MARILIA OLIVEIRA SARAIVA SEIJO

O ENSINO DE ENDODONTIA EM UMA INSTITUIÇÃO PÚBLICA: PERCEPÇÃO DOS ESTUDANTES

Belo Horizonte

Faculdade de Odontologia da UFMG

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Dissertação apresentada ao Programa de Pós-Graduação da Faculdade de Odontologia da Universidade Federal de Minas Gerais, como requisito parcial para a obtenção do grau de Mestre em Odontologia.

Área de concentração: Endodontia

Orientadores:

Profª. Drª. Renata de Castro Martins

Profª. Drª. Efigênia Ferreira e Ferreira

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Dissertação intitulada **"O ensino de endodontia em uma instituição pública: percepção dos estudantes"**, área de concentração em **Endodontia**, apresentada por **Marília Oliveira Saraiva Seijo**, para obtenção do grau de **Mestre em Odontologia**, **APROVADA** pela Comissão Examinadora constituída pelos seguintes professores:

Dra. Renata de Castro Martins
FAPEMIG - Orientadora

Dra. Efigênia Ferreira e Ferreira
FO-UFMG - Co-Orientadora

Dra. Daniela Lemos Carcereri
UFSC

Dra. Elen Marise de Oliveira Oleto
FO-UFMG

Profa. Dra. Maria Cássia Ferreira de Aguiar
Subcoordenadora do Colegiado do
Programa de Pós-Graduação em Odontologia

Belo Horizonte, 27 de julho de 2010.

DEDICATÓRIA

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RESUMO

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A percepção dos estudantes de graduação em relação o seu aprendizado é considerada um importante componente no monitoramento da qualidade dos programas acadêmicos. Dentro da Odontologia, a Endodontia é vista por muitos alunos como uma disciplina difícil. O emprego de novas tecnologias na graduação, como os instrumentos rotatórios de níquel-titânio (NiTi), poderá facilitar o trabalho e aprendizado dos estudantes, e contribuir na resolução da demanda reprimida por tratamento endodôntico dos pacientes assistidos pelo SUS. Tendo isto em vista, este estudo avaliou a percepção dos estudantes de Endodontia, da Faculdade de Odontologia da Universidade Federal de Minas Gerais, que empregaram instrumentos manuais de aço-inoxidável e rotatórios de NiTi durante a formatação de canais radiculares, e suas experiências de aprendizagem. Os estudantes matriculados nas disciplinas de Endodontia, do segundo semestre de 2009, foram divididos em 3 grupos (G): G1: estudantes do 5º período que formataram canais de dentes uni e/ou birradiculares com instrumentos manuais de aço inoxidável; G2: estudantes do 6º período que formataram canais de dentes multirradiculares com instrumentos manuais de aço-inoxidável; e G3: estudantes do 8º período que formataram canais de dentes multirradiculares com instrumentos rotatórios de NiTi. Um total de 126 questionários estruturados foi distribuído aos estudantes ao final do segundo semestre de 2009. As respostas obtidas foram categorizadas com relação ao rendimento durante o semestre, tempo gasto e qualidade dos tratamentos endodônticos realizados, dificuldades encontradas, características da técnica empregada, e sugestões para a melhoria da disciplina. A taxa de retorno foi de 115 questionários (91,3%), sendo 33% dos alunos do gênero masculino e 67% do feminino. O teste *Kruskal Wallis* não mostrou diferença estatisticamente significativa no rendimento relatado ($p=0,528$) e nas características das técnicas empregadas entre os 3 grupos. Os estudantes do G3 realizaram um maior número de tratamentos endodônticos ($p=0,009$), com menor tempo ($p<0,001$), comparado com estudantes do G1 e G2. Dificuldades foram relatadas pela maioria dos estudantes do G2 e G3, diferentemente do G1 ($p=0,048$). A qualidade relatada, dos tratamentos realizados, foi significativamente diferente apenas entre os estudantes do G1 e G2 (0,045). Atrasos, faltas e seleção dos pacientes, treinamento pré-clínico e clínico, dificuldades encontradas, tipo de técnica empregada e orientação dos

professores, foram os principais pontos citados pelos estudantes que podem afetar o aprendizado em Endodontia. Os instrumentos rotatórios de NiTi mostraram maior eficiência e resolutividade para formatar os canais radiculares, o que pode refletir em um importante impacto no aprendizado dos alunos e nos serviços de saúde pública A percepção dos alunos trouxe informações valiosas sobre o desenvolvimento da disciplina e o relacionamento entre professores e alunos, com a intenção de contribuir para o aprimoramento do ensino de Endodontia.

