ABSTRACTS

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L. Bjørndal

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How much endodontics are made and what is the standard procedure?

The endodontic status of a Danish population will be presented on the basis of: (i) a nationwide database including frequency of endodontic treatments over 25 years, (ii) endodontic questionnaires carried out amongst 600 randomly selected general practitioners (GP) and amongst all the members of the Copenhagen Dental association (n = 1156). Between 1977 and 2003 the annual number of root filled canals per 1000 patients has shown an increased by 17%. Today approximately 360 000 root fillings are performed per year. The number of tooth extractions has been more than halved within the same period. The reason to carry out root canal treatment is due to caries in over 50% of the cases. Treatment is most often carried out in molars, and in patients aged 40-60 years. In terms of procedure and the adoption of technology the following are noted: NiTi hand instruments were often used to negotiate canals by 18%, whilst 10% often used NiTi rotary systems. Electronic apex locators and warm gutta-percha techniques were employed by less than 20%. A majority (53%) often spent two sessions to instrument a molar, and 20% often needed three or more sessions. The regular users of a NiTi system and electronic measurement devices correlated with fewer treatment sessions than non-users. In addition, regular users of several new endodontic technologies was correlated with rubber dam application. In conclusion, an increase in the number of root filled canals per year was noted over the last 25 years, which is probably due to a reduction of the tooth extraction rate and an increased number of multi-rooted teeth in the population. The adoption of new endodontic technology amongst Danish general practitioners is at an exciting early phase. Hopefully, it will lead to an improved technical and biological treatment quality in private practice.

L.-L Kirkevang

Department for Oral Radiology, School of Dentistry, University of Aarhus, Denmark

The quality of endodontic treatments – Changes of periapical and endodontic status in the adult Danish population between 1998 and 2004

In 2000 the quality of root fillings in two Danish subpopulations (1974 vs. 1998) was compared. All patients had

undergone a full-mouth radiographic survey. In root-filled teeth the quality of the coronal restoration or crown, the quality the root filling, and the periapical status were assessed. The quality of coronal restorations and crowns did not differ significantly between the two populations, but the quality of the root fillings had improved during the 24 years. However, basic differences between the populations prevented direct assessment of the impact of this change on apical periodontitis (AP). In 2004 changes of periapical and endodontic status in a general Danish population was evaluated. In 613 randomly selected individuals full-mouth radiographic surveys were performed in 1998. Approximately 80% of these individuals were re-examined in 2004. All teeth were evaluated regarding periapical status according to the Periapical Index and presence of root-fillings. Compared to 1998 more individuals in 2004 had AP (50% vs. 42%) and more of the individuals had at least one root-filled tooth (59% vs. 52%). In 2004 and 1998 the frequency of teeth with AP was almost the same (3.7% vs. 3.3%). However, in 2004 more teeth had root fillings (5.7% vs. 4.8%) but fewer of the root-filled teeth had AP (44% vs. 52%). Of 313 root-filled teeth without AP in 1998, 20% developed AP and 3% was extracted. Of 303 rootfilled teeth with AP in 1998, 30% had healed, in 58% AP persisted and 11% had been extracted. More teeth presented with new periapical disease (AP), since the total number of teeth with AP was almost constant, and the number of rootfilled teeth with disease (AP) decreased.

C. Reit

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

Why is endodontics so difficult? Or is it?

High frequencies of technically defective root fillings have been demonstrated in most investigated populations. Unfortunately there is a strong correlation between substandard technical quality and the presence of post-treatment periapical disease resulting in a high frequency of 'failed' cases. Endodontic procedures are amongst the most challenging in clinical dentistry often including difficult access preparations and the negotiation of narrow and obstructed root canals. However, several investigators have made the apparently paradoxical observation that good quality root fillings are performed at a much higher rate by inexperienced dentals students than by experienced general dental practitioners. These findings indicate that the relatively low technical quality of root fillings produced not only can be explained by technical treatment difficulties. Few studies have been concerned with factors that influence the quality of root canal treatment performed in general dental practice. It might be assumed that such factors

will relate not only to the individual dentist and his or her knowledge, skill and attitude, but also to the context in which clinical work is performed. For example, the remuneration system, time pressure, patient expectations and quality of equipment are thought to have bearing on treatment quality.

