Australia regulates distribution of tooth-whitening products

Daniel Zimmermann
DTI

CANBERRA, Australia: From May 2013, tooth-whitening products with high concentrations of active ingredients may only be sold to customers by registered dental practitioners as part of their dental practice in Australia. Over-the-counter sales of these products will be limited to products containing 6 % or less hydrogen peroxide and for 18 % or less carbamide peroxide, a new amendment to the country’s Poisons Standard states.

These regulatory changes by the government are the result of a recent proposal by the Australian Dental Industry Association that the decision to supply patients with higher-strength tooth-whitening products rest with dentists. Prior to that, the Australian Dental Association (ADA) and the Australian Competition and Consumer Commission had repeatedly called on the government to restrict direct sales of these products in retail stores and online owing to a number of recalls of DIY tooth-whitening products believed to be unsafe for home use in the past.

“This is a sensible decision that enables appropriate patient access to tooth-whitening products and puts in place appropriate measures to ensure patient safety,” said Troy Williams, Chief Executive Officer of the ADA. “It ends the confusion that has existed over which tooth-whitening products may be sold in Australia.” Dentists too have praised the new regulation as a step towards better patient safety.

Up until now, the market for tooth-whitening products in Australia has been largely unregulated, with plenty of DIY products containing high levels of hydrogen and carbamide peroxide being launched onto the market, according to industry experts. As part of an increasing demand for cosmetic procedures, the market for tooth whitening has seen a boom in recent years, with more than 700 tooth-whitening salons available.

Better outlook for consumables market

A new report from the US has predicted the worldwide market for oral care products & dental consumables to exceed US$17.46 billion by 2016, a volume comparable to the current gross domestic product of the Nation of Brunei. The report published by MarketsandMarkets included products such as biomaterials, protheses, endodontic, orthodontic and periodontic products, as well as restoratives, alloys, cements, bonding agents, impression materials, prevention, disposables, and other products.

The new figures significantly differ from earlier predictions that estimated the market value to reach only US$14–15 billion in the same period. The reasons for this increase are the rising awareness in developing nations about oral hygiene as well as new product developments in the consumables sector, the report states. Higher income levels and insurance coverage in emerging markets like India and China are also expected to contribute significantly to the growth of the market.

Positive effects confirmed

Researchers from the University of Adelaide’s School of Dentistry have found new evidence that fluoride in drinking water is effective in preventing tooth decay.

In the largest population-based study to date using data obtained from the 2004–2006 Australian National Survey of Adult Oral Health, they found that the substance provides dental health benefits to adults, particularly those who have been exposed to fluoride for most of their lives.

Among other findings, they reported that adults who were exposed to fluoridated water for more than 75 per cent of their life had 50 per cent less tooth decay than those exposed for less than 25 per cent of lifetime.

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Biomet 3i and Sirona collaborate

According to the companies, the collaboration will provide dentists with simplified aesthetic restoration solutions by allowing the combined utilization of Biodent 3i’s patented BellaTek Encode Impression System and Sirona’s CEREC intraoral scanner to create intraoral impressions for custom abutments.

Diet shift affected oral health

A new study of human teeth over the last 7,500 years has revealed that oral bacteria diversity dropped markedly with the introduction of farming and manufactured food. This shift in diet is believed to have contributed significantly to the development of chronic oral diseases in post-industrial lifestyles.
“Priorities regarding dental care have changed”
An interview with Donna Batchelor, President of the Canterbury Branch of the New Zealand Dental Association

In the second-largest earthquake New Zealand has ever seen, the Canterbury region and its capital Christchurch suffered widespread devastation in early 2011. Two years later, dentists in the region are reporting an increase in stress-related symptoms like bruxism among dental patients. DT Asia Pacific spoke with Donna Batchelor, President of the Canterbury Branch of the New Zealand Dental Association, about the phenomenon, as well as the impact of the disaster on the region’s dental health care infrastructure.

DT Asia Pacific: In a recent interview, you said that some of your members in the region are reporting stress-related symptoms like teeth grinding that could be a result of the February 2011 earthquake. What is the extent of the problem, and how have your members reacted to the situation?
Dr Batchelor: Although there have been no studies to monitor stress-related symptoms like bruxism, among patients, inter-collegial discussions among members of the profession indicate that dentists are seeing more patients with problems of this nature and dealing with them according to their usual practice protocols.

Some have also reported consulting with medical practitioners more than usual concerning patients with stress-related issues.

The Christchurch earthquake of 2011 was the second worst in your country’s history. What is the situation in the region currently?
Dr Batchelor: Since the earthquake, we have had over 11,000 aftershocks. Unfortunately, there is slow progress with rebuilding and fixing damaged roads and sewers, as well as replacing lost facilities and public amenities. Dealing with insurance companies has also proven difficult for many families and businesses. However, New Zealanders have a get-on-with-it attitude to life and tend to put up with the situation rather than complaining. Many people are finding the long process difficult and stressful though.

How were your members affected by the disaster?
Dr Batchelor: There were no direct casualties among our dental community, but a significant proportion lost either family homes or business premises.

Dentists have joined other practitioners or have had to purchase buildings in different areas in or outside the city. A very small number have downsized their practices while dealing with homes damaged or ceased practise altogether.

Was there any support from the government?
Dr Batchelor: Initial support provided by the government assisted with paying the wages of staff during the first six weeks after the February 22 quake.

...a significant proportion lost either family homes or business premises.

...but a significant proportion lost either family homes or business premises. Some even lost both. Several dentists assisted with the victim identification process, which was complex and harrowing at times.

For those dentists whose practices were destroyed, under what circumstances are they currently working, and when do you foresee them being able to return to normal working conditions?
DENTAL TRIBUNE Asia Pacific Edition Asia News 3

Dentists are Singapore’s most sought-after medical specialists

Almost 50% of users on the site scheduled appointments with dentists, while only 18% booked appointments with obstetricians and gynaecologists, who were the second-most requested type of medical specialist. About 6.5% of users requested appointments with general practitioners and 1.3% with ear, nose and throat specialists.

The data was collected via bookings on www.docdoc.com, a health-care platform for finding doctors and booking appointments online in Singapore and South Korea. The website lists about 29,000 profiles of medical professionals in the Asia Pacific region. “This data highlights the huge demand for dental specialist care in Singapore,” said John Sharp, DocDoc’s president and CEO.

“The findings indicate either an undersupply of dentists or an uptick in the demand for cosmetic dentistry, or a combination of both,” he suggested.

Currently, Singapore has a dental workforce of slightly over 1,500 dentists, of which two-thirds are employed in the public sector. The dentist-to-patient ratio in the country is about 1 in 3,400.

What has the impact of the quake been on oral health care infrastructure and oral health behaviour?

The Christchurch Hospital Dental Service’s pre-quake facility was damaged, and they have had to move into a smaller facility for the next five years. Priorities regarding dental care have changed, as families are seeking less treatment as a result of dealing with the loss of their homes, schools, jobs and security.

Canterbury is a predominantly rural region. How did the oral health of people in the area compare with the New Zealand standard before the disaster?

