Microdentistry Update

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Microdentistry, the concept of minimally invasive care, was first introduced to the dental profession in the early 1990's and has seen steady adoption and growth since that time[1].

Microdentistry is now a buzzword in the profession. It began with a focus on the micro-management of occlusal pits and fissures, and tunnel preparations, but has grown in scope to cover just about every diagnosis and treatment phase of dentistry. The first meeting dedicated to this philosophy occurred in 2000, where clinicians, educators, and researchers gathered to share ideas and information. The attendees formed the World Congress of Microdentistry and defined microdentistry as an evidenced-based discipline dealing with oral hard and soft tissue saving procedures with the goal of improving the quality of life through optimal oral health. This philosophy is based on the principles of absence of disease model of health, early and accurate diagnosis, minimally invasive care, biomimetic restorations, and optimizing the patient experience. Certainly dental professionals of the future will spend the majority of their time practicing this type of care. Caries and periodontal disease will continue to be a problem for most patients. In spite of a continued climate of growing demand for cosmetic dentistry, not every patient requires 20 veneers. Most practitioners will continue to spend the majority of their treatment time dealing with caries and periodontal disease.

Minimally invasive treatment has become the standard of care in the health professions, but not without some resistance. In medicine, third-party payers favor minimally invasive procedures because not only is it the standard of care, but many times these procedures are less expensive, and result in outpatient treatment with less hospitalization costs, and ultimately have less post-operative sequelae. In dentistry, individuals associated with third-party payment organizations seem opposed to early intervention with minimally invasive care and prefer a model of health that involves absence of symptoms. This is the traditional model of "non-care" in dentistry, the watch-and-wait paradigm[2] of supervised neglect. In contrast, the philosophy of microdentistry is firmly grounded in a model of health that involves absence of disease, not absence of symptoms. The primary goal of operative dentistry is to maintain oral health, defined as the absence of disease of the teeth, periodontium and oral mucosa[3]. Microdentistry promotes early diagnosis of disease coupled with minimally invasive treatment.

Magnification and illumination are important to be able to visualize smaller, less invasive procedures. Magnification loupes are the minimal requirement for such procedures; many clinicians also opt for accessory illumination as well. Loupes are available from a variety of manufacturers and may have fixed, through-the-lens binoculars, or may be adjustable, ranging from 1.5-4.3x. A higher level of magnification up to 22x can be achieved with a surgical microscope. Several manufacturers provide microscopes; the choice becomes quality of optics, floor, wall or ceiling mounted, and accessory video capabilities. Microscopes provide incredible clarity for diagnosis, microscopic treatment, and improve the clinicians' skills for all aspects of restorative dentistry. Zeiss is well known for their optic lenses and provides a broad selection of loupes and microscope configurations.

Fig. 1

The KaVo DIAGNOdent tip measures fluorescence on an occlusal surface.

Early and accurate diagnosis is the foundation of microdentistry. There is a paradigm shift in attitude and understanding of caries that is occurring in both research and clinical practice. Tooth decay has long been treated as a bacterial infectious disease, but the treatment in the past has been a one-size-fits-all surgical removal of the diseased tissue without addressing the bacterial infection itself. There is a global shift now toward treating the disease from a medical model rather than strictly a surgical model. Clinicians can now culture the mouths of their patients to determine level of infection of the cariogenic pathogens, risk assessment of continued infection, and approach treatment with an anti-microbial regimen in addition to any surgical treatment. The Vivadent CRT test allows clinicians to accomplish these cultures in-office with a modicum of equipment. Patients are monitored for saliva flow for 5 minutes and then the saliva is cultured for 48 hours for mutans streptococci and lactotbacilli. A monoclonal antibody test may be available in the near future for caries diagnosis. Other new technologies have also

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improved the ability for early diagnosis of caries. The KaVo DIAGNOdent is a small hand-held diode laser that accurately and objectively measures fluorescence in teeth, figure 1. Using this data a clinician can make sound objective decisions for occlusal caries. Digital radiography has also greatly improved both the clinician's diagnostic capabilities and the patient's understanding of their conditions. Schick provides an excellent CCD sensor with comfortable sensor placement tools and straightforward manipulation software. Phosphor plate technology is available from Denoptics and Air Techniques. The new scanner/sensor technology from Air Tech has dramatically simplified the phosphor plate systems. Yet another technology to improve caries diagnosis is the DV2 endoscope from Dental View. This microscopic endoscope was originally introduced into dentistry to diagnose and treat periodontal disease, allowing 48x visualization of the root surface. However, it is very effectively used to look directly into a proximal contact area to determine if there is surface cavitation of an incipient lesion. Until an enamel surface is cavitated, it can be re-mineralized. After it cavitates, it requires surgical restoration.