G. Bergenholtz

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

Infection and inflammation – recent knowledge about immunologic and cellular reactions

The dental pulp is not normally recognised for its capacity to cope with injury and infectious challenges. Often it is seen as a rather helpless piece of tissue that easily breaks down subsequent to caries, trauma and operative procedures resulting in infectious processes affecting the periapical tissues. Clinical treatment decisions on cases with inflammatory pulpal involvements are affected by such views and endodontic therapy may more readily be chosen than a pulp preservation procedure even when the latter is a reasonable option. Recent years of pulp biology research on the defence and recovery potential of the pulp to microbial challenges have given us a more versatile understanding. Research has demonstrated that the pulpal tissue is fully capable of mounting swift and often effective inflammatory defence responses. The events leading to elimination of infectious elements and to pulpal repair/healing rely on sophisticated neuro-vascular interactions adapted to the pulp's specific location within the hard tissue structures of the tooth. They are also dependent on the involvement of a variety of cellular constituents belonging to the innate and the adapted immune defence including neutrophils and dendritic cells. In light of current knowledge the presentation will focus on the nature and function of the cellular and neurovascular elements involved in the tissue responses of the pulp to microbial influences. It will also describe how these events may appear in common pulpal disease conditions.

G. Bergenholtz

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

Diagnostic dilemmas

Differential diagnosis is about telling diseases or conditions apart, which may present with similar signs and symptoms. In Endodontics differential diagnosis relates to manifestations of pulpits and apical periodontitis, which are to be distinguished from other inflammatory conditions affecting teeth and their supporting structures. Such conditions may include periodontal disease, root fracture and external root resorption. Symptoms these conditions share with disorders of the pulp are well known and comprise pain, deep periodontal pockets, swellings, suppurations, increased tooth mobility, tenderness to biting pressure, palpation and percussion as well as periapically and/ or laterally located bone lesions. There are also a large number of non-dental conditions the clinician has to consider of which malignancy, although rare, belongs to a most feared diagnosis. Tools to distinguish one of two or more disease conditions from each other are limited. Although valuable clues are to be gained from the patient's disease history, the clinical presentation, the results of pulp vitality (sensibility) testings and the character of radiographic findings, the clinician has to contend with less than optimal diagnostic accuracy of these observations. In other words, a clinician has to be watchful for false leads and may therefore also include intuition and good clinical judgement in the diagnostic process. The lecture will display a series of clinical cases to demonstrate some of the intricacies one may be faced with in the practice of dentistry on distinguishing endodontic conditions from other dental and non-dental disorders.

P. Dummer

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Nickel titanium or stainless steel instruments?

Canal preparation should remove microorganisms and infected dentine, create space for irrigants and medicaments, and facilitate filling. Instruments and preparation techniques should be safe, predictable, efficient and associated with healing of periapical tissues. Although it is possible to enlarge canals effectively with stainless steel instruments their use by general dental practitioners is associated with root fillings of poor technical quality and a high prevalence of disease. Although the generally poor quality of root fillings may be a reflection of the competence of dentists and/or the economics of treatment provision, there is substantial evidence to suggest that use of stainless steel instruments is time-consuming, difficult to master and related to the creation of a variety of canal aberrations such as ledges, zips and perforations. Endodontic instruments made of nickel-titanium alloy are available in hand and rotary forms. Following their introduction in the mid-1990s the range of instrument designs has increased as manufacturers attempt to improve performance, as well as fight for market share. They have the advantage of being super-elastic that allows them to be manufactured with enhanced tapers that results in rapid removal of dentine, particularly in the coronal and mid root regions. In fact, evidence from laboratory studies has demonstrated they are safe, predictable and efficient; however, there are concerns about fracture of rotary systems in clinical use. Little evidence is available to suggest that nickel-titanium instruments are associated with treatment outcomes that are better than those achieved with stainless steel instruments. However, their use has provided the opportunity for the technical quality of root fillings to be improved in simple cases and those of moderate difficulty. Dentists should be aware of the advantages and disadvantages of endodontic instruments made from stainless steel and nickel-titanium. They should develop techniques that take advantage of the positive properties of each alloy; normally, this will result in hybrid techniques that involve both instrument types.

A. Molander

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

Hand instruments or rotating instruments?

