the global economic downturn have led patients to be cautious about spending; treatment acceptance is lower and waiting rooms are emptier than before. To treat more patients per day, surgeries need to streamline dental procedures and offer more than competitors. The latest in dental laser technologies may well be the answer to the recession for many practices. Offering superior treatment speed, increased clinical quality and a positive experience for patient and dental staff alike, dental lasers have come a long way from the situation where many dentists still had common misconceptions about lasers.



It may be true that some laser systems, which deliver the laser light to the tooth through an optical fibre, have limitations because of the relatively low speed at which the treatment can be carried out. To protect the expensive fibre, laser energy must indeed be kept low, often at the expense of treatment speed and efficiency. However, nowadays laser systems that utilise an articulated arm and are supported by advanced technology, such as VSP technology, can deliver laser energy much more efficiently, without compromising on speed. Such lasers achieve optical drilling speeds of up to 1.6 times higher than conventional high speed burs [1].

Choice of laser source

When the expansion of a dental

practice by means of installing a dental laser system is being considered, the right choice of laser source is of course essential. Erbium lasers have long been recognised as the optimal dental lasers for effective, precise and minimally-invasive hard dental tissue treatments [2]. Of all infrared lasers, they exhibit the highest absorption in water and hydroxyapatite, and are thus ideally suited for cold optical drilling in enamel, dentine and composite fillings. A recent study published in the Journal of Oral Laser Applications [3], states that an Er:YAG laser delivered through an articulated arm, cuts three times faster through dentine and 4.2 times faster through enamel, than an Er,Cr:YSGG laser delivered through an optical fibre. These results were obtained using a novel,

accurate and reproducible method to measure laser ablation speeds under realistic conditions, mirroring the laser treatments manually administered by a dental practitioner. According to the authors of the study, the measured differences in treatment speed are the result of differences in the laser wavelengths, pulse duration and shape of the laser pulses. Because of the differences in wavelength, Er:YAG is absorbed three times better in hard dental tissue than Er,Cr:YSGG. This essentially means that the Er:YAG removes more hard tissue at the same laser power settings, thus leading to faster procedures. In addition, to ensure that the patient experience of laser use for hard dental tissue treatments is positive, it is important that as little as possible heat that is created

by the laser energy be diffused into the surrounding tissue. The determining factor for this is the laser pulse duration. If the laser energy can be delivered to the target tissue in a very short time span, then the energy cannot escape from the ablated tissue, and so cold optical drilling is achieved. This is not only essential to maintain patient comfort but also determines optical drilling speed. In this respect Er:YAG lasers are at an advantage because they can generate very short, 50 microsecond pulse durations. Measurements using the Er,Cr:YSGG laser showed that, although the minimum pulse duration that can be selected is nominally 140 microseconds, in fact, on measurement, the generated laser pulses are found to be technically limited to 500 microseconds. A final consideration that indirectly contributes to higher optical drilling speeds is the shape of the laser pulse. Ideally, laser pulses should be square-shaped, without a long build up followed by a decrease in laser power. This ensures that laser power remains constant within the pulse. Its effect on the tissue does not change from that of cold optical drilling to that of drilling regimes with a thermal element; this would lead to inefficiency. The Er:YAG laser system used in the study provided practically square pulses, while the Er,Cr:YSGG system produced pulses with a longer decline in laser power throughout the pulse. According



The AT Fidelis laser system.

this difference in pulse shape also contributed to the measured difference in optical drilling speeds. By carrying out procedures such as cavity preparations and caries removal in several minutes less time, it is clear that eventually more patients can be treated on a daily basis.

Advantages for patients

In 90% of cases, patients feel no discomfort at all during Er:YAG laser treatments [4]. Procedures can frequently be performed without anaesthesia. This eliminates considerable waiting time while the anaesthetic takes effect. With improved patient comfort and reduced anxiety (no needles, no noise, no vibration, no numbness), the stress for both dentist and supporting personnel is also minimised. When no anaesthesia is used, patients can receive treatments in all four quadrants during the same appointment. Fewer follow-up appointments and faster treatments not only mean more, free chair time, but also happier patients. Satisfied patients are more likely to spread the word about comfortable and fast treatments, which will increase the number of people who visit the practice. Secondly, optical laser drilling does not leave a smear layer on the prepared tooth surface in the way mechanical burs do [5]. In most cases acid etching will not be required, eliminating even more procedure time.

There are dental laser systems on the market, such as the AT Fidelis from Fotona, that combine two laser sources to provide a comprehensive dental treatment platform. These laser systems allow the dentist to

perform both hard and soft dental tissue procedures, often in one session. They even allow dentists to perform procedures that would have otherwise needed to be referred elsewhere. After relevant clinical training, these systems will allow dentists to expand their services to include treatment options for periodontal disease, osseous surgery and many other procedures. This allows surgeries to fill gaps in the schedule with new, high-revenue generating procedures.

Because they allow higher patient turn-over through faster procedures, more patient referrals and added exposure to the dental practice, it is easy to see that lasers are indispensable to a modern dental practice in these troubled economic times.

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Some misconceptions about laser dentistry

Hard tissue lasers cut slower than high speed burs.

This can be true for laser systems that deliver the laser beam through an optical fibre delivery system. To protect the expensive fibre, the laser energy must be kept low. But laser systems such as Fotona's Fidelis III range utilise an articulated arm and advanced technological solutions, such as VSP Technology, that allow the laser to deliver much more energy for efficient laser drilling. This means that these lasers can cut at comparable and higher speeds than conventional high speed burs. In fact a recent paper has described the use of a very novel and accurate way to determine ablation speeds. The study shows that a hard tissue Er:YAG laser delivered through an articulated arm cuts 3.7 times faster through dentine and five times faster through enamel than an Er,Cr:YSGG laser delivered through an optical fibre (Waterlase MD, Biolase). Another study determined that the same Er:YAG laser delivers drilling (ablation) speeds that were higher than that of a high speed bur.

Lasers have limited uses; some work strictly on soft tissue, others only on hard tissue.

This is not entirely true. Laser systems that incorporate two laser types can work very effectively on both soft and hard tissue. This is because each laser's wavelength is ideally suited to work on each tissue type. For example, Fotona's AT Fidelis is indicated for more than 45 procedures, virtually replacing the dentist's entire traditional toolkit with a system offering faster, more efficient and effective treatments. In addition, many treatments simply cannot be performed with the conventional toolkit.

Lasers are 100% painless.

Most patients (90%) feel no discomfort at all during Er:YAG laser treatments. Fidelis lasers are thus predominantly used without anaesthesia, but certain situations and certain patients require local anaesthesia. A topical anaesthetic suffices for some soft tissue procedures; larger hard tissue procedures may require a local injection. Nevertheless, patient comfort is dramatically improved (no needles, no noise, no vibration, no numbness), thus reducing dentist and staff stress. Where no anaesthesia is used, patients can receive treatments in all four quadrants during the same appointment. Fewer appointments and faster treatments mean more free chair time.