At the center of the current debate on microdentistry is the micromanagement of occlusal pits and fissures. Non-cavitated lesions can be remineralized, but almost always it is impossible to determine if cavitation has occurred in the base of a fissure underneath apparent healthy enamel, the "hidden caries lesion." Karen Weerheijm has focused much of her research[4] on the undiagnosed carious lesion. A recent report from Dr. Rella Christensen at CRA[5] also indicates that a significant number (92%) of the stained occlusal fissures have caries present. Treatment for early enamel caries can include traditional pit and fissure sealants, which have a long history of clinical use and sound scientific support[6]. While many researchers still favor sealants in some instances, more clinicians are inclined to microscopically instrument the fissures to make sure there is no advancing caries,

Microscopic cavity preparation of an occlusal surface with incipient caries.

Air abrasion provides conservative cavity preparation of teeth.

figure 2, and then place a preventive resin restoration (PRR) or a small occlusal restoration. Dr. Richard Simonsen first proposed the PRR in the late 1970's as an improvement to traditional pit and fissure therapy in fissures with incipient caries. Since then, there has been a growing body of research supporting early intervention[7]. This is consistent with the early, accurate diagnosis and minimally invasive treatment philosophy of microdentistry. The controversy remains however, based on disagreement to the definition of caries, and if, when and how to treat these sites. The microdentistry philosophy is not limited to occlusal fissures but extends to periodontal disease and just about every aspect of clinical dentistry as well.

Clinicians now have a variety of

ErCr:YSGG laser energizes a water spray to cut tooth structure.

instrumentation to accomplish minimally invasive restorations. Air abrasion was re-introduced to the dental profession by J. Tim Rainey and ADT back in 1992. Current air abrasion technology is now a handheld device like the RONDOflex from KaVo. Air abrasion is very effective at conservative removal of diseased tooth structure, figure 3. It is very efficient for preparation or microdentistry restorations. Advances in this technology may include improved tip performance, contact tips, and parallel water spray. In addition to air abrasion, high-speed burs have been redesigned to microscopic levels that allow for finer cavity preparations. Yet another development for hard-tissue preparation is the hard-tissue laser. Available as either Er:YAG or ErCr:YSGG, the hard-tissue laser is a very effective preparation instrument. The Biolase ErCr:YSGG has sound scientific and clinical support and has a large user-base of experienced clinicians. This laser energizes a water spray, which very selectively removes tooth structure, figure 4. The ErCr:YSGG laser is also excellent for numerous soft-tissue procedures as well.

Recent developments in restorative materials will make biomimetic restorations a reality. The classic GV Black amalgam cavity preparation should be permanently abandoned as outdated care. Too many good restorative options are available

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Fig. 5

The Perioscope is the first dental endoscope designed to examine subgingival areas.

today to continue to remove massive amounts of healthy tooth structure as dictated by the use of amalgam. Dentin bonding has sufficient scientific support to validate it for standard use. Composite restorations do not have the mechanical and physical properties of amalgam and don't require excessive healthy tooth structure to be removed for them to be successful clinically. There is also a greater understanding of the anatomy of teeth and how cavity preparations affect their physical properties. Based on evidence pertaining to the peripheral rim of enamel[8], tunnel preparations, which maintain the marginal ridge of enamel are becoming standard of care, promoted by knowledgeable clinicians like Dr. Graeme Milicich. Glass ionomer materials like GC America's Fugi IX have been demonstrated to allow for an improved biological seal and bond compared to resin bonding, and allow continued ionic exchange with fluoride ions into the tooth structure beneath a restoration. Future materials will allow clinicians to seal teeth immediately during eruption and have them protected for a few years while allowing the enamel


Fig. 6

Acetal resin partial denture appliance provides an esthetic cosmetic alternative in removable prosthodontic appliances.

to mature at the same time. Conserving healthy tooth structure and restoring with biomimetic materials will result in substantially better treatment outcomes for patients.

Clinicians have been treating periodontal disease non-surgically with a variety of lasers for 12 years now. Current generations of lasers primarily include diode-based technology, which is smaller, less expensive and requires less maintenance than earlier gas and solid-state technology. The Biolase Twilight laser provides a broad selection of treatment parameters, in addition to a rheostat foot control. There is abundant scientific evidence to support the use of lasers in soft tissue procedures, as well as the bactericidal effects of laser energy[9]. The recent introduction of the Dental View DV2 Perioscope has dramatically improved the removal of subgingival calculus during non-surgical periodontal therapy, figure 5. This microscopic endoscope provides excellent magnified visualization of the root surface, and assures the complete or near complete removal of the bacterial infection. These technologies coupled with antimicrobial care like Arestin provide the best conservative approach to non-surgical periodontal care.