Descritores: Educação, odontologia, percepção, estudantes, endodontia, níquel-titânio, aço-inoxidável

ABSTRACT

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Endodontic teaching in a public dental school: students perceptions

The students' perceptions about their learning experiences are an important component to monitor the quality of academic programs. At Dentistry, the Endodontic discipline is considered difficult by many students. The use of new technologies at undergraduate, like nickel-titanium (NiTi) rotary instruments, will be able to become more easy the work and learning of students, and contribute at resolution of necessity for endodontic treatments at public service. This study evaluated the students' perceptions of Endodontic disciplines, at Federal University of Minas Gerais, that employed stainless-steel (SS) hand instruments and NiTi rotary instruments to perform endodontic treatments, and their learning experiences. The students enrolled at Endodontic disciplines, of second semester of 2009, were divided at 3 groups (G): G1; students of 5º semester that experienced treatments of straight canals with SS hand instruments; G2: students of 6º semester that experienced treatments of curved canals with SS hand instruments, and G3: students of 8º semester that experienced treatment of straight and curved canals with NiTi rotary instruments. A total of 126 questionnaires were distributed to dental students at the final of semester of 2009. The data obtained were categorized in accordance with the income during the semester, time spent and quality of the treatment executed, difficulties, technique employed, and suggestions to improve the discipline. The return rate was 115 (91.3%), being 33% of students of male gender and 67% of female. The Kruskal Wallis test showed no difference at income ($p=0.528$), and characteristics of technique employed ($p=0.560$), between the three groups. Students of G3 performed a great number of endodontic treatments ($p=0.009$), and with lesser time ($p<0.001$), compared with G1 and G2. The difficulties were related by the majority of G2 and G3, differently of G1 ($p=0.048$). The quality related of endodontic treatments performed was different only between G1 and G2 ($p=0.045$). The principal points that can be affect the Endodontic teaching based at perceptions of undergraduate students were: patients' lacks and delays, selection of patients, pre-clinical and clinical training, difficulties founded, type of technique employed, and

teachers’ orientation. The NiTi rotary instrument showed more efficiency and resolutivity than hand SS instrument to perform endodontic treatments, and it can reflect an important impact at a public dental service. The students’ perceptions brought valuable information about the development of the discipline and relationship between teachers and students, with intention to contribute to enhance the endodontic teaching.

Descriptors Education, dental, perception, students, endodontic, nickel-titanium, stainless-steel

LISTA DE ABREVIATURAS

ADEA	*American Dental Education Association*
NiTi	Níquel-titânio – *nickel-titanium*
SCR	Sistema de canais radiculares
SPSS	*Statistical Package for the Social Sciences*
SS	*Stainless-steel*
SUS	Sistema Único de Saúde
UNESCO	*United Nations Educational, Scientific and Cultural Organization*

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CONSIDERAÇÕES INICIAIS

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O relatório para a UNESCO (*United Nations Educational, Scientific and Cultural Organization)* realizado pela Comissão Internacional sobre Educação para o século XXI enfatiza, logo em seu início, a importância da Educação na formação interior do indivíduo, seus valores e atitudes. Este relatório enfatiza ainda que o conceito de educação ao longo de toda a vida vem dar resposta ao desafio de um mundo em rápida transformação, onde o indivíduo deve estar preparado para acompanhar essa inovação tanto na vida privada como na vida profissional, adaptando-se às transformações da sociedade sem deixar de transmitir os saberes básicos frutos da experiência humana. O importante é conceber a Educação como um todo entendendo os quatro pilares que a norteiam: o aprender a conhecer, a fazer, a viver junto e a ser (Jaques *et al*. 1998).