Lasers are a bad investment.

Lasers are not inexpensive, as is usually the case with most investments in developments with future earning potential. If dentists understand the benefits of lasers, the positive return on any investment will be very clear. With a reduced need for anaesthesia, more treatments in multiple quadrants can be carried out, during shorter visits, thus increasing per-visit production. Dual laser systems allow the dentist to treat more conditions efficiently and less invasively, even conditions that were previously unable to be treated. The combination of increased patient referrals and added exposure as a result of the practice offering more than its competitors, means that lasers are now indispensable in modern practices.

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Scientific literature review

The number of peer-reviewed journals covering the various aspects of dentistry is huge, certainly too big for busy dental practitioners to keep up with. As a special service to our readers, WDR brings a selection of literature abstracts, chosen by our editorial board as being particularly worthy of attention.



control women and generalised periodontitis in 148 (13.4%) and 118 (10.8%), respectively. A significant association was observed between generalised periodontitis and induced preterm birth for pre-eclampsia [adjusted odds ratio 2.46 [95% confidence intervals (95% CI) 1.58-3.83]. Periodontitis was not associated with spontaneous preterm birth or preterm premature rupture of membranes or with the other causes. The authors concluded that maternal periodontitis is associated with an increased risk of induced preterm birth due to pre-eclampsia.

Nabet C et al. *J Clin Periodontol.* 2010 Jan;37(1):37-45

Journal of Dental Research

PERIODONTICS

Journal of Clinical Periodontology

Alterations in the salivary proteome associated with periodontitis

This article reports on a study that was carried out to identify changes in the salivary proteome associated with active periodontitis. Quantitative proteomics (two-dimensional sodium dodecyl sulphate polyacrylamide gel electrophoresis, 2D SDS PAGE) was used to investigate whole saliva from individuals with severe periodontitis, and their proteomic profiles before and after periodontal treatment were compared; a comparison of 128 proteins across all saliva samples identified 15 protein spots with altered abundance. The predominant

alteration that was observed was an increase in the abundance of the S100 proteins S100A8/A9/A6. Of the remaining proteins with altered abundance, haptoglobin, prolactin inducible protein and parotid secretory protein have previously been associated with host defence. These results highlight the predominant involvement of S100 proteins in the host response during periodontitis, identify host defence components that have not been linked previously to this disease and suggest new potential biomarkers for monitoring disease activity in periodontitis.

Haigh BJ et al. *J Clin Periodontol.* 2010 Mar; 37(3): 241-7.

Maternal periodontitis and the causes of preterm birth: the case-control Epipap study.

The association between maternal periodontitis and preterm birth (<37 weeks' gestation) is analysed in this paper. Epipap is a case-control multi-centre study of singleton live births. One thousand one hundred and eight women with preterm deliveries and 1094 with deliveries at term (>37 weeks) at six French maternity units were included in the study. Periodontal examinations after delivery identified localised and generalised periodontitis. Cases were classified according to four causes of preterm birth. Polytomous logistic regression analysis was used to control for confounders (maternal age, parity, nationality, educational level, marital status, employment during pregnancy, body mass index before pregnancy, smoking status). The study found that localised periodontitis was identified in 129 (11.6%) cases and in 118 (10.8%)

Hyper-responsive phenotype in localised aggressive periodontitis

The 'hyper-responsive' trait is an increased inflammatory response upon stimulation of innate immune receptors. The objective of the study reported in this paper was to determine if a hyper-reactive trait is present in a cohort diagnosed with localised aggressive periodontitis (LAGP). Peripheral blood was collected from 30 LAGP, 10 healthy unrelated, and 10 healthy sibling participants and stimulated with lipopolysaccharide (LPS) from *E. coli* and *P. gingivalis*. Cyto/chemokine response profiles were evaluated and analysed by ANOVA. Elevated levels of pro-inflammatory cyto/chemokines were detected in *E. coli* and *P. gingivalis* LPS-stimulated LAGP cultures when compared with those of healthy unrelated control individuals. Periodontally

Anti-caries dental rinse



A dental rinse, Elmex, is now available for daily oral hygiene after tooth brushing, after meals, or at any time to prevent development of caries, to protect dental enamel and to provide effective protection in those areas hard to reach with a toothbrush. It is particularly useful for patients wearing

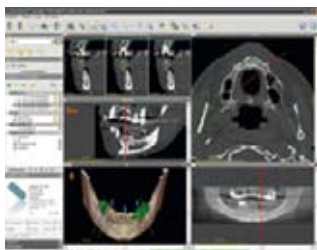
orthodontic appliances and patients with bridges and partial prostheses. Due to its surface activity and to its slightly acidic pH, amine fluoride promotes the formation of well-adhering calcium fluoride globules. These globules act as a fluoride deposit, which protects the tooth against acid attack and stimulates remineralisation. The production of bacterial acids which can damage teeth is inhibited.

GABA International AG
Therwil, Switzerland

More info... worlddental-online.com
& search 100055



Implant design software



The entire 3D planning process for dental implants can be performed directly on the dentist's or laboratory PC using coDiagnostiX software. All available implants are deposited graphically in the integrated implant database and can then be sorted hierarchically for a fast selection. The system is able to manage as many plans as desired for each patient. After the actual planning, the dentist and laboratory can choose the optimal scheme. Based on this decision, templates can then be drilled. The software is easy to use and is characterised by high computing speed and minimal hardware requirements.

IVS Solutions AG
Chemnitz, Germany

More info... worlddental-online.com
& search 100154



healthy siblings presented with attenuated hyper-inflammatory cyto/chemokine profiles. Regression analysis demonstrated the hyper-reactive trait to be concomitant with expression of pro-inflammatory cyto/chemokines and an absence of anti-inflammatory mediator expression. These findings demonstrate a hyper-responsive trait in a LAgP cohort, along with an attenuated hyper-responsiveness in healthy siblings, which can be induced in response to multiple TLR ligations.

Shaddox L et al.

J Dent Res. 2010 Feb; 89(2): 143-8.

Inhibition of apoptosis in periodontitis

This article describes a study designed to investigate whether the prolonged survival of inflammatory cells in periodontal disease could be due to the inhibition of apoptosis by tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) decoy receptors and inhibition of the terminal stages of apoptosis signaling by inhibitor of apoptosis (IAP) family members. Gingival tissue samples were taken from healthy individuals and those with chronic periodontitis. The expression of TRAIL, TRAIL receptors, TUNEL, cleaved caspase-3, xIAP, and survivin was determined immunohistologically and at the level of mRNA expression. Higher levels of TRAIL and the TRAIL decoy receptor, TRAIL R4, were expressed in the diseased periodontal tissues ($p < 0.005$). Statistically ($p < 0.05$) higher levels of cleaved caspase-3 and the cleaved caspase-3 inhibitors, xIAP and survivin, were seen. Similar changes were seen at the level of mRNA. The results indicate that apoptosis in periodontitis may be inhibited by elevated expression of TRAIL decoy receptors and cleaved caspase-3 inhibitors.

