The Advantages of Using a Dental Microscope in Restorative Dentistry – A Practically Oriented Report

Wolfgang Gänsler, DMD

Restorative dentists have been using magnifying optical systems, such as medical loupes and dental microscopes, for a long time. They have become an integral part of daily treatment. In this article I would like to highlight my personal successes after over 10 years of active application in daily routine, and explain the benefits and technological opportunities of such a "perfect visual aid" with a practice-oriented description.

Over the past 15 years there have been a number of fundamental technical changes in restorative dentistry. Restorative dentistry nowadays is no longer simply restricted to primary prosthetics-oriented treatment of a patient by providing appropriate work made in the dental laboratory. For colleagues practicing restorative, holistic dentistry it is now possible to provide patients with both aesthetic and functional restorations from the periodontal and endodontic foundation onward, after undergoing further training in certain specific disciplines and investing in those areas. These special fields include all aspects of periodontology, a systematic adhesive bonding technique, high-quality root canal therapy, periodontal plastic surgery, implant dentistry, and ultimately, after a lengthy period of treatment, permanent, functional and aesthetic restoration techniques (Fig. 1).

The first American specialist endodontists began integrating the dental microscope into their routine activities back in the mid 1980s. European restorative dentists were made aware of the use of the microscope in endodontics by American endodontists at the beginning of the 1990s. In Germany in the mid 1990s, colleagues with a high sense of technical commitment, such as Schlee, Dieterich, Iglhaut, and myself, began integrating the current design of the dental microscope into their practice concepts.

Reasons for turning to a dental microscope

Further development of adhesive bonding techniques, plus an increasing desire over the past 10 years to preserve teeth, has resulted in endodontics becoming highly important in restorative dentistry. In addition to the adhesive stabilization of teeth subjected to endodontic therapy, it was the introduction of the dental microscope that significantly increased success rates in primary and revision endodontic therapy as well as retrograde, apical surgery (Fig. 2).

Due to the prevailing physical laws and weak, shady illumination of an endodontic or periodontal subgingival surgical site by the operatory lamp, any outcome-oriented dentist reaches limits even with high-magnification loupes (up to approximately 5x magnification).

Recognition of the 4th canals existing in 98% of multi-root posterior teeth, the minutest lines of development and connection, a fractured foreign body, isthmuses, leakages, and ramifications in the deep root sections, is the domain of the dental microscope.

In this context the dental microscope with xenon illumination is the technologically perfect instrument for working in and on teeth with precision, optimal illumination, and variable magnification levels.

First experience with a dental microscope – today's standard

In 1996 I visited the ZEISS showrooms in Oberkochen, Germany. There, I decided in favor of a motorized dental microscope with an adjustable magnification level, xenon illumination, ceiling suspension, and technical features like a 180° tilting tube, dovetail mount as well as image and video documentation systems.

Like any new system that we integrate into our practice routine, working with the dental microscope slowed down procedures initially. Process sequences and instrument offering also had to be developed and the assistant trained to support dental microscope-based therapies.

If used on a daily basis, which is only feasible with a user-friendly dental microscope, the learning curve is very steep. Within six months the dental microscope became indispensable for complex endodontic and surgical interventions. During the following 10 years I began using the dental

Fig. 1: Application of adhesive on enamel

Fig. 2: Endodontic revision therapy

microscope as an integral part of my restorative therapies.

When we moved to new, more spacious premises and upgraded a treatment room that has an area of approximately 60 square meters and also serves as a seminar room for live operations, I switched to a new ZEISS dental microscope: the OPMI® PROergo system. This system was even more user-friendly than my proven ZEISS OPMI PROdent. The OPMI PROergo dental microscope allows optimal, ergonomic work even when treatment continues for several hours.

In the following section, I would like to describe in detail the advantages of using a dental microscope in restorative dentistry on a daily basis, which I now consider quite substantial.

Visualization of pathological findings for (new) patients – communication support

If the dental microscope features the appropriate video recording equipment, it is ideal for showing the (new) patient pathological findings vividly and visually. Together with a video documentation system such as the ZEISS MediLive® MindStream system, it is also possible to create a DVD for the patient due to undergo extensive and complex restoration work, and treatment sequences can be recorded and archived.

In addition to visualization, these recordings can also be used to provide convincing evidence to insurance companies. These video recordings are not to be underestimated as a form of quality assurance as, when reviewed, they enable dentists to reexamine complex therapies.

Comfortable treatment and ergonomics due to technological advantages

Since, with a dental microscope, it is technically feasible to feed xenon light into the observer's beam path view at an angle of less than 4°, illumination of even filigree sections of the surgical field is perfect. In conjunction with motorized zooming very local detail can be recognized, especially in endodontics.