Desta forma, sob esta perspectiva, as reformas educacionais devem ser orientadas e inspiradas tanto no nível de elaboração de programas, como na definição de novas políticas pedagógicas. Novas proposições de ensino-aprendizagem junto à valorização da pesquisa e da responsabilidade social impulsionaram o aparecimento de um novo quadro aonde os cursos de Odontologia deveriam se inserir (Jaques *et al*. 1998).

De acordo com a Lei n^{o} 9.394 que estabelece as diretrizes e bases da Educação Nacional, a Educação Superior tem por finalidades estimular a criação cultural e o desenvolvimento do espírito científico e do pensamento reflexivo, inserir profissionais no mercado de trabalho aptos a participarem do desenvolvimento da sociedade brasileira, incentivar o trabalho de pesquisa e investigação científica, suscitar o desejo permanente de aperfeiçoamento cultural e profissional, e prestar serviços especializados a comunidade (Brasil 1996).

Pode-se dizer que a prática odontológica no Brasil é resultado de um modelo institucionalizado pelas universidades e associações de classe, vinculados a componentes econômicos, políticos e ideológicos. A educação odontológica é um processo contínuo destinado a produzir profissionais capazes de manter ou restaurar o estado de saúde da cavidade bucal. O objetivo é produzir, eficientemente, um número suficiente de profissionais, com a qualidade adequada, capazes de produzir, entregar e distribuir serviços odontológicos da maneira mais econômica possível. As profissões existem para satisfazer uma necessidade social, e a Odontologia não é exceção. Ela

opera em um sistema social, dentro do qual a profissão e suas instituições estão continuamente se reajustando de acordo com a mudança da tecnologia, dos pontos de vista profissionais, e das necessidades ou demandas da educação odontológica (Chaves 1977, Secco & Pereira 2004).

O ensino odontológico no Brasil, em geral, pode ser caracterizado por três fases: a artesanal, a acadêmica e a humanística. A fase artesanal, desenvolvida de forma empírica nos primeiros centros formadores, preocupava-se com a estética. A fase acadêmica foi assinalada pela implantação formal das primeiras Faculdades de Odontologia, e depois pelo reconhecimento da necessidade do embasamento das ciências biológicas. Nas últimas décadas do século XX surgiram as preocupações de introdução das matérias da área de humanas no currículo odontológico (Brasil 2006).

Com as Diretrizes Curriculares Nacionais de 2002, os cursos de Odontologia passaram pela mudança de paradigma na formação de um profissional crítico capaz de aprender a aprender, trabalhar em equipe levando em consideração a realidade social. O perfil do profissional de Odontologia mudou para o profissional generalista, com sólida formação técnico-científico, humanística e ética, orientado para a promoção de saúde, com ênfase na prevenção de doenças bucais prevalentes (Brasil 2006). As diretrizes também indicaram como elementos da estrutura curricular o desenvolvimento de metodologias que privilegiem a participação ativa dos estudantes na construção do conhecimento. A principal função do educador nessa abordagem educacional passa a ser a de um professor capaz de criar situações e condições de aprendizagem do educando, nas quais o objetivo é a construção de saberes a partir dos conhecimentos prévios frente às situações-problemas reais ou simuladas, com as quais os educandos serão confrontados (Brasil 2006).

Muitos educadores estão apostando na “mudança de velhas práticas, em um ensino que privilegie a produção do conhecimento por parte dos alunos” (Castanho 2000). O currículo em sintonia com a pesquisa para o curso odontológico necessitaria de reestruturação das faculdades brasileiras, de modo a estabelecer um projeto interdisciplinar capaz de garantir a vinculação da pesquisa ao ensino; flexibilizar a grade curricular, tendo em vista um ensino centrado no aluno; utilizando cenários de aprendizagem que insiram o aluno no atendimento odontológico em diferentes

contextos sociais, rompendo com a divisão entre o ciclo básico e o profissionalizante (Maltagliati & Goldenberg 2007).