Lucas H et al.

J Dent Res. 2010 Jan; 89(1): 29-33.

ORAL MICROBIOLOGY AND IMMUNOLOGY

Detection of herpetic viruses in gingival crevicular fluid of patients suffering from periodontal diseases: prevalence and effect of treatment.

Although the role of bacteria in the aetiology of periodontitis is well established, it has been suggested that herpetic viruses could contribute to the initiation and progression of this disease. The aim of this study was to determine the prevalence of human cytomegalovirus (HCMV), Epstein-Barr virus (EBV) and herpes simplex virus (HSV) in gingival crevicular fluid (GCF) samples obtained from periodontally healthy, gingivitis and periodontitis patients. In addition, the effect of periodontal treatment (scaling and root planing) on the persistence of herpetic viruses was evaluated in a sub-group of patients suffering from chronic periodontitis. The presence of viruses in GCF samples was assessed by a nested PCR amplification technique. The persistence of viruses in periodontal sites was evaluated following scaling and root planing therapy. A statistically significant higher prevalence of HCMV was observed in periodontitis patients as compared to healthy control subjects (35 vs. 8%, respectively; $P = 0.0377$). A trend for a higher prevalence of HSV was also noted in the periodontitis group, in comparison with healthy control subjects. In addition, a higher prevalence of HCMV was associated with deep periodontal pockets in subjects suffering from periodontitis. In the sub-group of periodontitis patients, periodontal therapy resulted in the elimination (HCMV and EBV) or reduction (HSV) of the herpetic viruses. This study showed that the prevalence of HCMV and HSV viruses in GCF is higher in patients suffering from periodontitis compared to periodontally healthy subjects, and that the prevalence of HCMV is higher in deep periodontal pockets. It also suggested that

periodontal therapy may be associated with virus elimination in diseased sites.

Grenier G, Gagnon G, Grenier D.
Oral Microbiol Immunol. 2009 Dec; 24(6): 506-9.

Characterisation of bacterial flora in persistent apical periodontitis lesions

Microorganisms are able to survive and induce persistent infection in periapical tissues. The aim of this study was to investigate the composition of the microflora of persistent apical periodontitis lesions. Twenty apical lesion samples were obtained from 20 patients with chronic apical periodontitis by root end surgery and processed using aerobic or anaerobic culture techniques. All isolated strains were identified by 16S ribosomal DNA sequence analysis. Seventy-four strains were isolated, belonging to 31 bacterial species obtained from the 20 apical lesions that were isolated. The majority of the strains were facultative anaerobes (51.6%). *Propionibacterium acnes*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa* and *Fusobacterium nucleatum* were isolated from 16.2, 9.5, 6.8 and 5.4% of the samples, respectively. Fifteen samples harboured more than one species. The predominant association was with *P. acnes*, *S. epidermidis* and *F. nucleatum*. The microbiota of persistent apical periodontitis lesions are thus composed of diverse types of microorganisms with biofilm-forming capacity, including *P. acnes*, *S. epidermidis* and *F. nucleatum*.

Fujii R et al.

Oral Microbiol Immunol. 2009 Dec; 24(6): 502-5.

ENDODONTICS



Nanoparticle-based endodontic antimicrobial photodynamic therapy

This study investigated the *in vitro* effects of poly(lactic-co-glycolic acid) (PLGA) nanoparticles loaded with

the photosensitiser methylene blue (MB) and the use of light against *Enterococcus faecalis*. The uptake and distribution of nanoparticles in *E. faecalis* in suspension was investigated by transmission electron microscopy (TEM) after incubation with PLGA complexed with colloidal gold particles for 2.5, 5, and 10 minutes. *E. faecalis* organisms were sensitised in planktonic phase and in experimentally infected root canals of human extracted teeth with MB-loaded nanoparticles for 10 minutes followed by exposure to red light at 665 nm. The nanoparticles were found to be concentrated mainly on the cell walls of microorganisms at all three time points. The synergism of light and MB-loaded nanoparticles led to approximately 2 and 1 log₁₀ reduction of colony-forming units (CFUs) in planktonic phase and root canals, respectively. In both cases, mean log₁₀ CFU levels were significantly lower than controls and MB-loaded nanoparticles without light. The utilization of PLGA nanoparticles encapsulated with photoactive drugs may thus be a promising adjunct in antimicrobial endodontic treatment.

Pagonis TC et al.
J Endod. 2010 Feb; 36(2): 322-8.

Degree of conversion of a methacrylate-based endodontic sealer: a micro-Raman spectroscopic study.

Recently, a methacrylate-based obturation system, Resilon/RealSeal SE, has been developed to replace gutta-percha and traditional sealers. As a resin-based material, the degree of conversion (DC) is one of the most important characteristics. This study investigated the time-dependent change of the DC of RealSeal SE as well as the influence of canal moisture and root canal depth on sealer. The DC of RealSeal SE, either self-cured or dual-cured (n = 8 in each group), was calculated according to the Raman spectra obtained at different times after mixing. Thirty extracted teeth with a single canal were instrumented and divided randomly into 2 groups in terms of different canal drying methods. In the ethanol group, excess distilled water in the root canal was removed with paper points followed by 95% ethanol. In the

paper points group, the root canals were blot-dried with paper points until the last one appeared dry. The DC of RealSeal SE was calculated from serial cross sections (2, 5, and 8 mm from the apex) obtained 1 week after obturation with Resilon/RealSeal SE. A significant increase in the DC of RealSeal SE was observed at 1 week (P < 0.01), with little change afterwards (P > 0.05). The DC of sealer in ethanol group was significantly higher than in the paper points group (P < 0.01). However, DCs of RealSeal SE at different levels of tooth sections were not significantly different (P > 0.05). It appears that both self-cured and dual-cured RealSeal SE achieved a stable DC after 1 week. Root canal moisture was a critical factor in determining the DC of RealSeal SE.

Wu WC et al.
J Endod. 2010 Feb; 36(2): 329-33.



Tooth survival following non-surgical root canal treatment: a systematic review of the literature.

This study investigated reported tooth survival after root canal treatment (RCTx) and the effect of clinical factors on the proportion of root filled teeth

surviving after RCTx. Longitudinal human clinical studies investigating tooth survival after RCTx which were published up to the end of 2007 were identified electronically (MEDLINE and Cochrane database 1966-2007 December, week 4). In addition, four journals (Dental Traumatology, International Endodontic Journal, Journal of Endodontics, Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology & Endodontics), bibliographies of all relevant articles and review articles were hand searched. Two reviewers assessed and selected the studies based on specified inclusion criteria and extracted the data onto a pre-designed proforma, independently. The criteria were as follows: (i) clinical study on RCTx; (ii) stratified analysis of primary and secondary RCTx available; (iii) sample size given and larger than 10; (iv) at least 6-month postoperative review; (v) success based on survival of tooth; and (vi) proportion of teeth surviving after treatment. Three strands of evidence or analyses were used to triangulate a consensus view. The reported findings were excluded for quantitative analysis, were utilised for the intuitive synthesis, which constituted the first strand of evidence. Secondly, the pooled weighted proportion of teeth surviving and thirdly the combined effects of potential prognostic factors were

estimated using the fixed and random effects meta-analyses on studies fulfilling all the inclusion criteria.