As far as I was concerned, motorized adjustment of the focal length was one of the key points in favor of OPMI PROergo because, as opposed to my former system OPMI PROdent with its fixed focal length, this is a major advantage for daily work ergonomics. During procedures, which can take up to 2 hours, the dentist not only sits very upright, which is good for the back, but can now also position the patient vertically at such a small angle that the shoulder girdle is as relaxed as possible and the arms have an appropriate and relaxed grasping radius. Due to the 180° tiltable tube and the dovetail mount, the dentist always sits in a completely vertical posture and does not even have to tilt his head, which would have strained the neck muscles during lengthy sessions.

Conservative, adhesive restorations after systematic caries excavation

In cases with extensive carious defects and deep cavities, and where caries excavation is performed systematically and followed by adhesive management with built-up resin fillings, onlays placed at a later date may function properly for many years.

If caries is to be excavated close to the pulp, I like to use the dental microscope because, due to its shadow-free light in conjunction with rhodium-plated mirrors, it is excellent for distinguishing even the minutest of infected areas (Figs. 3, 4). The closer to the pulp the operator needs to work while removing caries, the more this type of optimal vision enables great care to be exercised.

Routine dental techniques – tooth extractions with complications

Which dentist has not experienced a seemingly simple extraction of a devitalized premolar that has undergone inadequate endodontic therapy, or an extraction of a

Fig. 3: Caries excavation close to the pulp

Fig. 4: Canal visualization after excavating caries from tooth 36

partially retained wisdom tooth that suddenly involved complications? The tooth fractures, individual fragments can only be removed with difficulty due to sclerosis of the individual roots with the bone, and vision is impaired by bleeding. Here, too, the dental microscope provides steady conditions due to its excellent illumination and adjustable magnification. The dentist can zoom down to the depth of the extraction alveolus and thus very precisely mobilize a stubborn root remnant if the assistant ensures minimal bleeding with the use of a special-purpose microaspirator. With microscope-assisted tooth extraction, the alveolar bone can also be preserved with a view to subsequent implantation.

Periodontal therapy in visually barely accessible (subgingival) root sections

In closed or open periodontitis therapy, based on the Full Mouth Therapy Concept, one often has the problem that the deep subgingival pockets or interdental recessions and furcations already affected by bone destruction are hardly accessible to the naked eye. Due to the optical benefits mentioned and the illumination of the surgical field, I like to use the dental microscope in these instances because it is possible to detect any clinging islands of biofilm and remove them precisely.

Orthograde and retrograde endodontics – the domain of the dental microscope

During the initial phase of my self-employment as a dentist, I was very dissatisfied with the quality of my endodontic therapies. In one particular case, (posterior) teeth that had undergone proper endodontic treatment caused the patient pain soon after the endodontic therapy. The patient was subsequently referred to an orthodontic surgeon, who worked conventionally without a dental microscope, for an apicoectomy. The patient's retrograde therapy was also only temporarily successful.

Due to the further endodontic training sessions I attended back in 1994/1995 with many American endodontists, among them Dr. Clifford Ruddle (Santa Barbara, California, USA) and Prof. Syngcuk Kim (University of Pennsylvania, Philadelphia, USA), I became aware that much higher success rates could be achieved in endodontics. At those presentations and courses I suddenly saw verification x-ray images showing 4 and 5 root canal systems which those endodontic professionals were able to localize by using a microscope.

As I explained in the introduction, it was just a small step toward purchasing the first ZEISS dental microscope of my own and gaining my first experiences with this slightly different "visual aid". Now, after 10 years of extensive use of the dental microscope in all restorative disciplines, it has become an indispensable part of my (endodontic) routine (Fig. 5).

The long-term success rates in orthograde and retrograde endodontics have risen toward 100%, firstly due to the more conservative preparation philosophies and the thermoplastic filling technique, and secondly due to the use of dental microscopes. The shadow-free, bright xenon light enables the straight canal sections to be examined right down to the constriction.

Ledges, branches, fractured instruments, perforations, foreign bodies, and even isthmus-like branch lines can be localized and simultaneously treated with slender ultrasonic tips under optimal, magnifying vision. The localization of absent canals, pulp denticles, tooth-colored restorations in the pulp chamber, and removal of old, insufficient root canal fillings is much more reliable when using magnification systems such as dental microscopes or medical loupes.

If, despite a seemingly sound orthograde root canal filling, apical inflammation does occur in a few cases - usually where apical ramifications are inaccessible - a

Fig. 5: Localization of the middle mesial canal 27

Fig. 6: Apical microsurgery on tooth 15

dental microscope is also a great help in apical microsurgery (Fig. 6). Again, the filigree apical portion of the root can be removed under optimal illumination and the leakage delta responsible for the inflammation prepared with ultrasonic tips and ligated with a suture.

Diagnosis of minute longitudinal fractures is often only possible at a magnification level exceeding 12x to 15x. Here too, the dental microscope provides useful diagnostic reliability.