Endodontics has also been developing minimally invasive care. The microscope has created a new field of endodontic surgical microscopy. Clinicians can now perform much more precise endodontic surgery. Canal preparation is also changing with the development of new rotary instruments and the "crown down" preparation techniques. A new development in the field of endodontics is the recent FDA clearance for laser root canal preparation with the Biolase ErCr:YSGG laser. The first of its kind, this technique involves even more conservative preparation of the root canal. Removing less healthy tooth structure leaves the remaining tooth much stronger. In addition, there is the benefit of bactericidal affects of the laser beam. There will be continued improved clinical procedures in endodontics.

Implants have given practitioners the opportunity to conservatively replace missing teeth without the severe surgical preparation of adjacent teeth. This procedure is now predictable and has sufficient scientific and clinical support. It should be considered as the primary treatment option in patients who are suitable candidates for implant treatment. Removable Prosthodontics are also seeing improvements in new restorative materials. Recently introduced acetal copolymers like Aesthetic Perfection from CDM are now being used for prosthetic

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frameworks, figure 6, and for a host of oral appliances from mouth guards to night guards. The acetal copolymer is tissue or tooth colored and is virtually monomer free. This material is a thermoplastic resin that is injection molded, creating restorations that are non-porous, won't collect bacteria, odors and stains, and are significantly stronger than previous materials[10]. Patients appreciate the fact that they are somewhat flexible and more comfortable to wear. These materials provide an alternative to partially edentulous patients.

Cosmetic dentistry has even seen new developments in conservative, and minimally invasive care. While patients universally desire whiter healthier appearing smiles, for many patients porcelain veneers are a severely invasive procedure. Many patients can achieve their cosmetic goals by whitening or bleaching alone. This is a very conservative approach to cosmetic care, not requiring the surgical removal of healthy tooth structure. Tooth whitening has been around since the late 1800's and has gone through many generations of development and change. More recently the trend in whitening was a regimen of take-home gel worn in a tray. Once popular in-office bleaching has become popular again with the development of many new light assisted bleaching systems. Crest recently changed the whitening market with the introduction of the Whitestrips product. Much less expensive and available over the counter, now many patients pursue cosmetic improvement on their own as the first step in their treatment. Most bleaching systems have been effective at some level and this area of dentistry promises to see continued interest, growth and development.

Microdentistry offers significant improvements in patient care. There is no satisfactory argument against early diagnosis and minimally invasive treatment. Improved visualization coupled with new technologies and materials will translate into better dentistry for all patients. It's not just about pits and fissures anymore, microdentistry is a growing movement in all aspects of clinical dentistry. This is the future of dentistry and it is being developed today. The World Congress of Microdentistry will be holding its third annual scientific session in Newport Beach, California August 21-24, 2002. The meeting is open to all members of the dental profession, including auxiliaries. For more information contact Annette Sigman at: (800) 475-5569 basigman@aol.com or visit the website at www.wcmicrodentistry.com. **DT**

References:

1. Kutsch VK. Microdentistry: a new standard of care. Journal Massachusetts Dental Society. Winter 1999. 47(4):35-39.

2. Christensen G. Has tooth structure been replaced? JADA January 2002. 133(1):103-105.

3. Lutz F, Krejci I. Resin composites in the post-amalgam age. Compendium December 1999. 20(12):1138-1148.

4. Weerheijm KL, de Soet JJ, de Graaff J, van Amerogen WE. Occlusal hidden caries: a bacteriological profile. J Dent Child 1990. 57:428-432.

5. Christensen R. Air abrasion caries removal, 5 year status report. Clinical Research Associates Newsletter. December 1999. 23(12):2-3.

6. Martens C, De Craene G, Dermaut R. The invasive pit and fissure sealing technique in pediatric dentistry: an SEM study of preventive restoration. J Dent Child 1988. 55(1-2):34-42.

7. Shuman, Ian E. Quantifiable caries detection, minimally invasive tooth preparation, and esthetic restorations. Contemp Esth Nov/Dec 2000. 4(11):44-48.

8. Milicich G, et al. Peripheral rim fracturing and the occlusal effect. PPAD April 2000. 12(3).

9. Moritz A, Schoop U, Goharkhay K, et al. Treatment of periodontal pockets with a diode laser. Lasers Surg Med 1998. 22(3):302-311.

10. Turner JW, Radford DR, Sherriff M. Flexural properties and finishing of acetal resin denture clasps. J Prosthodontics September 1999. 8(3):188-95.