Of the 31 articles identified, 14 studies published between 1993 and 2007 were included. The majority of studies were retrospective (n = 10) and only four prospective. The pooled percentages of reported tooth survival over 2-3, 4-5 and 8-10 years following RCTx were 86%, 93% and 87% respectively. Substantial differences in study characteristics were found to hinder effective direct comparison of findings. Evidence for the effect of prognostic factors on tooth survival was weak. Based on the data available for meta-analyses, four conditions were found to significantly improve tooth survival. In descending order of influence, the conditions increasing observed proportion of survival were as follows: (i) a crown restoration after RCTx; (ii) tooth having both mesial and distal proximal contacts; (iii) tooth not functioning as an abutment for removable or fixed prosthesis; and (iv) tooth type or specifically non-molar teeth. Statistical heterogeneity was substantial in some cases but its source could not be investigated because of insufficient available information. The pooled proportion of teeth surviving over 2-10 years following RCTx ranged between 86% and 93%.

Front Cover Product

Ready-to-use root canal sealer



a standard 2-tube pack. The sealer has excellent, well-proven properties. It is biocompatible and is characterised by optimal viscosity as well as ideal radiopacity. It is ideal for use with both cold and warm obturation techniques.

Now this classic product has been made more convenient for the user: it is also offered as 2Seal easymiX in a convenient double-chamber mixing syringe with exchangeable, flexible intra oral tips. The syringe significantly improves handling and the precision of mixing of both components. The ideal ratio

2Seal, a tried and tested epoxy-amine based root canal sealer, has been available for many years in

ensures that mixing is always optimum, and the sealer can then be applied directly into the root canal, leaving no mess or waste. This is a clear advantage in daily practice. The sealer fulfils all criteria cited in the Quality Guidelines of the European Society of Endodontology. Furthermore, epoxy resin sealers have been examined in more than 90 studies and have proven reliable in clinical application. 2Seal easymiX is available as a starter kit with one double-chamber syringe, 20 mixing tips with intra oral tips, a mixing block and a convenient organiser. The mixing syringes are also available in a double-pack. Mixing tips with intra oral tips come in refills of 40.

VDW GmbH
Munich, Germany

More info...

www.worlddental-online.com & search 100166

Light activated bone regeneration



Light treatment technology can harness and accelerate the natural regenerative ability of osteoblasts and other cells involved in osseointegration. This process involves the direct structural and functional connection between living bone and the surface of a load-bearing artificial implant, typically made of titanium. It is a property virtually unique to titanium and hydroxylapatite, and has enhanced the science of dental implant techniques.

The OsseoPulse low profile headset to deliver light treatment is comfortable, lightweight, has a soft nose and earpieces for individual comfort and delivers energy directly to the wound to accelerate early healing and bone regeneration. The flexible headset and array positioning fits a range of patients and supports up to four arrays for complex treatment plans. The headset is uniquely designed for implant patients. Flexible positioning of the treatment array can occur anywhere on the mouth. As the bone regeneration system does not cover the mouth or eyes, it allows normal functioning for the patient.

The device is adjustable not only to accommodate the patient but also to take into account the complexity of treatment. Easy to position through the manipulation of only three screws, the device supports two arrays for simultaneous treatment of two surgical sites. The simple, intuitive user interface allows the dentist to select the protocol and programme treatment plan. Patients can operate the machine through the use of only one button and are provided with a countdown time for treatment sessions.

Biolux Research
Vancouver, Canada

More info... worlddental-online.com
& search 100053



The four factors listed above were identified as significant prognostic factors with concurrence between all three strands of evidence.

Ng YL, Mann V, Gulabivala K.
Int Endod J. 2010 Mar;43(3):171-89.

ORAL AND MAXILLO FACIAL SURGERY

THE INTERNATIONAL JOURNAL OF ORAL & MAXILLOFACIAL IMPLANTS

Implant-retained nasal prosthesis for reconstruction of large rhinectomy defects: the Salisbury experience.

The authors of this paper report their experience with 34 patients who had large full thickness nasal defects reconstructed with an implant-retained prosthesis. Their technique of modifying post-rhinectomy defects is described and factors influencing implant success are evaluated. 111 implants were placed to retain a nasal prosthesis. Age, sex and tumour histology did not affect the outcome. Smoking, extent of rhinectomy, use of radiotherapy (pre- and post-implant), hyperbaric oxygen, length and location of the implant and type of retention (bar/magnets) influenced implant success. The overall success rate was 89% (99/111), 94% in patients who did not receive radiotherapy and 86% in those who did. The prosthesis was in place in all patients (100%) at the time of last follow up. Post-rhinectomy defect modification enables adequate access for safe placement of long implants with good primary stability and helps the maintenance of good hygiene (further enhanced by the use of skin grafts). The authors think implant-retained prosthesis is a reliable option for reconstructing large full thickness rhinectomy defects. They suggest that their technique of modifying the defect, use of long implants and magnets for retention is responsible for the high success rate of implants used to retain a nasal prosthesis.

Ethunandan M, Downie I, Flood T.
Int J Oral Maxillofac Surg. 2010 Feb 8.

Nasal suction technique for maxillary sinus floor elevation: a report of 24 consecutive patients.

Purpose: Inadvertent perforation of the sinus membrane is a frequent complication encountered during sinus floor elevation (SFE). Different strategies have been described for the prevention or treatment of perforations, with varying results. This paper reports the findings of a preliminary study into the application of a novel nasal suction technique in which negative antral air pressure was used to facilitate the raising of the sinus lining and to reduce the risk of perforations occurring during SFE. Materials and Methods: In 24 consecutive patients, nasal suction was applied through the ipsilateral nostril during SFE. The suction device was attached to a high-flow vacuum regulator that incorporated a suction canister connected to a -10-kPa medical vacuum (-75 mm Hg). Fifteen subjects received unilateral SFE, and six subjects had bilateral staged lateral wall sinus elevation; the remaining three subjects had osteotome sinus floor elevation (three unilateral and one bilateral) with simultaneous implant placement. Results: During SFE, the use of nasal suction facilitated the inversion of the sinus lining around the edges of the lateral access window. This made the sinus lifting easier, as the need for extensive instrumentation was significantly reduced. In three subjects, elevation of the sinus lining occurred spontaneously from the lateral, medial, and inferior surfaces of the antrum when nasal suction was applied. Conclusion: Sinus lifting was facilitated by nasal suction. No perforation of the sinus lining occurred in this series. Controlled clinical trials are being designed to further demonstrate the clinical efficacy of the nasal suction technique in SFE.