Microsurgical techniques in periodontal plastic surgery and implant surgery

Application of microsurgical principles from vascular surgery to plastic dental surgery created a desire to use very fine suture material at a high level of magnification. Apart from the development of microsurgical instruments it was the medical loupe with a magnification of approximately 5x and the dental microscope with an even higher magnification that made it possible to see size 7.0 or 8.0 suture materials.

Incised sections of papilla must be adapted as precisely as possible, especially in the crucial, highly aesthetic, anterior gingival region. Here, a dental microscope allows excellent monitoring of suture use and ligature placement (Fig. 7).

Precise control of prosthetic preparations and impressions

In order to ensure precise preparation of a hard tooth structure, especially in the final phase of patient rehabilitation performed according to a treatment plan, it is essential to provide the dental technician with preparation margins that are as accurate as possible – irrespective of whether the restorations are to be made of gold or porcelain. I prepare the teeth to be restored using medical loupes before completing a final check or producing a preparatory finish under the dental microscope - it can be swung over the patient in a matter of seconds (Fig. 8). As part of the chain of precise quality assurance, I can also quickly check the impressions for accuracy under the dental microscope. When performing treatment with the dental microscope, over the years I have discovered that with an evolving level of training one can employ the dental microscope quickly and in many different ways, without slowing working procedures significantly more than when practicing using medical loupes.

The dental microscope as a high-quality marketing and positioning instrument

Routine work at a higher level of magnification encourages the dentist to maintain precision and accuracy, which represent integral parts of any high-quality, restorative practice philosophy. In my personal opinion, this technological development which enables the dentist to see every detail and can open up a new world of dental treatment simply by employing a user-friendly, well-equipped microscope, should not be underestimated.

I think that everywhere in the world an increase in the number of dental practitioners has brought about a situation where we are all competing for the same patients. Additionally, patients today are well aware of their role as clients in the dental health service sector and have the technical facilities for obtaining information easily (e.g., the internet). The less social security systems contribute to high-quality treatment using state-of-the-art methods, the more critical and performance-oriented those patients will be who can still afford modern, high-quality dentistry. In comparison to dentists working conventionally yet adequately, any colleagues working under magnification using a medical loupe or dental microscope are in a position to handle highly complex treatments successfully and will therefore have an enormous advantage.

For me, the dental microscope has added quite considerable technical reliability to my dental treatment routines. A command of even seemingly very difficult endodontic therapies, in conjunction with an increase

Fig. 7: Microsuture 5 days after implantation and augmentation

Fig. 8: Preparation of a quadrant for porcelain onlays

in experience and operating know-how, has meant that I am extremely confident when handling patients. A dental microscope in conjunction with the willingness to undergo further training and development in the specialized fields mentioned creates a wonderfully "unique selling proposition" in the competitive world of dentistry that is not easy to emulate.

For the past 10 years I have witnessed how delighted patients are who have undergone complex endodontic therapy with the aid of a dental microscope along with all other special endodontic instruments which combine to form wonderful advertising media. The difference from previous visits to the dental office is extremely obvious to the patient during treatment.

Conclusion – the advantages of using a dental microscope

In writing this practice and experience report my intention was to point out some advantages of the dental microscope that I have experienced during my career as a dentist employing microscopy. For me the acquisition of a dental microscope was one of the two crucial factors in my development to become a specialized restorative dentist. The microscope, in conjunction with further technological developments and an increase in experience, is bound to lead to specialization that will continue to enjoy a high degree of protection against emulation in the competitive world of dentistry.

One advantage of using the dental microscope that should not be underestimated, especially in the physically and psychologically highly strenuous dental profession, is a healthy, namely upright, working posture. Due to its superior technological features a convenient-to-use microscope can provide the dentist with considerable quality of life and good health. To put it crudely, the microscope can "hump up" for us as we sit in a highly ergonomic, upright position keeping the spine relaxed.

In my opinion, the dental microscope, with all its advantages, is now absolutely indispensable in any quality and outcome-oriented dental practice philosophy.

Image courtesy: Dr. Wolfgang Gänsler, Illertissen, Germany

Dr. Wolfgang Gänsler earned his DMD degree from the University of Ulm, Germany, and has continued highly intensive postgraduate training in all dental fields since then. He maintains his private practice in Illertissen, Germany, specializing in restorative dentistry with periodontal, endodontic, and functional pretreatment as well as full-mouth rehabilitation in centric mandibular relation. Since 1999, he has increased microendodontic orthograde and retrograde referral work. He has been working with a dental microscope in his practice since 1996. Dr. Gänsler holds live demonstration courses on endodontics and functioning as well as aesthetic composites. He also lectures about practice concepts and rubber dams as well as digital photography and much more.
Dr. Gänsler can be reached at Dr.Gaensler-Fortbildungen@t-online.de | www.praxis-dr-gaensler.de