I have to admit that we do not know. Although the dental status in rural and urban areas was examined in the 2009 New Zealand Oral Health Survey, findings from that region were not reported.

Do you have any recommendations for other dentists or dental organisations living in high-risk areas regarding how to prepare for a disaster like this?

All records should be backed up off-site, preferably in another city, as obtaining records for disaster victim identification was very important in the aftermath of the quake. Fresh water supplies, hand sanitisers and emergency kits for various specialties, such as orthodontics, endodontics and maxillofacial surgery, should be stored in significant numbers. The New Zealand Association of Orthodontists, for example, has created a travel kit containing pliers and other equipment.

Replacing equipment and materials was also difficult and protracted after the quake, despite the very best efforts of the suppliers. Therefore, having the tools, materials and equipment to provide basic urgent treatment is important.

Dentists living in high-risk areas should also check the wording of their insurance policies.

Thank you very much for this interview.

DENTSCH

What has the impact of the quake been on oral health care infrastructure and oral health behaviour?

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Mouthwash improves oral health more than toothbrushing alone

CHICAGO, IL, USA: The findings of a new study suggest that using a germ-killing mouthwash in addition to regular toothbrushing provides greater oral health benefits than toothbrushing alone. Study participants who rinsed their mouth twice a day reduced plaque and gingivitis significantly.

The study was conducted among 159 US adults diagnosed with mild to moderate plaque and gingivitis, who were divided into two groups. While members of the first group brushed their teeth and rinsed with a placebo mouthwash, members of the second group used a placebo mouthwash twice a day.

After six months, the researchers observed that participants in the first group had reduced their dental plaque by up to 26.3 per cent.

In addition, the study found that almost 100 per cent of the participants using the antimicrobial mouthwash showed a reduction in gingivitis, compared with only 50 per cent in the placebo group. Overall, members of the antimicrobial mouthwash group had a 20.4 per cent reduction in gingivitis, said Dr Janice Pliszczak, representative of the Academy of General Dentistry.

According to the study’s authors, mouthwash can reach nearly 100 per cent of the mouth’s surface, while toothbrushing affects only 25 per cent. By using a germ-killing mouth rinse twice a day in addition to one’s daily brushing routine, a person can effectively target oral bacteria usually left behind, they concluded.

The study was published in the January/February issue of General Dentistry, the journal of the Academy of General Dentistry.

Head and neck cancer: New system simplifies treatment planning

Yvonne Bachmann

LEIPZIG, Germany: Doctors and computer scientists from Leipzig in Germany have developed a system that makes it easier to plan treatment for head and neck cancer. The multimedia system collates patient data and processes it for use by the treating physicians.

The head and neck cancer mortality rate is high. In Europe, only four out of ten patients survive the first five years after diagnosis.

Researchers at the University of Leipzig are well aware of these figures. “In recent years, we have treated more patients than ever before, yet the chances of survival are still the same,” said Dr Andreas Boehr, chief physician at the Department of Otolaryngology. This observation motivated the development of the new program.

Once a week, the doctors involved in the treatment of patients suffering from head and neck cancer meet for about half an hour and confer about what treatment is appropriate in each case.

“In order to make the right decision, we need to do more than simply look at the patient and say we’ll do this and that,” said Prof. Andreas Dietz, director of the Department of Otolaryngology. “We have to obtain the most accurate diagnosis and offer the optimal treatment. If the first treatment attempt is not successful, the patient could be negatively affected.”

According to Dietz, treatment of head and neck tumours worldwide is not generally interdisciplinary. The doctors in Leipzig however adopt a different approach: ENT-specialists, oncolo-
gists, pathologists, radiologists and surgeons all take part in the weekly tumour board review.

A new software program called Oncoscan, which was developed by ENT doctors and computer scientists from the Innovation Center Computer-Assisted Surgery at the University of Leipzig, simplifies the decision-making process for tumour board reviews significantly. Among other functions, the program processes lab results, test results, medical reports and image data from X-ray, MRI and CT scans. Together with other data, this is combined into 3-D tumour models. The program also calculates the size and extent of the tumour.

Previously, data was stored in various places. Bringing it together in one system provides an overview for tumour board reviews. A special function enables the doctors to vote for the appropriate treatment with a remote vote after the presentation. The aim of voting is not to come to a democratic decision, but to aid decision-making, according to Dietz. Oncoscan not only simplifies treatment planning, but also documents the process of decision-making; thus, the data is stored long term and can be retrieved.

Smile contributes most to first impressions, survey shows

MADISON, Wis., USA: A survey among US adults has revealed that an attractive smile has the greatest impact on a positive first impression at work or in personal relationships. Almost half of the participants rated a person’s smile over what a person says or the way he or she dresses. The study involved a nationally representative sample of 1,018 men and women aged 18 to 49 (45 per cent).

According to the academy, attractive smiles can create a person’s chances of career success. A person’s smile can change the professional and personal life, favourable first impression in information about making a personal relationships. Almost half of the participants rated a person’s smile over what a person says or the way he or she dresses. The study involved a nationally representative sample of 1,018 men and women aged 18 to 49 (45 per cent).

With regard to age, the survey revealed that people aged 50 and older (52 per cent) are more likely to remember a smile when first introduced to another person, compared with those aged 18 to 40 (45 per cent).

In addition, the investigators found that people with crooked or stained teeth are perceived as less attractive by 57 per cent and as less confident by 25 per cent of US citizens. Women in particular (40 per cent) found an imperfect smile less appealing, while only 35 per cent of men reported likewise.

In collaboration with a panel of lifestyle experts, the academy has compiled an e-guide titled “First Impressions in the Digital Age,” which provides useful information about making a favourable first impression in professional and personal life, as well as on social media networks.

The guide can be accessed free on the academy’s website.

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4 World News
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Zimmer acquires P-I, launches new implant system

New functional hybrid dental implants to be available in Latin America and other select markets

Jan M. Agostaro
DT Latin America

SÃO PAULO, Brazil: In 2012, Zimmer Dental—quietly—acquired Exopro, a company founded by the father of modern dental implantology, Prof. Per-Ingvar (P-I) Brånemark. The strategic acquisition of Exopro adds Brazil to the growing list of Zimmer Dental global subsidiaries and offers new opportunities in the burgeoning Latin American region.

According to Dental Tribune Latin America sources, for its P-I brand, Exopro has spent several years researching and developing a unique and cost-effective implant system, which is now ready to be launched and distributed in Latin America and select global markets.

Brånemark first developed and proved his theory of osseointegration in Sweden in the 1950s. Over 60 years have passed since that remarkable discovery changed dentistry forever, improving the lives of millions of people around the world. Now, according to Faíbio Giannini, President of P-I/Exopro, the company is ready to launch its new P-I product line in Brazil and other select global markets where customers require a cost-effective implant solution built on simplicity and ease of use.

With commercial initiatives supported by private equity investment funds, the P-I brand offers knowledge, contemporary science, technology, and, most importantly, a simplified approach to address modern implant dentistry demands.