O *feedback*, por parte dos sujeitos envolvidos no processo da educação (alunos e professores), é fundamental no processo de avaliação do ensino. Ele contribui para a determinação das aptidões, atitudes, e nível de conhecimento dos alunos, bem como, dificuldades encontradas pelos professores, permitindo uma avaliação por meio das opiniões dos sujeitos envolvidos neste processo. Isto se constitui em um ponto chave para o monitoramento da qualidade do ensino. Deve-se reconhecer a importância do *feedback* no processo educativo, pois este quando adequadamente gerenciado influenciará muito no desenvolvimento do currículo (Oliver *et al.* 2008).

Apesar da percepção do aluno contribuir com dados importantes para identificar os pontos fortes e fracos da educação odontológica, ela ainda tem recebido pouca atenção dos administradores e gestores do ensino. Henzi *et al.* (2005) avaliaram o ambiente de aprendizado através da percepção dos alunos e identificaram áreas no ensino odontológico que necessitariam de melhoras, como o modo como o aluno responde a situações de estresse, relação entre estudante e professor, experiência de aprendizado, interesse do aluno, e o suporte da instituição. Estes autores concluíram que conseguindo acesso a essas áreas de preocupação dos alunos, a faculdade poderia elevar o nível de satisfação dos estudantes com sua educação superior. Em 2007, Henzi *et al.* seguindo esta mesma linha de pesquisa, observaram que os estudantes desejam um currículo bem organizado e eficiente, com o máximo de experiência clínica possível e aberto às novas tecnologias, e que a faculdade deveria mostrar interesse em prover o bem estar do aluno. Dessa forma, é importante que a opinião dos alunos seja considerada em todas as discussões e decisões a respeito do ensino nas faculdades de Odontologia. O clima educacional afeta fortemente as realizações, satisfações e sucessos dos alunos, e por isso, obter um *feedback* regular sobre suas experiências no ambiente educacional possibilita administrar mudanças com sucesso (Till 2005, Divaris *et al.* 2008).

Na Odontologia os educadores estão inseridos em uma era onde mudanças fundamentais no formato do currículo e nos métodos de ensino/aprendizagem têm sido propostas. Os docentes em Odontologia têm escutado por mais de 10 anos que o sistema

educacional está com problemas e que os profissionais estão perdidos, sem visão e impossibilitados de conquistar seus objetivos (Hendricson *et al.* 2007). Sendo assim, a necessidade de mudanças dessa formação tem estado na pauta das discussões há algum tempo, e pouco se tem avançado. A questão da formação de profissionais de saúde envolve diretamente as oportunidades advindas do mercado de trabalho, o perfil profissional e a satisfação das demandas populacionais. Assim, a articulação entre as políticas de educação e de saúde é fundamental para que as transformações sejam possíveis (Araújo 2006).

A relação existente entre saúde e educação diz respeito à adequação dos profissionais às necessidades sociais da população. Essa relação deve ser obtida pela efetiva interação entre a formação dos profissionais de saúde, os serviços de saúde do SUS (Sistema Único de Saúde) e as comunidades, constituindo uma importante estratégia para promover as mudanças necessárias na formação acadêmica. Neste cenário, a Odontologia como profissão tem-se mostrado ineficiente nas suas ações, apesar de não ter ficado à margem das transformações vividas pelos sistemas de saúde nas últimas décadas. A prática atual da profissão é fruto da exaustiva ênfase dada ao caráter individualista que caracterizou a Odontologia desde o seu início (Araújo 2006).

O ensino odontológico é considerado um processo pedagógico complexo e muito estressante, onde o aluno matriculado em um programa de 4-6 anos de duração tem que se ater a uma diversidade de competências. Apesar das diferenças entre os sistemas educacionais, filosofias, métodos e recursos disponíveis mundialmente, o ponto de vista dos acadêmicos sobre a sua educação parece ser convergente para os assuntos que desenvolvem estresse, como: exames e notas, pouco tempo de prática clínica, relação aluno-faculdade e aspectos financeiros (Sofola & Jeboda 2006, Cardall *et al*. 2008, Divaris *et al.* 2008). Além disso, o currículo de Odontologia tem sido caracterizado como denso, inflexível e promotor da memorização do conhecimento sobre o raciocínio baseado em evidências e habilidades de pensamento crítico. Neste ambiente, os estudantes apresentam um comportamento passivo e são desencorajados a se tornarem pensadores críticos ao longo da vida. (Divaris *et al.* 2008, Fugill 2005). Aliados a isto, os exames, o tempo limitado para o lazer, a insegurança na passagem da fase teórica para a fase clínica são dificuldades enfrentadas no período da graduação que geram

estresse e acabam interferindo na performance do estudante durante o curso (Cardall *et al*. 2008).