Ucer C.
Int J Oral Maxillofac Implants. 2009 Nov-Dec; 24(6) 1138-43.

PAEDIATRIC DENTISTRY

INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY

A comparison of inhalation sedation agents in the management of children receiving dental treatment: a randomised, controlled, cross-over pilot trial.

This study compared the relative effectiveness of inhalation sedation using (A) nitrous oxide and oxygen with (B) nitrous oxide, sevoflurane, and oxygen in the management of children receiving dental extractions. It also aimed to determine patient and guardian preference between the two sedation techniques. A randomised, controlled, double-blinded, cross-over, pilot clinical trial was undertaken. Thirty patients aged 6-15 years, ASA category I or II, who required two identical dental extractions with inhalation sedation were recruited. At the first session, patients were randomly allocated to receive treatment with sedation Method A or B. At the second session, the alternative sedation protocol was employed. Overall, 80% of patients successfully completed treatment at both appointments. There was no statistically significant difference between either the success rate of the two methods or in guardian preference between the two modes of sedation. There was a statistically significant difference in patient preference in favour of Method B. The results from this pilot study would suggest no increased benefit, in terms of treatment completion, from the additional use of sevoflurane in combination with nitrous oxide and oxygen. There was, however, a small but significant patient preference in favour of nitrous oxide with sevoflurane and oxygen.

Soldani F et al.
Int J Paediatr Dent. 2010 Jan; 20(1): 65-75.

Evaluation of mandibular infiltration versus mandibular block anaesthesia in treating primary canines in children.

The objectives of this study were to determine the effectiveness of mandibular infiltration compared with mandibular block in treating

primary canines in children and to relate the effectiveness to the type of treatment performed. A total of 89 children, 6-9 years old, requiring identical treatment on contralateral mandibular canines were selected. The split mouth study design was used. The anaesthetic used in both techniques was 2% lidocaine solution with 1: 80,000 epinephrine. Dental procedures included class III, IV, and V restorations, formocresol pulpotomies, and extractions. The child's pain reaction and behaviour for each anaesthesia technique and the type of treatment were rated at certain intervals of treatment using sounds, motor, and ocular changes indicating pain and the Frankl Behaviour Rating Scale. Evaluations were made upon injection, probing, rubber dam placement, and during tooth preparation and extraction. No statistically significant difference was found between the two anaesthetic techniques for either pain or behaviour at all evaluation intervals ($P > 0.05$), during the performance of restorations, pulpotomies, or during extractions. Mandibular infiltration anaesthesia is as effective as mandibular block for restoration, pulpotomy, and extraction in primary canines. The mandibular infiltration anaesthesia was not significantly less painful than the mandibular block.

Yassen GH.

Int J Paediatr Dent. 2010 Jan; 20(1): 43-9.

EUROPEAN JOURNAL OF
**PAEDIATRIC
DENTISTRY**

Clinical report on plaque formation, distribution and maturation within the primary, mixed and permanent dentitions.

This report describes the formation distribution and maturation of dental plaque within the primary, mixed and permanent dentitions. Eight caries-free volunteers who were 4-6 years of age participated in the study. The children received prophylaxis and refrained from toothbrushing for 48 hours. The occurrence and distribution of plaque in the primary dentition were assessed. One

child continued the experiment from the age of 6 to 15. The recording of plaque was made and pictures were taken. In the primary dentition, 704 surfaces were assessed. A significant difference between plaque on the buccal and other surfaces was recorded ($p < 0.001$). In the mixed and permanent dentition, plaque scores of 128 surfaces were recorded. Plaque scores of partially erupted posterior teeth and posterior teeth in full occlusion differed significantly with limited accumulation of occlusal plaque in the latter. The report highlights that the most critical period for plaque accumulation is the time from tooth emergence to full occlusion, when the tooth has a reduced participation in the mechanical oral function. As caries is a plaque induced disease, the potential to caries development in children during tooth eruption is consequently high.

Carvalho JC, Figueiredo CS, Mestrinho HD.

Eur J Paediatr Dent. 2009 Dec; 10(4): 193-9.

Clinical evaluation of temporomandibular disorders in children and adolescents: a review of the literature.

The abbreviation TMD (temporomandibular disorders) has been used to signify the variety of symptoms, signs and combinations that have often been assigned to the TMJ (temporomandibular joint) and its related structures (muscles, bone and facial structures). The prevalence of temporomandibular disorders in children and adolescents varies widely. The most common signs and symptoms of TMD are: temporomandibular joint sounds, impaired movement of the mandible, limitation in mouth opening, preauricular pain, facial pain, headaches and jaw tenderness on function. Many studies have shortcomings in their method of assessing or measuring TMD: the problem is probably due to the fact that temporomandibular disorders have multiple aetiological factors. This article reviews the literature concerning the diagnostic procedures used to assess signs and symptoms of temporomandibular

disorders in children and adolescents. The literature was searched using Medline, Embase, and Cochrane Library from 1992 to February 2008. Only articles written in English were included in the study. The key words and mesh used were: temporomandibular disorders, mandibular dysfunction, children, adolescents. The inclusion criteria were: symptoms and signs of TMD, questionnaire, clinical protocol examination. Clinical studies as well as cross-sectional studies, longitudinal and epidemiological research were considered. The articles reviewed were grouped according to the diagnostic procedure used. Out of the 37 articles selected, the Helkimo Clinical Dysfunction Index was used in 6 studies (16.22%), the CMI Index in 1 (2.70%), the RCD/TMD in 9 (24.33%) and a clinical protocol examination in 21 (56.75%) articles. This review of the literature showed that clinical examination protocols without reproducible items and a measurable and reproducible classification into diagnostic subgroups were the types of investigation used in most of the cases. This gave a multitude of different results depending on the criteria used and the method of data collection. Such methodological problems should be acknowledged in studies relating to TMD in order to obtain a reliable diagnostic procedure.

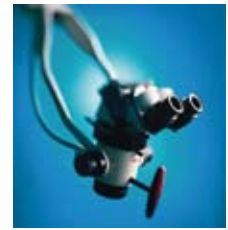
Toscano P, Defabianis P. Eur J Paediatr Dent. 2009 Dec; 10(4): 188-92.

Multidisciplinary management of Blepharo-Cheilo-Dontic Syndrome and the role of overdenture in dental management.