In 2007, P-I Brånemark jointly with a group led by Giannini established a pilot programme in Brazil to develop the new system further. For over three years, they conducted market analyses in Brazil and in other countries and regions of the world. The P-I product line was finally launched in July 2011.

“We developed this new implant system with a world-renowned researcher, P-I Brånemark, with very strong scientific backing and knowledge,” said Giannini. “We have products much simpler to use than what is out there, supported by science and technologies that address the most demanding clinical needs.”

Highlights of this new product line include the Functional Hybrid Implants, which feature simplified conical surgical preparation, platform-switching connections, and a micro and nano structured, minimally roughened surface (blasted and ion bombarded), along with other complete and well-designed surgical and prosthetic solutions.

“The P-I line of functional hybrid dental implants uses technologies developed by Brånemark himself, and by other clinicians and scientists from all over the world in well-known universities,” according to Giannini.

With Zimmer Dental’s backing and history of global leadership and innovation, the initial rollout will focus on market growth in Brazil, although other select global markets where a cost-effective dental implant system is desired will also be considered. “With cutting-edge technologies such as the Zimmer Trabecular Metal Dental Implant and Zt’s digital dental solutions, as well as premium solutions such as the Tapered Screws-Vent implant system, Zimmer Angled Tapered Ablutions, and Puros Allograft Grafting Particles, the new P-I product line will allow Zimmer Dental to offer an even more comprehensive range of solutions to clinicians to best serve their patients,” explained Harold C. Flynn, Jr., Zimmer Dental president.

“P-I products have been in clinical use in Latin America and Europe for over eight years now, so this launch is based on solid clinical and scientific research,” Giannini added. “Brazil was a very good environment in which to test the fundamentals of our products; it was our battlefield and reason that we achieved exceptional levels of safety and performance.”

With over 220,000 dentists, many of them with postgraduate qualifications in dental implantology, Brazil is a formidable market indeed. In addition, several Brazilian dental implant manufacturers are positioning themselves for a rapid expansion into world markets. At IDS 2015, many of these companies will be present at the Brazilian pavilion.

For its part, the new P-I/Zimmer Dental offering is now positioned to be a major product line in the dental implants business in Latin America and in other select markets with a demand for an economic implant system built on simplicity and ease of use.

Exopro started as a development corporation in 1988 in Sweden, evolving into a leading dental implant company owing to its research-based endeavours. Under the philosophic principles of Brånemark, its aim is to create high-performance, simple, safe and versatile solutions for patients and professionals.
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Minimally invasive restorative technologies and materials are more prevalent as a philosophy and treatment modality in today’s world of modern dental restorative therapy. With the combination of early caries detection, dentin adhesives, nanohybrid composites, and micro instrumentation, the days of G.V. Black’s rule of “Extension for Prevention” are all but gone.

Today, patient comfort, with early intervention and a conservative approach to cavity instrumentation when a restoration is needed, “taking a front seat” to the old “watch and wait” approach to the treatment of dental caries. Going back to revisit dental histology, we remember that pit and fissure caries often starts as a “pin point” lesion that expands in a triangular fashion as it progresses toward the dentino-enamel junction (DEJ).

Once the lesion penetrates the DEJ, the caries spreads laterally and pulpally at a much more rapid rate due to the relative “softness” of the dentin as compared to hard enamel. It tends to reason that based on the histologic progression of tooth decay, initial penetration into the lesion should conserve as much as the healthy enamel as possible while allowing sufficient access to instrument the dentin and remove the softer carious dentin while leaving healthy, mineralised dentin behind. This article will detail the use of a caries removal and preparation system that helps the dentist accomplish these goals, while limiting the use of anaesthetic which has been shown to increase patient satisfaction when a15 to 22 per cent of patients in an independent study have been shown to need a needle phobic.

Once the composite restoration is completed, a single instrument composite polishing system will be used to complete the procedure.

Incipient lesions in enamel only: The fissurotomy and “preventive resin” restoration

The procedure of Fissurotomy allows the dentist to conservatively widen the primary grooves of a posterior tooth using specially designed carbide burs designed to keep the preparation size to an absolute minimum, while creating ideal shape and finishing a divergent walls and rounded internal line angles to reduce the risk of fracturing for the composite to be placed. After caries removal, the preparation is restored using flowable composite material.

In many cases, the preparation can be confined to only the affected area of the tooth. “Extension for prevention” is not required therefore, only the diseased tooth structure and minimal surrounding hard tissue is removed. The majority of surrounding healthy tooth structure is preserved. Since the composite resin microchemically bonds to the underlying dentin and enamel, an insoluble seal is achieved. The chances of future micro leakage and recurrent decay are greatly reduced using this minimally invasive approach and the integrity of the tooth is preserved.

Caries beyond the dentino-enamel junction

After a carious lesion penetrates the dentino-enamel junction (DEJ), it will spread laterally and pulpally at a faster rate because of the softer nature of the of the dentin substrate as compared to harder enamel. Also, because of the presence of dentinal tubules that are fluid filled and communicate directly the C fiber nerve endings in the dental pulp, rotary excavation of carious dentin with conventional carbide burs has a propensity to cause discomfort to the patient unless local anaesthesia is used.

The “Comfortable Cavity Prep” system

The Comfortable Cavity Prep System is a kit of “task specific” rotary instruments by SS White designed to give the dentist both a conservative way to access carious lesions in tooth structure and a way to remove carious dentin only, leaving behind structurally healthy dentin substrate. Access into enamel does not elicit pain response because there is no nervous innervation of this tissue. The diminutive tip of the Fissurotomy Bar allows for pinpoint access through the enamel to the carious lesion with little to no removal of healthy tooth structure.

Once the DEJ is penetrated, SmartBurr II, a polymer bur, designed to discriminate between healthy and carious dentin, removing only decayed tooth structure in used. According to the manufacturer, some of the other clinical benefits of SmartBurr II include:

1) No trauma to the dentinal tubules, thereby in many cases, reducing, or eliminating the pain response and decreasing the need for local anaesthetic.
2) The minimally invasive nature of the polymer cutting instrument reduces the risk of pulp exposure when excavating deep carious lesions
3) Carious excavation using SmartBurr II leaves a greater amount of healthy tooth structure remaining after preparation to help support and retain restorative materials.

A Recent Maryland clinical study stated the use of polymer burs appears to offer a straightforward and efficient means for achieving the goal of conservative dentistry with a method for removing caries infected dentin while preserving caries-uninfected dentin and conserving healthy tooth structure, while at NYU College of Dentistry, a clinical study compared caries removal with a SmartBurr II instrument (without anaesthesia) to caries removal with a conventional carbide bur (with anaesthesia).

Results showed that 84 per cent of patients preferred use of a SmartBurr II instrument compared to use of a carbide bur with no local anaesthetic for future dental treatment. A major clinical benefit of this system is the systematic approach to conservative cavity preparation that the unique instrumentation provides the dentist.