A comissão de mudanças e inovações na Educação Odontológica da ADEA (*American Dental Education Association*) reporta que a Educação em Odontologia é descrita como cara e profundamente insatisfatória aos seus consumidores. As profissões existem para servir as necessidades da sociedade, comunidades e indivíduos que se tornam pacientes ou clientes em uma variedade de configurações. O serviço prestado pelos profissionais de Odontologia para a sociedade é salvaguardado por instituições acadêmicas de Odontologia que recrutam, formam e desenvolvem os futuros membros da profissão. Se educadores em Odontologia atendem a esses fins, as mudanças e inovações na Odontologia devem ser sensíveis à evolução das necessidades sociais, padrões de práticas, desenvolvimentos científicos e condições econômicas. As instituições acadêmicas de Odontologia devem preparar estudantes para serem inseridos na prática da Odontologia como profissionais, cidadãos informados, e líderes esclarecidos em um sistema de saúde em constante mudança. A questão mais grave enfrentado pelo sistema de cuidados a saúde oral, é fornecer cuidados para uma população crescente de pacientes carentes e inseguros, que não têm acesso aos cuidados de saúde oral e enfrentam o aumento dos custos da saúde (ADEA 2006).

O motivo que leva um aluno a se matricular em uma faculdade de Odontologia pode ser influenciado pelas expectativas do papel do dentista e em relação ao ambiente educacional e resultados do aprendizado. O grau de concordância entre expectativas e experiências pode determinar o desempenho dos alunos e o envolvimento com os cursos, especialmente se as expectativas não são preenchidas. Assim, os estudantes de Odontologia precisam de uma conexão entre a sua profissão e um ambiente de estudo, mas de acordo com suas expectativas de carreira (Kristensen *et al.* 2009).

A relação professor/aluno é a base para o bom desenvolvimento do aluno durante a graduação, pois os estudantes valorizam o conhecimento técnico de seus instrutores bem como a sua capacidade de serem consistentes, justos, sensatos e acessíveis (Connor & Troendle 2008). Os professores de Odontologia, também chamados de educadores, devem entender que liderança não é uma qualidade que poucos indivíduos possuem, e sim um processo que influencia os outros, nesse caso os alunos. Ensinar a essa nova

geração requer visão, criatividade e mente aberta. Os estudantes de hoje esperam dos seus instrutores acesso, receptividade e transparência nas decisões tomadas, dessa forma a performance acadêmica e a vida do estudante serão muito influenciadas pelos professores (Connor & Troendle 2007, 2008). Os professores dos cursos de graduação, e em especial da área da saúde, devem ter três responsabilidades básicas: definir um tom emocional adequado para cada sessão clínica; facilitar o processo de ensino-aprendizagem; e agir como modelos para seus alunos. A postura, gestos e expressões faciais dos instrutores enviarão mensagens aos alunos que muitas vezes terão um impacto maior do que as próprias palavras (Chapnick & Chapnick 1999).

Inserida no programa de Odontologia, a Endodontia é considerado por muitos estudantes de graduação como uma aprendizagem complexa, difícil e estressante devido à diversidade anatômica dos sistemas de canais radiculares (SCR). É uma disciplina que requer riqueza de dados e pormenores anatômicos do elemento dentário e das estruturas circunvizinhas, os quais são obtidos na imensa maioria das vezes pela imagem radiográfica. Outros fatores que se somam a isso são a responsabilidade com a saúde do paciente, e a falta de autoconfiança. Muitos estudantes não se sentem adequadamente preparados para a execução de procedimentos considerados de maior dificuldade, como o tratamento endodôntico de molares (Rolland *et al.* 2007). Esta insegurança pode ser um reflexo de aulas clínicas e didáticas insuficientes durante o currículo Odontológico (Hayes *et al.* 2001). Os estudantes de Odontologia sentem uma necessidade de terem contato com os pacientes o mais cedo possível, a fim de adquirirem experiência clínica, e desta forma sentirem mais autoconfiantes no seu desenvolvimento da atenção aos pacientes (Gerzina *et al*. 2005, Ashley 2006, Cardall *et al*. 2008).