Despite a marked decline in caries prevalence an expected corresponding decrease in the frequency of root fillings performed has not been observed. Also, an increased treatment of multi-rooted teeth has been observed over time. In most populations, a high prevalence of periapical radiolucencies in root-filled teeth, a high frequency of technically defect root fillings, and a strong correlation between the two occurrences have been reported. A major factor related to technical quality of root fillings is the challenge of mastering curved canals. Traditional stainless steel files makes this task difficult and time consuming. Several studies have shown the superiority of NiTi files over conventional instruments in this context and it might be assumed that a general adoption of NiTi technology might increase root-filling quality. A mandatory education programme regarding NiTi Rotary Instrumentation (NTRI) was conducted within the public dental service of Gothenburg. All employed dentists were enrolled. Technical quality of root-filled molar teeth were assessed before and after education. Four percent of the dentists were practising NTRI before the education. This frequency increased to 73% immediately after the intervention. Four years after the education programme the adoption rate was increased to 87%. According to a follow up questionnaire the most common reasons for adoption were that NTRI increased the technical quality of root fillings and that it made endodontic treatment easier and faster. The rate of 'excellent' root-fillings increased significantly from 29% before the education to 49% after the education. The increase was most pronounced in mesiobuccal canals in upper molars and mesial canals in mandibular molars. The rate of 'unacceptable' root fillings was not significantly decreased.

G. Debelian Private Practice, Bekkestua, Norway

Nickel-Titanium rotary instruments and instrumentation techniques

Rotary NiTi instruments offer significant advantages over stainless steel files that have been used in endodontics for many years and their use should be seriously considered by all dental practitioners. NiTi instruments are extremely flexible and can be bent into almost any position under rotation. It is extremely important to know the cutting efficiency of each NiTi file since that will determine how it should be used clinically. There are many NiTi file systems available on the market today, and all of them are superior to stainless steel files following the root canal anatomy when used correctly. During this presentation the major instruments available in the Scandinavian countries will be discussed along with their physical properties and differences. A comprehensive instruments sequence and clinical protocols to optimize root canal preparation efficiently and safely to avoid complications will be provided.

A. Wenzel

Department for Oral Radiology, School of Dentistry, University of Aarhus, Denmark

Digital radiography in endodontics

The major advantage in digital radiography is that it requires no chemicals and wet development. Further, most receptors need less radiation dose. The digital image is more dynamic than film, which means that fewer retakes are needed because of incorrect exposure. Some diagnostic tasks, particularly when distance measurements are needed, are easier with a digital image than film. Currently, the dentist can choose between two established concepts for direct digital image acquisition, the solid-state sensors and the storage phosphor image plate. In the sensor systems, a wire connects the receptor and the computer, and the image is displayed almost immediately on a computer monitor after exposure. In the storage phosphor system, a plate is exposed to x-radiation, and a latent image is created. The information contained in the plate is emitted when stimulated by light in a laser scanner. Scanning time range between 6 and 30 s, depending on the make. The image is displayed on the computer monitor, which facilitates patient information. The holders for the digital receptors have improved immensely in recent years. In connection with endodontic treatment, the first big advantage may be the short time between exposure and display of the image. The second advantage may be the software facilities for measurement calibration to a known file length and easy distance measurements for estimation of root filling length. Enhancement filters available in the software may facilitate the detection of the tip of the inserted endodontic instrument. Studies have found that various receptors are equally accurate in detecting the file tip, except for the finest size 10 instruments. Others have shown that accuracy of root filling length was similar with a phosphor plate and a sensor system. Factors other than image quality may therefore be relevant for the choice of receptor in endondontic treatment.

A. Fouad

Department of Endodontics, University of Maryland, MD, USA

Electrical apex locators – accuracy of recent improved instruments?

Electronic Apex Locators have been available for over 40 years. During this period of time, the technology has gone through several generations. Innovations in this area were aimed at enhancing accuracy, reducing the dependency on environmental factors, and facilitating the user interface. The current dual- or multi-frequency instruments emit different electrical currents with different impedances, and thus are able to measure the narrowest area in the root canal by measuring the point of change in the relationship of the impedance of the different current signals. Numerous clinical and in vitro studies have shown that apex locators are reasonably accurate in detecting the apical foramen. Furthermore, outcome studies have shown that they could reduce the number of radiographs taken whilst improving the final obturation distance from the apex. However, many cases are treated in which the root apex lacks an anatomical constriction or has blockage from

previous root canal treatment procedures and/or materials. Apex locators also do not provide information on the anatomy of the root canal system, the presence of multiple canals in a root or the necessary documentation of the working length determination step. Therefore, the use of a radiograph to verify the working length step is still important and necessary. This presentation will discuss all these issues, and present data on the current utility of electronic apex locators in endodontic treatment.