Instrumenting and restoring a deep carious lesion

A patient presented with a rather extensive radiographic caries lesion on the distal aspect of tooth #4 (Fig. 1). One can clearly see the caries penetration below the proximal contact area into the distal surface of the tooth, the larger apex of the “triangle” at the surface, narrowing to a pinpoint as the lesion follows the enamel rods toward the DEJ. The caries then spreads laterally along the DEJ and pulpally toward the centre of the tooth.

As in many of these clinical cases, another area of caries penetration is seen in the central groove of the occlusal surface as a “small, pinpoint” area that may or may not “click” with an explorer tip (Fig. 2).

The carious penetration in the central groove is “opened up” using a Fissurotomy bur (Figs. 3 & 4) to gain conservative access to the active lesion below (Fig. 5).

As the lesion is opened up, it is noted that the caries spreads in the bucco-lingual direction as well. Figure 6 shows the preparation as the proximal portion of the preparation is extended to allow access for removal of the caries.

Moreover, a diode laser has been used to remove the interproximal tissue and gain better access to the gingival margin of the cavity for matrix placement. Once the convenience and access forms of the cavity are completed, the excavation of the carious with SmartBurr II can begin (Figs. 7 & 8).

The appropriate size diameter SmartBurr II is chosen and the excavation is completed with slow speed instrumentation. The major advantage of using the polymer bur is that it will easily remove decayed dentin, but it is not able to cut healthy dentin, which is always removed when using round carbide burs for this procedure. Figure 9 shows the completed preparation after isolation with holdite (Isolite Systems) and placement of a sectional matrix (Composi-tight 5D, Garrison/Dental Solutions). Owing to the close proximity to the dental pulp, aboasive cavity liner (TheraCal, Bisco) is placed on the cavity floor (Fig. 10). TheraCal is a light cured resin modified calcium silicate pulp protectant/liner designed to perform as a barrier and to protect the dental pulp complex. Its alkaline pH helps promote pulp healing and apatite formation.

Once the liner is light cured, a self-hardening dentin bonding resin is applied to the enamel and dentin (All Bond Universal, Bisco) per manufacturer’s instructions and light cured. Next, the first increment of composite material (Artek, Bisco) is placed into the cavity preparation and light cured (Fig. 11). This increment fills the proximal box and pulpal floor of the cavity to a point just apical to the proximal contact area. The final increments are then placed, light cured, and finished. Figures 12 and 13 respectively show radiographic and clinical views of the completed composite restoration on tooth #4 after instrumentation with the Comfortable Cavity Prep System.

A simplified and systematic approach to finishing composite restorations

Once a composite restoration is placed, it must be trimmed/finished and polished so that the
surface is smooth like natural tooth structure and the margins of the tooth/restoration are confluent and imperceptible to the eye of an explorer. Many composite finishing systems require two or three successive diamond or carbide instruments to refine or prepare the composite surface for the final luster, which is placed with rubber abrasives.

Trimming and Finishing Burs (SS White) are manufactured in both 12 and 20 blade configurations. These posterior composite burs are designed for two-step contouring and pre-polishing all posterior composite restorations. The 12 blade burs are engineered to finish and contour composite restorations directly after placement. Anatomical features such as grooves, pits and fissures can be easily placed into the composite restoration with this set of finishing burs. They create a seamless transition from composite to natural tooth at the margins of the restoration. The 20 blade configuration is used to pre-polish the surface of the composite by removing any irritations or scratches, and blending the cavo-surface margin in a natural seamless form. These burs are non-invasive and create an ultra-smooth surface on all composite materials, ideal for final polishing. These burs are used in a high speed handpiece with water spray to optimise the finished surface.

Once the trimming/finishing step is completed, the occlusal contacts on the restoration are checked with articulating paper (Accufil II, Parkell) and further adjusted with the appropriate 20 blade trimming/finishing bur as needed. Once the occlusion has been properly adjusted, the final luster or polish can be imparted to the restoration. Again, for many polishing systems, two or three grits of rubber abrasives are required to finish the process and end with a high luster on the surface of the restoration. Jazz Supreme Single Step Composite Polishers (SS White) are designed to use low speed and low pressure with water to create a beautiful luster on the surface of composite restorations. The water creates a slurry with the diamond particles and silicone in the polisher to impart a high surface gloss on the composite material. According to the manufacturer, some of the benefits of the Jazz Supreme system are:

1) The combined technology of diamond particles and silicone impregnated in the rubber abrasive help create the highest possible surface luster.
2) A single step system saves the operator time and helps create an optimal shine much faster.
3) The shanks of the instruments are made of stainless steel and are surface refined with gold flashing making these instruments ideal for multiple use.
4) The Jazz Supreme Polishers are compatible with all aesthetic composite materials, eliminating the need for multiple polishing systems.

**Figure 14** is an occlusal view of a maxillary molar that has an existing amalgam restoration and occlusal decay. A 550 carbide fissure bur (SS White) is used to remove the existing amalgam while a Fissurotomy Bur (SS White) is used to remove marginal decay while conserving as much healthy tooth structure as possible (Figs. 15 & 16). Once the cavity preparation is complete, the adhesive procedure is completed and the composite material placed in the cavity preparation and light cured.

The first step in the finishing/polishing procedure is to use a 12 blade finishing carbide (SS White) to accomplish anatomical contouring and marginal refinement (Figs. 17 & 18). When instrumenting the margins of the composite, make sure the flutes of the bur are either moving away from the restorative material toward the tooth, or moving across the margin contacting tooth and restorative material simultaneously. This way the cutting instrument will not ditch the margin of the restorative material, which is not as hard as the adjacent enamel. Next, the 20 blade finishing carbide is going to pre-polish the surface of the composite material and further refine the marginal interface. Once the trimming and finishing step is complete, polishing is accomplished with a Jazz Supreme flame shaped rubber abrasive polishing point (Fig. 19).

Notice how when used with water spray, a slurry develops on the surface of the restorative material that will help to increase the final luster of the restorative material (Fig. 20). The completed composite restoration on the occlusal surface of the maxillary first molar is shown in Figure 21. In addition, a highly reflective surface is created while the number of steps and instruments used to create the end result is significantly reduced.

**Conclusion**

Initiate article, a total instrument system by SS White called “The Comfortable Cavity Prep” system along with finishing and polishing armamentarium has been demonstrated from conservative cavity preparation to finishing of the final restorative material in two clinical cases. Use of this system can help the dentist achieve conservative, comfortable, and expedient cavity preparation as well as finishing and polishing of today’s nano-microhybrid composite restorative materials. SmartBurs II and Fissurotomy Burs are an essential part of the caries treatment regimen. They help to create great patient experiences by reducing the pain and fear associated with cavity preparations. SmartBurs II make a positive impact on practice management and are a contributing factor to increased patient retention and referral rates.

Editorial note: Dr. Lowe has received honoraria from SS White.
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As concepts for the treatment of caries have evolved, the purpose and use of sealants have changed. In the 1980s, sealants were indicated only for the preventive sealing of pits and fissures. In other words, all teeth—even those with no clinical sign of caries—were considered for sealing. Now it is understood that there is no need to seal the teeth of patients with good oral health and no sign of etiological factors preventively. Owing to this new understanding about caries and its causes, the indications for the use of sealants must be reviewed and extended.