Blepharo-Cheilo-Dontic (BCD) syndrome is a rare condition characterised by abnormalities of the eyelid, lip and teeth. A 12-year-old girl with BCD syndrome presented following referral from the multidisciplinary cleft lip and palate clinic. She had skeletal Class III relation, with left posterior cross bite, occlusal contacts on the second permanent molars with poor oral hygiene. The permanent units missing were 15, 14, 13, 12, 11, 21, 22, 25,

Product news

Dental microscope system



Ideal for facilitating dental microsurgery, the key features of the Leica M300 Dental system include clear, bright images, an impressive 3D effect and an exceptionally-large depth of field. With different working distances of objectives and the various binocular tubes, the user can achieve a good ergonomic working position that can be adjusted quickly and simply to body measurements. The microscope is low in weight, high in comfort and extremely mobile. The modular design of the microscope allows the user to tailor it to specific requirements. For example an ultra-light video camera can be added to record daily work.

Leica Microsystems GmbH
Wetzlar, Germany

More info...worlddental-online.com & search 100174

Polarised daylight lighting



The Halo luminaire emits a quality of light virtually identical to that of natural daylight, for use in the office and in the surgery. Using a circular Actulite polarising panel, downlight is controlled and all glare is removed from emitted light, eliminating harmful ultra violet rays and disturbing reflections. The peripheral diffuser around the circumference of the luminaire not only gives effective side lighting but adds to the aesthetic value. Two different-sized models are available with diameters of 640 mm and 355 mm. A steel tray containing high frequency control gear and tubes for ceiling mounting or suspending on stainless steel cables is provided. The Actulite Halo is available in emergency format or with high frequency dimming.

Aura Corporation Ltd.
Wolverhampton, UK

More info...worlddental-online.com & search 100165

Sonic tips for controlled and efficient oral surgery



Designed in close collaboration with Dr. I Agabiti, brand new surgical sonic tips (SFS) have been developed for use during treatments carried out using Sonosurgery.

What makes these innovative tips so special is that they use the drive of the dental air turbine; the oscillating movement of the "sonic" hand piece is thus generated by air pressure. This elliptical, three-dimensional movement allows excellent substance removal and consequently results in high efficiency. The advantages of Sonosurgery are that the sonic tips produce very fine cuts to allow maximum conversion of dental substance; in addition, they only cut on hard substances, thus conserving the soft tissue and allowing an unobstructed view of the operative site.

Possible applications include the gentle removal of the periodontal ligament of a tooth in its alveolar compartment from all sides within the course of an extraction, root separation in case of an extraction of a tooth with more than one root, apicectomies, splitting of the crest and lateral incisions in the bone as part of a bone spreading treatment, sinus elevation and the creation of a sinus window. All in all, the sonic tips provide the optimum preconditions for controlled, efficient and economic work in oral surgery.



Komet/Gebr. Brasseler GmbH & Co. KG
Lemgo, Germany

in the upper arch and 35, 34, 32, 44 and 45 in the lower arch. This patient presented a complex aesthetic problem, which through multi-disciplinary care resulted in a satisfactory aesthetic outcome. In this case report the clinical management and the role of the overdenture in her dental management is presented.

Adeboye SO, Cole BO, Jepson NJ, Hodgkinson PD. *Eur J Paediatr Dent.* 2009 Dec; 10(4): 201-4.

DENTAL PUBLIC HEALTH



The erosive potential of lollipops.

The erosive potential of lollipops was determined *in vitro* by measuring the pH and neutralisable acidity. Subsequently, 10 healthy volunteers tested different types of lollipops. Whole saliva was collected 5 minutes before, 15 minutes during and 10 minutes after consumption. Salivary flow rate and pH were determined. It was found that fruit flavoured and cola flavoured lollipops have a very low pH (2.3 - 2.4). Yogurt-containing and salmiak (salty liquorice) flavoured lollipops have much higher pH values (3.8-4.7). The neutralisable acidity of 1g of lollipop showed a large variation from < 200 microl to > 1700 microl 0.1 M NaOH. *In vivo*, lollipops induced 2.5 to 4.7-fold increase in salivary flow rate with a concomitant drop in salivary pH. For fruit-flavoured and cola-flavoured lollipops the salivary pH dropped below pH 5.5. For strawberry yogurt and salmiak lollipops, the salivary pH remained above this critical value. The volunteers did not report significant differences in preferences for the lollipops. Lollipops differ considerable in erosive potential, with fruit flavoured and cola flavoured lollipops having the highest risk for inducing dental erosion. This information is of use for clinicians counselling juvenile patients with dental erosion.
Brand HS, Gambon DL, Paap A, Bulthuis MS, Veerman EC,

Amerongen Av. Int Dent J 2009 Dec; 59(6): 358-62

DENTAL IMAGING



Evaluation of nonsyndromic multiple supernumerary teeth using three-dimensional computerized tomography: a case report and literature review.

Multiple supernumerary teeth without any associated syndromes are very rare. This report describes a case of nonsyndromic multiple supernumerary teeth and a discussion of the value of three-dimensional computerised tomography (3D CT) for precise radiographic imaging of the anomaly. Exact radiographic presentations with an associated diagnosis of nonsyndromic multiple supernumerary teeth have not been published. A young, 15 year old Chinese female patient presented with asymmetrical nonsyndromic multiple supernumerary teeth in the premolar and molar regions of her mouth. A 3D CT was used to evaluate the exact location and orientation of these teeth and to guide the treatment strategy. The use of 3D CT for the evaluation of supernumerary teeth proved to be very useful in determining their size, location, and state of development, as well as their impact on adjacent teeth and tissues. The 3D CT is a very useful radiological tool to assess nonsyndromic multiple supernumerary teeth.

Wang WM, Wang X, Wang TM. *J Contemp Dent Pract.* 2010 Jan 1; 11(1): E081-7.

A comparison of panoramic image quality between a digital radiography storage phosphor system and a film-based system.

This study compared digital panoramic images acquired for the pre-surgical assessment of third molars captured with a storage phosphor-based system with conventional film

panoramic radiographs. A total of 51 pairs of digital and conventional panoramic images, made simultaneously, were included in the study. The images were evaluated for diagnostic quality prior to third molar surgery by two experienced oral surgeons and rated with a four-point grading scale. Despite the fact that conventional panoramic images were rated higher than the digital images, the difference was not statistically significant: conventional and digital panoramic images were found to be of comparable image quality with regard to their diagnostic contribution to third molar surgery. However this study contributes to the understanding of the differences in image quality between digital and conventional panoramic radiography for certain diagnostic tasks. The lack of significant differences in image quality may be an endorsement for digital panoramic radiography.

Parissis N et al. *J Contemp Dent Pract.* 2010 Jan 1; 11(1): E009-16.

A new concept in restorative dentistry: LIFEDT-light-induced fluorescence evaluator for diagnosis and treatment: treatment of dental caries.

In vivo experiments compared and analysed the variations in brightness of sound dentine and active and arrested carious dentine illuminated with an intraoral LED camera to determine if this new device could be helpful in daily practice to discriminate between caries and sound dentine. Within the limitations of this *in vivo* study, the images created with the intraoral LED camera revealed significant variations in fluorescence between sound dentine and active and arrested caries processes. This concept defines a pragmatic clinical and therapeutic approach for treating active and arrested carious lesions based on the interpretation of variations of a fluorescence signal and applying the LIFEDT concept to the treatment of dentine carious lesions.