P. Wesselink

Department of Cariology, Endodontology, Pedodontology at the Academic Centre for Dentistry Amsterdam, The Netherlands

Ultrasonics and Laser – essential aids?

Both *in vivo* and *in vitro* research have shown that conventional root canal preparation with either hand or rotary instruments leave canals partially unclean. In spite of copious irrigation tissue remnants and bacteria remain in the canal. The anatomy of the root canal system apparently does not permit complete instrumentation and irrigation of the canal. Recent developments in irrigation delivery by ultrasound, laser activation or rapidly changing pressures in the canal are supposed to contribute to cleaner canals than by conventional methods. Data will be shown to which extent these suppositions are reality.

T. Kvist

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

The operating microscope – is that supposed to be good?

The use of the surgical operating microscope has brought light and vision into the pulp chamber and root canal as well as the operating field in surgical endodontics. The ability to visualize the root canal system in fine detail has made the surgical operating microscope an invaluable tool for specialists in endodontics. The magnification ranging from x04 to x30together with the coaxial illumination incorporated in most types of surgical operating microscopes has made the diagnosis of cracks and fractures more precise and accurate. With magnification ranging from x4 to x10 most operative procedures can be undertaken more safely. During non-surgical endodontic procedures microscopic examination of the pulp chamber helps to identify the openings of the root canals. Searching for calcified canal openings includes the use of the endodontic explorer, troughing with burs or ultrasonic tips and close visual inspection of the structures of the dentine in the floor of the access cavity. The surgical operating microscope is also beneficial for retrieval of broken instruments and management of perforations. In surgical endodontics the operating microscope helps the surgeon to identify root tips and to expose fused roots. On the resected root surface the surgical operating microscope disclose multiple foramina and isthmi. Ultrasonic retro-tips and micro mirrors and a full range of adjunctive instruments are available for the surgeon. The

tactile sensation is increased when the root surface is explored and instrumented with magnification. As a consequence surgical endodontics has left the era of guesswork and turned into a discipline of microsurgery.

A. Molander

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

Treatment of acute pain

Dental pain and its treatment will remain a major task for the dental profession. Still more than half of endodontic treatments are instituted due to pain. The most frequent therapy, both for non-vital and vital pain cases, is complete canal instrumentation. The number of endodontic treatments in molar teeth is increasing both with respect to acute and nonacute cases. Emergency cases are unscheduled and are often unwanted challenges to most practitioners. Moreover, endodontic treatment is time consuming and short cuts may cause technical and biological complications, thus compromising the prognosis of the tooth. In addition, it will ruin the schedule in the dental office. Consequently there is a need for safe and quick procedures. Regarding acute pulpits it has convincingly been shown that pulpotomy without the adjunct of a sedative medicament is as effective as complete pulpectomy. Also for acute apical periodontitis the mere trepanation and opening of the pulp chamber is equally effective in giving pain relief as complete instrumentation. It has been shown that approximately 90% or more of patients seeking care due to these diagnoses will experience sufficient pain relief using these rapid procedures. Information to the patient about expected development of pain level after emergency treatment is an important factor in the management of pain patients. It is recommended that the diagnostic procedures are focused and that 'pulpotomy' is carried out in order to avoid complications and save time.

A. Fouad

Department of Endodontics, University of Maryland, MD, USA

Antibiotics – when?

The use of antibiotics is prevalent in endodontic treatment. Practitioners prescribe antibiotics to treat spreading endodontic infections, to prevent flare-ups or exacerbations of asymptomatic endodontic infections and to manage all types of endodontic pain, including that from an inflamed vital pulp. This presentation will review whether there is evidence to support the use of systemic antibiotics in all these situations. The mechanisms of action and susceptibility profiles of endodontic bacteria will be discussed briefly. Outcome studies that investigated the use of antibiotics in endodontics will be explored, emphasizing the difference between clinical trials of one or more specific types of antibiotics, and those that used a randomised, placebo-controlled, study design. The presentation will outline current indications, as well as accepted regimens of systemic antibiotic. The presentation will also address the effectiveness of using topical antibiotics inside the root canal system, with emphasis on contemporary materials and medications. Novel antibiotics used in other types of infections, as well as novel methods to detect antibiotic resistance will be mentioned. Finally, the presentation will discuss issues of risk/benefit in the use of systemic and topical antibiotics, and will provide some insights into areas where further research could allow the use of antibiotics to more effectively manage patients with endodontic infections.