Sealing pits and fissures is no longer indicated for preventive reasons only, but is considered a therapeutic procedure to halt the progression of early caries. In this way, sealants are increasingly regarded as part of a minimally invasive philosophy that aims for early diagnosis and intervention, as well as prevention of future caries.

Sealing pits and fissures is no longer indicated for preventive reasons only, but is considered a therapeutic procedure to halt the progression of early caries. In this way, sealants are increasingly regarded as part of a minimally invasive philosophy that aims for early diagnosis and intervention, as well as prevention of future caries.

This treatment first aims at the control of the etiological factors of caries (e.g., diet, oral hygiene and socioeconomic status). However, in the more advanced stages of caries, minimally invasive procedures are indicated to interrupt lesion progression and preserve the natural dental structure. In such cases, using sealants has proven to be a very effective treatment, not only for caries affecting enamel but also for caries affecting dentine.
Case report

This case report concerns a patient who was treated according to the minimal intervention philosophy by using sealants for early carious lesions. The 12-year-old female patient presented for a routine dental appointment. After a complete examination, clinical signs of caries were detected in the first and second right mandibular molars. Active caries involving the initial part of the dentine and 2 mm of cavitation was observed on the first molar, while the second molar exhibited only enamel involvement, with whiter opaque characteristics (Fig. 1).

After the diagnosis, it was decided to treat the patient based on the precepts of the minimally invasive philosophy. To start with, the patient was educated about proper oral hygiene and diet in order to help her control the caries. For both lesions, a resin sealant (UltraSeal XT hydro, Ultradent) was used. Both teeth were isolated with a rubber dam, retained with a clamp on the second molar. The occlusal surface of the teeth was conditioned using 35% phosphoric acid gel (UltraEtch, Ultradent) for 15 seconds and then rinsed off with water for another 15 seconds.

The surfaces were then dried with a powerful air-water spray until they had a matt and whiter aspect. On the first molar, with the carious lesion having already spread to the dentine, two separate layers of one-step adhesive (Adper Single Bond, 3M ESPE) were applied. The excess was removed with an air spray for five seconds, followed by three seconds of curing using a high-energy broadband LED curing device (VALO, Ultradent). Afterwards, a natural-shade resin sealant (UltraSeal XT hydro) was applied to the surfaces of both teeth using an Inspiral brush tip (Ultradent), which facilitates the delivery of the material into areas that are difficult to access, improves the sealant flow and prevents air bubbles. The sealant was then cured for three seconds using the same curing device.

Next, an ultraviolet light was attached to the VALO and the light was placed over the sealed areas (Fig. 2). This approach, taking advantage of the fluorescence properties of the sealant, enabled the clinician to check the sealed areas to ensure that the sealant was optimally adapted to prevent micro-leakage and to assess the immediate and future quality of the seal. After having achieved the marginal seal that is essential for the halting of caries (Figs. 3 & 4), the occlusion was checked.

Discussion

This case report demonstrates an alternative treatment for caries using a minimal intervention philosophy. A resin sealant was used to prevent the carious lesion from spreading. With this less invasive procedure, it is possible to ensure greater comfort for the patient and to achieve a simplification of dental treatment, resulting in greater preservation of dental structures.

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The objective of endodontic treatment has continue to be a constant since root canal treatment was first performed; the prevention or treatment of apical periodontitis such that there is complete healing and an absence of infection while the overall long-term goal is the placement of a definitive, clinically successful restoration and preservation of the tooth.

From about 1985 to 1995 there was more change in clinical endodontics than in perhaps the previous 100 years combined. In these 10 years, clinical endodontics changed forever with the emergence and development of four very important technologies: the dental operating microscope (DOM), ultrasonics, nickel-titanium rotary instruments, and EDTA.

Where We Were

The Dental Operating Microscope

Superior vision became attainable with the integration of the dental operating microscope (DOM). Diagnostically, the operating microscope is an essential tool in locating cracks and tracking vertically fractured teeth.6 It allows a more detailed view of root canal anatomy, enabling the operator to more efficiently examine, clean and shape complex anatomy. It provides superior resolution, thereby aiding the removal or bypassing of separated canals.7 A microscope provides an improved surgical technique allowing for smaller osteotomies, shallower bevels and the location of isthmi and other canal ramifications, thereby allowing an unprecedented success rates of up to 96.8 per cent.8 A DOM has significantly shown to improve the probability of locating a second mesial buccal canal in maxillary molars. Baldrissi-Cruz et al. showed that the MB-2 canal was located in 90 per cent of maxillary molars with the operating microscope but only 52 per cent with unaided vision.8

Nickel Titanium Instruments

Canal preparation procedures became more predictable successfully with the emergence of nickel titanium (Ni-Ti) files.9 This superelastic alloy has shape memory, allowing for better maintenance of the original canal anatomy. These files produce less extrusion of debris, allow greater cutting efficiency and reduce the time for canal shaping compared to stainless-steel files. They are biomechanically, antioestrous and do not weaken following sterilization.10,11 Although full rotary has been the mainstay for nickel titanium systems for years, reciprocating motors have taken the market by storm allowing less debris extrusion and quicker negotiation to the apices and less file fatigue.

Mineral Trioxide Aggregate

This decade of professional change concluded with the introduction of mineral trioxide aggregate (MTA). This remarkable and biocompatible restorative material has become the standard for pulp capping and has salvaged countless teeth that previously had been considered hopeless. In Vital pulp therapy, when MTA is used as a direct pulp cap to maintain pulp vitality, studies have shown that these areas were free of inflammation and allowed for healing.

MTA has proved to be the ideal pulpotomy agent in terms of dentin bridge formation and preservation normal pulp architecture.10 MTA produces favourable results when it is used as a root-end filling material in terms of lack of inflammation, presence of cementum and hard tissue formation.11 It is used to repair both furcal and lateral perforations with a relatively high degree of success and to seal both internal and external root perforations in a predictable manner.12

The operating microscope has become an indispensable aid in the field.

Demineralizing agents such as EDTA have therefore been recommended as adjuvants in root canal therapy in combination with sodium hypochlorite to dissolve inorganic material and the organic components of the pulp horn. EDTA can be used as an adjuvant in root canal therapy with more promising results compared to mechanical means of root canal preparation. EDTA is used as a root-end filling material in terms of lack of inflammation, presence of cementum and hard tissue formation.11 It is used to repair both furcal and lateral perforations with a relatively high degree of success. EDTA is also used in the removal of the smear layer as well as the organic components of the pulp horn. EDTA is used as a root-end filling material in terms of lack of inflammation, presence of cementum and hard tissue formation.11 It is used to repair both furcal and lateral perforations with a relatively high degree of success and to seal both internal and external root perforations in a predictable manner.12