Terrer E et al. *J Contemp Dent Pract.* 2010 Jan 1; 11(1): E095-102.

Daily use of an ergonomic dental treatment unit

In this article the author describes her practical experience of testing the new ESTETICA E70 treatment unit from KaVo.

In our dental practice at Ulm, Germany, we have been testing and using the new ESTETICA E70 treatment unit since October 2008, with the conclusion that the new unit is highly useful.

The new system is precisely tailored to the everyday needs of a dental office. Frequently required functions can be reliably and intuitively controlled using direct keys. We found the suspended chair particularly useful since, compared to conventional units, it allows the dentist to get much closer to the patient during treatment. This approach is much more ergonomic; we have found that it reduces body fatigue during extended treatment sessions. We have also been using the new KaVo wireless foot control with the E70 and have found it highly convenient for routine work. The foot control can be placed anywhere since there are no annoying cables: there is no restriction due to finite cable length, assistants are never in the dentist's way and there are no cables lying around over which members of the dental team could trip. It is also handy that the foot control only needs to be charged once every three months.

The integrated endodontic function has saved an enormous amount of time and effort. The ergonomics and workflow are significantly better than with stand-alone devices, since these latter always have to be placed alongside the dental unit, and they are always somewhat difficult to access. In addition, there

is no need to switch back and forth between different foot controls, as the two devices are completely and seamlessly integrated.

The ability to integrate multimedia systems is also particularly attractive. The E70 allows display systems to be integrated into the workflow and makes them accessible to patients: a video interface can be incorporated for a surgery microscope, intraoral camera, digital x-rays, pictures from a digital camera, etc.

The automated, standardised hygiene functions of the E70 significantly reduce potential sources of errors. A consistently high standard of hygiene can be ensured during a normal working day, in which chair hygiene is frequently the responsibility of different employees. Since the hygiene guidelines

for dental practices are becoming increasingly strict, this simplifies the workflow and saves a great deal of time.

The E70 leaves both the dentist and patient with an equally favorable impression. The chair is very stable, even when heavy patients shift their position mid-treatment. The materials from which the treatment centre is manufactured are expertly processed, and the surface quality of the unit is outstanding. Overall, patient feedback has been highly positive.

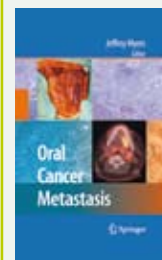
Dr S. Spiller
Ulm, Germany

KaVo Dental GmbH
Biberach, Germany

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BOOK REVIEW

Oral cancer metastasis
Ed. by Jeffrey Myers
Pub. by Springer 2010;
346 pp, 149,95 €



Squamous cell carcinoma of the oral cavity (SCCOC) is one of the most prevalent tumours of the head and neck region. Despite

improvements in treatment, the survival of patients with SCCOC has not significantly improved over the past several decades. Most frequently, treatment failure takes the form of local and regional recurrences, but as disease control in these areas improves, SCCOC treatment failures more commonly occur as distant metastasis. This book summarises the current status of investigations into SCCOC metastases and the potential of these studies to positively impact clinical management of SCCOC in the future.

Springer
Secaucus, NJ, USA

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Front Cover Product

Instrument for piezoelectric surgery



instrumentation. The use of ultrasound for dental surgery has clear advantages. Intrasurgery Plus, an instrument for

First used by oral and maxillofacial surgeons for osteotomies, piezoelectric surgery is a minimally invasive technique that lessens the risk of damage to surrounding soft tissues and important structures such as nerves, vessels and mucosa. It also allows the maximum level of precision to be reached, overcoming the limits imposed by traditional

piezoelectric bone surgery, allows osteotomy and osteoplasty to be carried out in extremely delicate situations. Thanks to the ultrasonic vibration and electronic control, the instrument allows cuts to be made efficiently, precisely and safely, without injuring the soft tissue and causing necrosis because of high temperatures. A large range of tips is included with the instrument, e.g., a sharp tip that allows micrometric cuts. Maximum visibility is provided during operations, thanks to the flow of physiological liquid and the cavitation effect.

Carlo de Giorgi s.r.l.
Baranzate, Italy

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A dental hygienist in USA talks about her job 'I favour a conservative treatment plan'

Since the first dental hygiene school was set up in a garage in Bridgeport, Connecticut, USA by dentist Alfred Fones in 1913, the profession of dental hygienist has become ubiquitous in the USA. A passionate ambassador of the profession of dental hygienist is Cindy Weimer Bradtmueller of Indiana.



Across the world, the dentist reigns supreme in the dental office. However, good dental care can only be provided and achieved if the dentist is flanked by his or her dental team. Often the dentist's 'right hand man' is the dental hygienist, and in the United States of America — the land of the 'American smile' — the two roles have worked in complement for a century.

Dr Alfred Fones of Bridgeport, Connecticut originally trained his chairside assistant (also cousin) Irene to clean teeth and perform preventive treatment on children, which later led Dr Fones to start the world's first dental hygiene school. In 1923 the American Dental Hygienists' Association (ADHA) was formed 'to develop communication and mutual cooperation between hygienists', and today represents the interests of more than 150,000 American dental hygienists. Over 250 accredited dental hygiene programmes are run across the United States, and the profession of dental hygienist is highly respected, with competition for course places and top grades required from entrants. Indeed, the role of dental hygienist is so common that you are

almost as likely to hear an American refer to a dental hygiene appointment as to a traditional dental appointment.

Fifty-four-year-old Cindy Weimer Bradtmueller of Fort Wayne, Indiana has been a dental hygienist for over 25 years. For the last two and a half years she has worked in a small private dental practice near the city of Fort Wayne.

Besides the dentist, the well established practice consists of one other dental hygienist, a dental assistant and a receptionist, each of whom have worked there for over 17 years.

Bradtmueller originally aspired to becoming a medical nurse, but turned to dental hygiene when she realised, at quite a young age, that she would rather 'work around

mouths' than deal with the more intimate patient care required in a medical environment.

Having positive childhood experiences of attending the dentist also encouraged Bradtmueller to opt for dentistry as her field of choice in the early 1980s. After initially dropping out of college to marry, she tried her hand at working as a waitress, in a factory, at an amusement park and as a nursing assistant before taking a job as a dental receptionist. It was then that she decided to go back to school to train as a dental hygienist.

"Being married, I was a non-traditional student" says Bradtmueller. "I was actually the first hygiene student at our school to have a baby whilst taking this course". The first of her two sons was born before her final year of dental hygiene school, and Bradtmueller has worked part-time as a dental hygienist ever since, which has allowed her to balance work and family life.

Bradtmueller studied at the Indiana University - Purdue University Fort



Cindy Weimer Bradtmueller spends a lot of time scaling and polishing, root planing and applying fluoride.