D. Ørstavik¹ & A. Molander²

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Treatment of infected root canals in one or two sessions?

Treatment of apical periodontitis is basically an antimicrobial treatment of the root canal system. The classical view that an inter-appointment dressing is necessary for satisfactory reduction of the root canal infection is challenged by treatment concepts using instrumentation and filling in one appointment. Filling of teeth with vital pulps or necrotic teeth without apical periodontitis pose little controversy, the issue is: can satisfactory disinfection of teeth with apical periodontitis be obtained in one appointment? It seems difficult, inasmuch as bacteriological studies have shown that only about half of the teeth become bacteria-free after instrumentation with sodium hypochlorite. However, novel approaches to instrumentation and filling may help overcome this problem. The first randomized study with follow-up results of one-appointment treatment and one-week calcium hydroxide showed no significant difference between the methods, although the results were marginally better for calcium hydroxide. More recently, in another randomized clinical trial, the antimicrobial efficiency of a ten-minutes intra-appointment dressing with 5% iodine-potassium-iodide was compared to a one-week interappointment dressing with calcium hydroxide. There was no statistically significant difference in bacterial numbers between the two modes of disinfection. Moreover, many root filling materials have antibacterial activity which may kill bacteria surviving initial instrumentation. It seems as if the number of visits is of less importance than putting sufficient effort into the chemo-mechanical treatment of the root canal system. It has also been shown that when practitioners master nickeltitanium rotary instrumentation, they significantly increase the technical quality of root fillings. This is in itself a crucial factor for the prognosis of treatment. Therefore, if time is not a limiting factor in itself, treatment of infected teeth with apical periodontitis in one appointment seems a viable option for teeth with simple root canals, particularly single-rooted teeth.

P. Wesselink

Department of Cariology, Endodontology, Pedodontology at the Academic Centre for Dentistry, Amsterdam, The Netherlands

Testing microleakage in the laboratory – requirements and clinical relevance

A large number of *in vitro* leakage studies appear in the endodontic literature. The usefulness of the information of

these papers is often questioned. However, within its limitations properly conducted *in vitro* leakages test are applicable for ranking old and newly developed filling materials on their sealing capacity. Especially those studies that produce quantitative data may give relevant information to the clinician to judge new materials and compare them with traditional existing sealers and root filling techniques. It will be shown which test may give relevant information and to which extent the information may be extrapolated to the clinical situation.

M. H. Lausten

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Selection of temporary filling

Leakage of a provisional filling material during root canal treatment may be a reason for unhealed endodontic treatments. In order to prevent bacterial leakage of the temporary endodontic filling, several in vitro studies have suggested a thickness of 3.5-4 mm. A Danish in vivo study tested the bacterial leakage of two temporary filling materials with clinical and microbiological evaluation. The noneugenol zinc oxide cement Coltosol® F was compared with the standard zinc oxide eugenol cement. The results showed a connection between bacterial leakage and the thickness of the fillings. There was a greater risk of reinfection with, e.g. Enterococcus species, when the filling had a thickness of 3 mm as opposed to 6 mm, but the choice of material had no direct effect on the bacterial leakage. There was a greater risk of reinfecton in multi-surface cavities as opposed to occlusal cavities. Recent in vitro results showed that the fracture frequency of teeth filled with Coltosol F and zinc oxide eugenol differed significantly (P = 0.0034). The hygroscopic expansion of Coltosol F in a cavity may lead to cusp deflection, infraction development and fracture. Coltosol F is not recommended for temporary filling in rootfilled teeth except for a few days. A temporary endodontic filling material with the thickness of 6 mm prevents bacterial leakage. As a clinical consequence the dentist should avoid the use of cotton pellets under the filling, if it reduces the thickness of the filling less than 6 mm.

D. Ørstavik

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New root canal sealers – are they better?