Where We Are

Irregular and Irregular Delivery Systems

Perhaps the greatest international attention in recent years has focused on methods to improve endodontic disinfection in the root canal system. The desired attributes of a root canal irrigant include the ability to dissolve necrotic and pulpal tissue, bacterial demineralization with a broad antimicrobial spectrum, the ability to enter and wash into and within the dentinal tubules, biocompatibility and lack of toxicity, the ability to dissolve inorganics material and remove the smear layer, ease of use and moderate cost. The combination of sodium hypochlorite and EDTA has been used worldwide for antiseptic of root canal systems. Sodium hypochlorite has the unique ability to dissolve necrotic tissue and the organic components of the smear layer.13 It also kills sessile endodontic pathogens organised in a biofilm.13,14 There is no other root canal irrigant that can meet all these requirements, even with the use of methods such as increasing the temperature21 or adding sur- factants to increase the wetting ef- ficiency of the irrigant.22

Demineralizing agents such as EDTA have therefore been recom- mended as adjuvants in root canal therapy in combination with sodium hypochlorite as they dissolve inorganic dentine particles and aid in the removal of the smear layer during instrumentation.16 It is very important to note that while sodium hypochlorite has unique properties that satisfy most requirements for a root canal irrigant, it also exhibits tissue toxicity that can result end in damage to the adjacent tissues, including nerve damage should sodium hypochlorite incidentally occur during canal irrigation.17 It is therefore very important that irrigant deliver- ery devices are used that not only allow volume control but change right to the apex but also deliver them in a safe an decisive manner without apical extrusion.

Root canal irrigation systems can be divided into two categories: manual agitation techniques and machine-as- sisted agitation techniques.18 Manual irrigation includes positive pressure irrigation, which is commonly performed with syringes or a side-vented needle. Machine-assisted irrigation techniques include sonic and ultrasonic systems, as well as newer systems such as the EndoVac (SybronEndo, USA), which delivers apical negative pressure (ANP) irrigation, the plastic rotary F File (Plastic Endo, Lincolnshire, IL), the Vibhringe (Vibhringe BV, The Netherlands), the RinsEndo (AirTechnics, USA) and the Endo-Alturter (DENTSPLY Tulsa Dental Specialties, USA). Of all the techniques listed, the EndoVac has repeatedly shown to break the apical vapour lock (the column of gas that is formed at the apical 5 mm of the root canal formed by the hydrodynamics of organic tissue by sodium hypochlorite), produce a current of irrigant, remove debris and deliver voluminous amounts of irrigant to the apex without the risk of apical extrusion.19

Laser

The integration of lasers is a vi- able addition to the endodontic armamentarium and has the potential to overcome some of the challenges to successful root canal therapy. Of particular benefit is the ability to avoid vibration pain upon access, even in “hot” teeth that are difficult to anesthetise, and the three-di- mensional ability to remove pulpal tissue, bacteria, smear layers and dentin from canal walls via laser en- ergy and photodynamic activity. Of particular significance is the ability of laser light to generate 1,000 microns into the dentinal tubules.20 Bacterial infiltration into dentinal tubules has been reported to be 400 microns20 and chemical reactions have a penetration depth of only 100 mi- croscopic.20 This has significant implications for the ability of bacterial entombment and mi- croleakage. The resulting disinfec-
Endo research in the Asia Pacific region is significant

An interview with Prof. Luke Sung Kyo Kim, President of the Asia Pacific Endodontic Confederation

Up to 1,000 representatives from endodontic societies all over the Asia Pacific region, the US and the Middle East are expected to attend the upcoming biannual congress of the Asian Pacific Endodontic Confederation (APEC) in Seoul, South Korea, in March. Dental Tribune Asia Pacific had the opportunity to speak with APEC’s president Prof. Luke Sung Kyo Kim, who is also Chairman of the Department of Conservative Dentistry at the Kyungpook National University’s School of Dentistry in Daegu in South Korea, about the congress and the state of endodontics in the region.

Dental Tribune Asia Pacific: Prof. Kim, how many members does the APEC currently have, and how often does it meet?

Prof. Luke Sung Kyo Kim: It may come as a surprise to you that our organisation is almost 50 years old. Since the APEC was founded in 1985, 15 national endodontic societies have joined the confederation. Our membership includes representatives from professional bodies in Australia, Japan, Korea, Hong Kong, Singapore, Taiwan, Malaysia, Indonesia, India and the Philippines, Iran, Jordan and the US are members from outside the region.

Our general congress takes place every two years, with smaller meetings or events held at larger international endodontic congresses in the intervening period.

The upcoming congress in Seoul will bring members of APEC together once more. What are the most important issues that will be discussed?

From a clinical point of view, the use of the operating microscope and newly developed NiTi rotary instruments will be key issues. We decided on “New horizons in endodontics” as the congress theme; as we expect much of the current research in our region to be presented at the event.

What research is currently being conducted in the region, and what are the most prominent institutions when it comes to endodontics?

Much significant research in our region is concerned with coronal leakage, behaviour of NiTi rotary instruments, and the biochemical aspects of the dental pulp and periapex. While MTA (mineral trioxide aggregate) was primarily developed in the US, much of the research on this material has been conducted by scientists here.

Many universities all over the region regularly produce excellent results. If you look at the major journals in endodontics, such as the Journal of Endodontics and the International Endodontic Journal, there are quite a number of current articles written by authors from universities in South Korea, Japan, Australia, Hong Kong and Taiwan, to name a few.

Besides MTA, endodontics has evolved significantly owing to the use of lasers, CBCT and new instrumentation that only requires one file to prepare root canals. Have these developments already found their way into endodontic practices in the Asia Pacific region, and what are the current trends there?

Most of these techniques are already available and used in clinical practice throughout the Asia Pacific region. Endodontists practicing in the most developed markets have all the state-of-the-art equipment, including MTA-like materials, NiTi rotary instruments, operating microscopes, heat-controlled gutta-percha filling devices and electronic apex locators, at their disposal.

What was behind the decision to host the congress in Korea, and what is the state of endodontics there?

The APEC congress has been held in Korea three times and the Korean Academy of Endodontics has been a long-time member of APEC, with clinical specialists from Korea like me having worked as councillors and officers for the organisation. Therefore, Korean members have also been greatly involved in the organisation of this congress.

In combination with the high level of endodontics, which is comparable to most developed countries in the world, this expertise makes the country a perfect host for this kind of event. Specialists in Korea are very much up to date with the latest developments in the field and therefore scholars and students from all over the world come to Korea to learn about or share information and research on endodontics.

What are your expectations of the meeting?

I expect that the latest techniques, concepts, instruments and materials in our field will be presented at the congress. With these concepts and products on display, endodontic specialists will be able to update their knowledge. Visitors can look forward to getting hands on with the most advanced treatment concepts in our field.

Thank you very much for the interview.

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“...the operating microscope and newly developed NiTi rotary instruments will be key issues.”
A tooth is compromised from a treatment of choice. However, if endodontic therapy should be the restorative or periodontal aspect, then a tooth is sound from both a restorative and periodontal aspect, which will ultimately allow retention and reduction of bacteria in the dentinal tubules is significant with respect to providing unparalleled levels of endodontic success. Digital Radiography

Digital radiography has significantly reduced treatment time for endodontic procedures with far less exposure compared to the conventional film. High-resolution digital images are instantly generated and easily manipulated for enhanced diagnostic performance. Digital storage of images is simple, allowing quick transfer and communication.