Four new image formats for cone beam CT system



J. Morita has enhanced the capability of the 3D Accuitomo, a cone beam Computed Tomography system specially designed for the Dento-Maxillo-Facial area. The 170 version offers an additional four image sizes. Consistent high image quality is provided across the whole range. A voxel size of 80 μm in the largest format allows unsurpassed resolution. The large field of view (FOV) is suitable for the precise diagnosis of the whole head region. Enhanced image dynamics enable greater precision for the visualisation of hard and soft tissue. The built-in flat panel detector (FPD) technology provides a 14-bit greyscale and creates a balanced distribution of the contrasts.

The 3D Accuitomo can be used for many different dental applications, including implant therapy, apical lesions, impactions, endodontics, restorative dentistry and surgery. The practitioner can choose between imaging regions without having to forego consistent high-resolution. Patient radiation dosage remains low. The zoom-reconstruction function is also a feature of the 170 version. This "magnifying lens" allows an 80 x 80 image with a voxel size of 160 μm to produce sharp and detailed views of the regions of interest with a voxel size of 80 μm . This eliminates the need to make secondary detailed images which could expose patients to X-rays unnecessarily.

J. Morita Europe GmbH
Dietzenbach, Germany

More info... worlddental-online.com
& search 100163



Wayne (IPFW). To qualify for the course she needed a good grade point average (GPA) and mostly 'A' grades due to the strong competition to gain a place on the dental hygiene programme.

'In the USA entry onto dental hygiene programmes varies from state to state,' explains Bradtmueller. In some states you can be accepted onto a dental hygiene programme from high school and in others you need to have completed a pre-hygiene university level course. The length of the programme may be three or four years; in Bradtmueller's state of Indiana it is three and a hygiene candidate will successfully pass courses in chemistry, biology, physiology, English, speech, microbiology, sociology, psychology, anatomy, pharmacology, immunology, radiology and dental materials.

Of course, all roles in dentistry go beyond academic study: 'My grades were good but I also have good hand dexterity and good people skills,' says Bradtmueller. 'I genuinely care about my patients.'

To complete her three year dental hygiene course, Bradtmueller sat a national written examination and a state practical examination in June 1983, qualifying as a Registered Dental Hygienist (RDH). In other states in the US this is known as a Licensed Dental Hygienist (LDH). The exams test candidates' clinical dental hygiene skills as well as their knowledge of dental hygiene and related subjects, before they are granted the licence to provide dental hygiene care and patient education in a dental office.

Bradtmueller's daily duties include preventive teeth cleaning such as removing calculus and plaque from all surfaces of the teeth; taking and developing dental radiographs; applying fluorides (but not sealants at her particular practice, although other dental hygienists do); teaching patients how to brush and floss their teeth effectively and educating them on nutrition; and record keeping. She spends the majority of her time scaling and polishing, root planing and applying fluoride.

'The most important dental hygiene message I give patients is how to daily, thoroughly, remove plaque,' says Bradtmueller. 'Getting along with grumpy, grouchy people can be a challenge, but I aim to motivate the unmotivated!'

In the US, as with many other countries, the dentist, or 'DDS' as Bradtmueller refers to him, directs the treatment plan; but in Bradtmueller's experience:

'The dental hygienist usually determines the treatment and the DDS confers. I have worked in several dental offices where the DDS recommended an extensive perio treatment plan for hundreds of dollars. I disagreed as I thought that so much treatment was not necessary. I'm most comfortable when the DDS allows me to use my own judgement. I prefer to begin with a conservative dental treatment plan and get more aggressive if my original plan doesn't work. My favourite bosses have supported this plan.'

Bradtmueller is particularly proud of the independence her job allows her and says that most of her bosses have respected her opinion and let her make her own treatment plans. 'Doing my job well and seeing improvement in my patients is what I enjoy the most about being a dental hygienist,' she says.

In some US states dental hygienists can work in a private practice without the dentist being present, and Bradtmueller adds that it is even possible for hygienists to have their own businesses in some states. However, in Indiana a hygienist can only work with the dentist present in the same practice. 'If the DDS is ill or on vacation we can't work and often don't get paid. Dental hygienists in Indiana have been trying to pass a law to allow us to work without the dentist/employer present for over 25 years.' In addition, Indiana hygienists would like to be able to administer local anaesthetic to patients, another duty permitted to dental hygienists in other states. Although there are limitations to

her role, aside from clinical work Bradtmueller has been involved with dental health education, giving presentations at schools, nursing homes and at a 'crisis pregnancy clinic', as well as nutrition counselling. Bradtmueller is clearly confident in her diverse abilities and feels assured that in her country, dental hygienists are given the respect they deserve by other dental professionals and by patients. The impression that might be perceived by the public in some countries that dental hygienists 'just clean teeth' is refreshingly absent.

Bradtmueller has not been idle in keeping her skills up to date in the years since she qualified. Fourteen hours of mandatory continuing education (CE) must be completed by dental hygienists in Indiana every two years, including two hours of CPR and two hours of ethics, to maintain their qualification and keep their licence. Bradtmueller has also completed a one week course in periodontal therapy.

Although her sons are now fully grown, like many other dental hygienists Bradtmueller still works part-time so her working hours allow her to spend plenty of time with her dogs, with her family, to cook and read and host exchange students. 'Working part-time has always let me have a great balance in my life,' says Bradtmueller, although she looks forward to a retirement full of international travel in the not-too-distant future.

The future for the dental hygienist across the Western world looks very promising. In the twenty-first century preventive dentistry continues to gain momentum, reducing the incidence of oral disease. As people retain their natural teeth for longer, maintaining optimal dental hygiene and dental care becomes increasingly important. The expanding, dentate older population, as well as the oral health needs of children threatened by modern sugary diets, will ensure that the range of skilled services provided by the dental hygienist stays in very high demand.

Biocompatibility of dental materials by Gottfried Schmalz and Dorte Arenholt-Bindslev Published by Springer 2009; 380 pp, 149,95 €



This updated and revised English-language edition of the original 2004 German version, provides the scientific basis for a matter-of-fact discussion of the safety of dental materials. It gives a comprehensive and scientifically based overview of the biocompatibility of dental materials. Up-to-date concepts of biocompatibility assessment are presented, as well as information on almost all material groups used in daily dentistry practice. Furthermore, special topics of clinical relevance (e.g. environmental and occupational hazards and the diagnosis of adverse effects) are covered. The book will improve the reader's ability to critically analyse information provided by manufacturers, provide a better understanding of the biocompatibility of single material groups, and will thus help the reader choose the most appropriate materials for any given patient and so prevent the development of adverse effects. Insights are provided on how to conduct objective, matter-of-fact discussions with patients about the materials to be used in dental procedures. Advice is given, through the use of well-documented concepts, on how to treat patients who claim adverse effects from dental materials. The book also includes a wide range of clinical

photographs that will serve as a reference when analysing clinical symptoms, such as oral mucosa reactions.

Springer
Secaucus, NJ, USA

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