After a decade or two of relative standstill, many new root filling materials are emerging on the scene for better endodontic quality and performance. Accepting that placing the root filling is a difficult, yet critical aspect of endodontic treatment, methods of improving this procedure are in high demand. The root filling generally serves three functions: (i) sealing off the canal; (ii) burying and killing survivor microbes; and (iii) preventing stagnation of tissue fluid to serve as nutrients for surviving organisms. Silicone-based sealers,

Roeko-Seal and Gutta-Flow, claim superior adaptation to the canal wall, and Gutta-Flow also limits the need for extensive lateral condensation. These materials show high compliance with biological and technical requirements in standard specifications for endodontic materials. Clinical studies indicate that silicone-based sealers perform as well as conventional, zinc oxide eugenol-based materials. Resins for sealers have stirred a lot of controversy. Endo-Rez has been on the market for some time; it now comes with gutta-percha cones that are resin-coated for better adhesion between sealer and cone in order to minimize leakage along this interface. Much interest has been focused on Resilon/Epiphany, or Top-Seal, where the resin sealer adheres to root dentine via a primer, and where the gutta-percha has been replaced by a thermoplastic core which binds directly to the sealer. This has given rise to the 'monoblock' concept, where the material interfaces, which might allow for bacterial leakage, have been eliminated from one dentine surface to the other. Clinical studies with this material show promising results and compare favourably with conventional materials. These materials may improve our clinical performance and should be added to our armamentarium for improved results and better endodontic prognosis.

P. H. Bindslev

Department of Dental Pathology, Operative Dentistry and Endodontics, School of Dentistry, University of Aarhus, Denmark

Thermoplasticized root fillings – a way to go?

Warm gutta-percha techniques have been used for more than 40 years and the methods constantly developed and to some degree improved. Recently, a further modification of the warm technique has been introduced. In combination with the dentine bonding technique polymer based cones can be plastified by heat and introduced in the canal. The aim of the use of thermoplasticized root fillings has been to improve homogeneity of the filling and to reduce microleakage by improving the adaptation between root filling and canal wall. A further aim has been to infiltrate lateral canals and ramifications with root filling material. Heat and the resultant softening of gutta-percha can be utilized outside or inside the canal. By the inside technique a heated instrument plasticizes the gutta-percha which is then laterally or vertically compacted. When heat is utilized outside the canal a resin core covered with gutta-percha is heated in an oven and placed in the canal. Another method implies a thermoplastically moulded gutta-percha which is injected into the canal. Some of the systems demand considerable skills of the operator, especially to avoid periapical extrusion of root filling material. Some systems operate with high temperatures in the canal which may be harmful to the periodontal ligament. Furthermore, there is limited clinical documentation for the superiority of the warm techniques compared with the classical cold lateral technique. However, new developments are constantly introduced and some modifications of the warm technique seem promising.

C. Reit

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

When root fillings fail – Thought processes and clinical alternatives

Researchers have pointed out the high number of root-filled teeth with periapical lesions found in most studied populations. Recently it was speculated that the number could be as high as 3.6 million in Sweden, for example. Investigators have also focused attention on the substantial variation amongst clinicians in the management of such cases. To a large extent, this variation may depend not only on differences in personal value judgements, but also on the ambiguity of information regarding the outcome of retreatment and the risks of untreated disease. Clinical decision making involves complex interactions of possible decisions. However, a clinical decision problem can be structured and alternative actions available in a certain situation can be built up as a so called 'decision tree'. Following the diagnosis of a periapical lesion in an endodontically treated tooth the first choice is either to postpone the final decision and reexamine the patient a year later, or to make a final decision immediately. If the decision maker is attracted by the latter alternative, he is faced with a choice between accepting the treatment result or instituting additional therapy. If he regards therapy to be indicated, a decision has to be made between nonsurgical retreatment, surgical retreatment and extraction. Factors that must influence us at the various choice nodes will be discussed.

S. Friedman

Endodontic Department, University of Toronto, Canada

Orthograde retreatment: strategies and techniques

Orthograde retreatment is the primary treatment option for persistent disease after initial root canal treatment. However, many clinicians are concerned that orthograde retreatment is not possible to perform in some clinical situations, and consequently select surgical treatment or even extraction. To alleviate such concerns, this lecture will outline the main strategies and techniques of orthograde retreatment. Clinical examples will be used for illustration, demonstrating removal of crowns and posts, options for retaining crowns and posts, and elimination of different types of root filling materials.