Cone-Beam Computed Tomography (CBCT)

What digital radiography has provided us for imaging in the present, CBCT (cone-beam computed tomography) will carry us into the future. CBCT technology has been around since the 1980s, however, only recently has it become a viable option for the endodontic office. Cone-beam technology uses a cone-shaped beam of radiation to acquire a volume in a single 560-degree rotation, similar to panoramic radiography. It has advantages over conventional medical CT, including increased accuracy, higher resolution, scan-time reduction and dose reduction. Endodontic uses include but are not limited to diagnosis of odontogenic and non-odontogenic cysts, cysts vs. granulomas, location of untreated canals and the diagnosis of certain root fractures. The extent of internal, external and cervical resorption can be accurately mapped and the presurgical evaluation of anatomic landmarks can be precisely surveyed.

Regenerative Endodontics

Regenerative endodontics has become an exciting possibility, allowing stem cell found in the dental pulp to regenerate and replace diseased tissue with healthy tissue and revitalized a tooth. The vascularisation of necrotic teeth with immature apices can be a significant challenge to the clinician. In the past, aplication procedures have allowed root length to continue, but the walls of the roots remained thin, allowing the high risk and probability of fracture. Revascularisation techniques provide such a tooth the ability to not only continue linear root growth, but also allow increased thickness of dentin on the root canal walls, which will ultimately allow retention of the natural tooth, obviating the need for extraction and implant replacement. The technique is uncomplicated and easy to learn. Through the use of a specialized tri-antibiotic mixture, blood clot induction and its coronal sealing with MTA, many necrotic and immaturely developed teeth that would otherwise be extracted can now be retained.

Endodontics vs. Implants

With the advent of implants, patients were able to maintain their occlusion and health in those functional areas that were missing teeth. Unfortunately implants are also being used to replace viable teeth. If a tooth is sound from both a restorative and periodontal aspect, then endodontic therapy should be the treatment of choice. However, if a tooth is compromised from a

The literature review found equal survival rates of single-tooth implants and endodontically restored teeth. Both therapies had overall survival rates of 94 per cent, thus providing predictable outcomes. However, implants have a longer mean and median time to function, and have a higher frequency of postoperative complications requiring additional treatment intervention.

Where We Are Going

Science and research will elevate the specialty of endodontics to its rightful pinnacle. The cornerstone of our specialty’s integrity and relevance must be built on a strong foundation of randomized clinical trials and evidenced-based endodontics. The future of endodontics is bright as we continue to develop new techniques and technologies that will allow us to perform endodontic treatment painlessly and predictably, and continue to satisfy one of the main objectives in dentistry, that being to retain the natural dentition.
In addition to intra-oral and panoramic radiographs, various visual techniques are available for endodontic treatment today. Above all, information obtained through the dental microscope has become essential. "See better, do better" is a slogan in modern endodontics. The dental microscope is a wonderful tool for problem-solving in endodontics, for instance for the removal of broken instruments and root-filling materials, finding missed canals, perforation repair, diagnosis of tooth fractures, evaluation of marginal integrity of restorations, precise manipulation in periradicular surgery and deep dental caries, and confirmation of root-canal cleanliness. Yoshioka et al. (2002), for example, reported that the rate of detection of root-canal orifices under a microscope was significantly higher than the number detected with the naked eye. It was also found that surgical loups were relatively ineffective compared with the microscope.

In addition, computed tomography (CT) is becoming increasingly popular among endodontists, particularly in the assessment of difficult cases and for problem-solving in endodontic treatment. Higher use (34.2 per cent) of CBCT was demonstrated by a recent web-based survey of active members of the American Association of Endodontists in the US and Canada (Dailey et al. 2010). Owing to its high radiation dosage, however, careful consideration is needed before taking CT images. Consequently, a project team from the Japanese Association for Dental Science presented a report in 2010 on the use of CT in dentistry, and a joint position statement by the American Association of Endodontists and American Academy of Oral and Maxillofacial Radiology was issued in February 2011. The combined use of the dental microscope and CT for apicectomy was approved as an advanced dental technology by the Ministry of Health, Labor and Welfare in Japan in 2007, and seven Japanese dental hospitals have been using the technology since 1 February 2015.

Optical coherence tomography (OCT) is a high-resolution imaging technique that allows micrometre-scale imaging of biological tissues over small distances. It was introduced in 1991 and uses infra-red light waves that are reflected from the internal microstructure within the biological tissues (Shemesh et al. 2008). There have been reports on its use for intra-canal imaging, diagnosis of vertical root fracture (Yoshioka et al. 2013) and perforations. Since OCT is non-invasive and free of radiation, this technology may be very useful for endodontic diagnosis and treatment (Figs. 1a–2).
VDW launches obturators entirely made of gutta-percha

DTI

MUNICH, Germany: VDW’s latest innovation makes use of the advantages commonly associated with gutta-percha, as the new GUTTAFUSION carriers for the thermoplastic obturation of root canals are now made entirely of this material. According to the German specialist company, these obturators now feature a core made of cross-linked gutta-percha that remains stable even when heated and therefore simplifies post space preparation procedures.

In addition, they are coated with gutta-percha, which flows evenly when heated in the GUTTAFUSION oven, for example, filling the whole root canal system, including ramifications, isthmuses and the apex.

Root canal fillings done with GUTTAFUSION can be removed easily for retreatment, the company said. Specialy designed for use with tweezers and fingers, the obturator handle allows for easy application of the obturators in molars. According to VDW, no other instruments are required for separation.

GUTTAFUSION has a high radiopacity and is compatible with most rotary NiTi systems.

The three obturator sizes correspond to the R25, R40 and R50 instruments. The correct obturator size can also be determined with a NiTi size verifier, which is available in sizes 20 to 55.

OptraSculpt Pad now features non-stick surface

DTI

SCHAAN, Liechtenstein: The OptraSculpt Pad is a new modeling instrument from Ivoclar Vivadent. It boasts foam pad attachments to allow clinicians efficient, non-stick application of composite filling materials, without leaving any marks.

Natural-looking results are easy to accomplish in anterior and cervical restorations with this material, the Liechtenstein company said.

The highly flexible synthetic foam adapts to the shape of the tooth and therefore allows smooth contouring of the filling. Reference scales on the instrument’s handle are intended to assist in the creation of aesthetic and anatomically correct anterior restorations. In addition, the markings allow comparison of the clinical situation with the ideal average tooth width proportion and angular alignments in the upper anterior dentition.

According to Ivoclar Vivadent, OptraSculpt Pad is particularly suited to the placement of Class III, IV and V restorations and direct veneers.
Endodontic management of a hypertaurodontic maxillary first molar

A case report with a two-year follow-up

Drs Jojo Kottoor, Denzil Valerian Albuquerque, Anuj Bhardwaj, Ntanashanthapathy Yelmurugan
India

Taurodontism is a morphological variation in which the body of the tooth is enlarged and the roots are reduced in size. Taurodontic teeth have large pulp chambers and apically positioned furcations.1 This variation was first described by Gorjanović Krnjević2; however, the term “taurodontism” was first introduced by Sir Arthur Keith3 to describe molar teeth resembling those of ungulates, particularly bulls.

The term “taurodontism” comes from the Latin term “tauro-,” which means “bull” and “odont,” which means “tooth” or “bull tooth.”4 The Greek term “tauro-” also means “bull” and “odontos,” which means “tooth” or “bull tooth.”

Such morphological variations are an endodontic challenge and even more difficult to treat when additional roots and/or canals are present. The endodontic management of one such taurodontic molar is reported in this case report.

Case report

A 44-year-old male patient was referred to our clinic for treatment of the right maxillary first molar (tooth #16). The preoperative periapical radiograph (Fig. 1a) suggested the following possibilities:

- a mesio-occlusal carious lesion with endodontic involvement;
- a highly calcified and elongated pulp chamber extending up to the trifurcation;
- three short roots with the trifurcation in the apical third;
- a periapical radiolucency in relation to the mesiobuccal and palatal root apex.

Clinically, vitality tests were negative and a diagnosis of hypertaurodontism, according to Shifman and Channel,5 with pertaurodontism, according to Kottoor et al.6 was made for the tooth.

Local anaesthesia of 2% lignocaine with 1:100,000 epinephrine was administered to the patient. The mesial surface of the tooth was restored with composite resin (Z100, 3M ESPE) after caries excava-
tion to enable optimal isolation. Under rubber dam isolation, the access cavity was established with an Endo Access bur and an Endo Z bur (DENTSPLY Tulsa).

A dental operating microscope (DOM; Seiler Revelation) was used throughout the procedure to facilitate visualisation. The calcified mass occluding the pulp chamber was removed using ET 18D ultrasonic tips (Satelec/Acteon). Three root canal orifices were located: two narrow orifices, the mesiobuccal and distobuccal, and a wide palatal orifice. Root canal orifices were named according to the nomenclature proposed by Kottoor et al.3

An electronic apex locator (Root ZX, Morita) was used to determine the initial working length, which was confirmed radiographically (Fig. 1b).

The root canals were cleaned and shaped with ProTaper (DENTSPLY Mailfleer) rotary instruments. The buccal canals were instrumented up to F2 and palatal canal to F4. The canals were irrigated with 2.5% sodium hypochlorite using ultrasonics, 17% aqueous solution of EDTA, and 0.2% w/v chlorhexidine gluconate.

The canals were dried using sterile paper points and obturated with gutta-percha cones and AH Plus sealer (DENTSPLY DeTrey) using the cold lateral compaction and vertical compaction techniques. The access cavity was then restored with miracle mix (cermet and Ketac Silver, 3M ESPE; Fig. 1e).

The patient returned to the endodontic clinic after three weeks with sensitivity in the complaint prompted a re-entry into the tooth to evaluate the possibility of any additional canal(s). The coronal restoration was removed and the pulp floor was carefully imaged again under the DOM at a higher magnification. The visual and tactile examination under the DOM revealed a second mesiobuccal canal (P-MB).

Under the microscope, it was possible to insert a #15 K-file and the existence of the additional canal was confirmed using an electronic apex locator. A working length radiograph was taken with a #20 K-file in the untreated canal (Fig. 1d).

The P-MB canal was instrumented to F2 under irrigation with 5% sodium hypochlorite and EDTA and obturated by cold lateral compaction of the gutta-percha and AH Plus sealer (Fig. 1e).

Follow-up clinical examination after a week revealed that the tooth was asymptomatic and was not sensitive to percussion or palpation. Subsequently, endodontic management of tooth #15 was completed. The 24-month follow-up radiograph showed complete resolution of the periapical radiolucency in relation to the mesiobuccal and palatal root apices (Fig. 1f).

Discussion

Taurodontism is frequently associated with other anomalies and syndromes. These include Klippel-Fleisher syndrome,7 ectodermal alterations,8 Down syndrome,9 Moebius syndrome,10 Wolf-Hirschhorn syndrome,11 Lowe syndrome,12 Tricho- dento-osseous syndrome,13 Williams syndrome,14 but it is not a con-
stant feature of these syndromes.15

However, identification of patients with multiple tauro-
dontic teeth could lead to early recognition of a systemic disorder and improve quality of life. It has also been found to be associated with dental anomalies such as oligodontia, supernumerary teeth, and amelogenesis imperfecta.16 In this case, the patient was a healthy male with a negative medical history.
Its aetiology is still unknown, but it has been suggested that it may be caused by a failure of the diaphragm of Herwig’s epithelial root sheath to invaginate at the correct time and horizontal level or changes in the mitotic activity of cells of the developing teeth that can affect root formation or influence by external factors on the development of the teeth.\textsuperscript{18} Differences in opinion exist regarding the amount of displacement and/or morphological change required to constitute taurodontism. Based on the relative amount of apical displacement of the pulp chamber floor, Shay\textsuperscript{19} classified taurodontism as hypertaurodontism, mesotaurodontism, and hyper-taurodontism. This subjective, arbitrary classification led normal teeth to be misdiagnosed as taurodontism.

Feichtinger and Bossi\textsuperscript{20} stated that the distance from the bifurcation or trifurcation of the root to the cemento-enamel junction should be greater than the occluso-cervical distance for a taurodontic tooth. Keren\textsuperscript{21} proposed the Taurodont Index, relating the height of the pulp chamber to the length of the longest root.

Although there are many classification systems to determine the severity of taurodontism,\textsuperscript{22} the classification proposed by Shifman and Chanan-\textsuperscript{23} in 1979 is the most widely used system. According to this index, taurodontism is present if the distance from the lowest point at the occlusal end of the pulp chamber to the highest point at the apical end of the chamber, divided by the distance from the occlusal end of the pulp chamber to the apex and multiplied by 100 is 20 or above (hypertaurodontism: TI 20–50; mesotaurodontism: TI 50–40; hypertaurodontism: TI 40–75).

Except for a higher prevalence of taurodontism among females in a Chinese sample,\textsuperscript{24} no study has found a gender difference for this abnormality. Although permanent mandibular molars are most commonly affected,\textsuperscript{25} taurodontism is occasionally observed in mandibular premolars and even in maxillary premolars, mandibular canines, and incisors.\textsuperscript{26,27} Its prevalence increased seven and eight times in non-white populations from 5.67 to 60% of subjects.\textsuperscript{28–29} Endodontic treatment of taurodontic teeth is challenging taurodontic treatment of a hypertaurodontic maxillary first molar may be complex, particularly regarding the cleaning and shaping of the root canals and root-canal obturation, especially in hypertaurodontic teeth.

Conclusion

The case report has described the successful endodontic treatment of a hypertaurodontic maxillary first molar that would have seemed impossible to perform with conventional techniques. Success was mostly attributed to the use of magnification, which allowed better visualisation of the four canal orifices.

This case report has served to illustrate to clinicians that sound knowledge and modern equipment facilitate enhanced management of endodontically challenging taurodontic teeth.
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*University clinical study available upon request.

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