T. von Arx

Department of Oral Surgery and Stomatology, School of Dental Medicine, University of Berne, Switzerland

Retrograde revision – recent methods

Endodontic surgery, and in particular periapical surgery, has seen enormous progress in the last decade. The development of new materials and surgical techniques including microsurgical principles has an ongoing impact in this speciality benefiting the patient and the clinician alike. It was realized that the identification, using magnification and treatment of microscopic findings, of isthmuses, accessory canals, or microfractures of the root would result in periapical healing. One device to optimize visualization in periapical surgery is the endoscope that the author has been using in periapical surgery is the endoscope that the author has been using in periapical surgery is the for nearly 5 years. During surgery, the endoscope is utilized for diagnostic procedures following root-end resection, root-end cavity preparation (retropreparation) and retrograde root canal obturation. Since the ultimate goal of periapical surgery is the sealing of any potentially noxious agent within the physical confines of the root, a root-end filling should prevent egress of bacteria, toxins and their by-products into the periradicular tissues. Modified zinc-oxide eugenol cements containing ethoxy benzoic acid have become a widely used retrofilling material. Recently, a new material, Mineral Trioxide Aggregate (MTA), has been introduced after extensive experimental investigation.

has been introduced after extensive experimental investigation. From these studies, MTA was found superior compared with traditional filling materials in terms of sealing ability, marginal adaptation and biocompatibility. A different approach of retrograde obturation using an adhesive technique is the sealing of the cut root-face with a specially developed resin composite (Retroplast). The author has worked with this material for more than 3 years and the preliminary results appear to be promising. A relatively new adjunct in periapical surgery is the use of regenerative techniques in conjunction with the surgical procedure. Although a number of case reports and case series have reported the potential of such treatment, the routine application of regenerative techniques in periapical surgery has to be thoughtfully evaluated at this time.

T. Kvist

Department of Endodontology, The Sahlgrenska Academy at Göteborg University, Sweden

The highest success rate – orthograde or retrograde?

A root-filled tooth with a persistent periapical lesion can be retreated using either an orthograde or a retrograde approach to the canal. In the orthograde or non-surgical retreatment the tooth is re-entered through the crown, the root filling removed and the canal again negotiated and exposed to antimicrobial rinsing and dressing before it is re-obturated. As an alternative root canals might be retreated from a retrograde direction. A surgical retreatment will include removal of the periapical soft-tissue lesion, resection of the root tip and placement of a retrofill. Several factors must influence the choice between non-surgical and surgical retreatment of a case, and aspects of biological outcome, costs and risks have to be deliberated. Outcome studies have focused almost exclusively on either surgical or non-surgical procedures. Only a few direct comparisons between the methods are available and data do not support

the notion of a systematic difference in healing potential between surgical and non-surgical retreatment. Therefore, the choice has to be based on individual case-related factors. In the majority of cases the aetiology of the persistent lesion is an intracanal infection, many of which are associated with a poor technical quality of the root filling. Therefore, there is an obvious rationale for non-surgical procedures in many cases. If, however, the seal is considered adequate surgical procedures should be considered. Root-filled teeth are often restored with crowns and posts. Their removal for access to the root canal will increase monetary costs and risks for fractures. Consequently more complex restorations favour a surgical approach. However, deliberation of medical circumstances or inaccessibility of the surgical site may result in an absolute or relative contraindication for surgical procedures. Finally, personal skills, training and armament of the dentist as well as patients individual preferences must be taken into consideration.

S. Friedman

Endodontic Department, University of Toronto, Canada

Treatment outcome and influencing variables – initial treatment

As technology in dentistry continues to improve, clinicians and patients are continuously challenged to make critical clinical decisions. Ouestions such as 'should a tooth be treated or rather extracted and replaced?' and 'is one technique better than the others?' are examples of the daily dilemmas faced by dentists. The basis for the answers to these questions is current knowledge about the outcome of endodontic treatment – the potential to achieve healing. The information about endodontic treatment outcome is greatly confused by the inconsistent reporting in the literature. For example, the 'success' rates of Initial (first-time) Treatment range from 44% to 98%, precluding specific conclusions regarding the outcome. This variability is caused by methodological differences amongst the studies, that also causes them to differ in the level of evidence they provide. Therefore, studies should be differentiated according to design and methodological rigor, and only the best evidence should be used to support clinical decisions. This lecture will review the studies on the outcome of Initial Treatment, and highlight those that comprise the best evidence. According to these studies, the probability of complete healing after Initial Treatment ranges from 73% to 86%, whilst several clinical variables can be identified that influence this outcome. The information derived from this lecture should be helpful for clinicians in their communication with patients, and facilitate clinical decision-making regarding endodontic therapy and alternatives.

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