O preparo mecânico-químico do SCR inclui a instrumentação mecânica e irrigação antibacteriana, e possui como objetivos a eliminação de microorganismos e a criação de um adequado espaço que permita uma obturação hermética e tridimensional do mesmo (Shilder 1974).

Os instrumentos manuais de aço inoxidável utilizados comumente na formatação dos canais radiculares apresentam uma menor flexibilidade, o que pode resultar em erros de procedimento como transporte, degrau ou perfuração. As ligas níquel-titânio (NiTi) têm se tornado populares para a confecção de limas endodônticas devido ao seu

menor módulo de elasticidade comparado com as de aço inoxidável (SS), o que facilita o uso desses instrumentos em canais curvos (Walia *et al.* 1988). Estes instrumentos formatam adequadamente os SCRs, com menor tempo, maior eficiência clínica, permitindo assistir a um maior número de indivíduos com alta qualidade técnica (Gluskin *et al.* 2001, Baumann 2004, Peru *et al.* 2006). No entanto, a introdução dos instrumentos rotatórios de NiTi para a prática de estudantes da graduação ainda encontra alguma resistência, apesar de vários estudos indicarem um baixo número de complicações (Gluskin *et al.* 2001, Sonntang *et al.* 2003; Peru *et al.* 2006). Fatores que têm dificultado a inserção destes instrumentos na graduação são os riscos de fratura e o maior custo destes instrumentos (Hänni *et al.* 2003, Arbab-Chirani & Vulcain 2004, Parashos & Messer 2006).

A Universidade Federal de Minas Gerais, em Belo Horizonte, possui um currículo que consiste de 9 períodos (semestres), e oferece anualmente 144 vagas para novos estudantes (72 por semestre). As disciplinas de Endodontia são ministradas durante os 5º, 6º e 8º períodos do curso. No 5º período (Endodontia I), os alunos têm o primeiro contato com a endodontia (teoria, pré-clínico em dentes extraídos e prática clínica com pacientes), e executam tratamentos endodônticos mais simples (dentes uni e/ou birradiculares), utilizando instrumentos manuais de aço-inoxidável. No 6º período (Endodontia II) os estudantes executam tratamentos endodônticos mais difíceis (dentes multirradiculares), utilizando, também, instrumentos manuais de aço-inoxidável. A disciplina de Endodontia III está alocada no 8º período. Esta é uma disciplina opcional do currículo, com um número de alunos matriculados menor que nas disciplinas obrigatórias (Endodontias I e II). Os estudantes matriculados nesta disciplina já cursaram previamente as disciplinas de Endodontia I e II, e utilizam instrumentos rotatórios de níquel-titânio (NiTi) e realizam principalmente tratamentos endodônticos de dentes multirradiculares.

É importante se avaliar a eficiência e aceitabilidade dos métodos educacionais, e das novas tecnologias empregadas na Odontologia, através da experiência de aprendizado dos alunos. Como os estudantes podem ser considerados peças importantes para se obter o *feedback* necessário para uma revisão curricular, e consequentemente, melhorias na relação ensino/aprendizado, este trabalho teve como objetivo avaliar a percepção dos estudantes de Endodontia, da Faculdade de Odontologia da Universidade

Federal de Minas Gerais (FO-UFMG), que empregaram instrumentos manuais de aço-inoxidável e rotatórios de NiTi durante a formatação de canais radiculares, e suas experiências de aprendizagem.

Devido à importância da publicação das pesquisas para o desenvolvimento científico e por ser uma forma objetiva de apresentação dos resultados conseguidos, essa dissertação foi estruturada na forma de dois artigos. O primeiro artigo comparou o uso de instrumentos rotatórios de NiTi e manuais de aço inoxidável, por alunos de graduação da FO-UFMG, durante a realização de tratamentos endodônticos. O segundo artigo avaliou a percepção dos estudantes de graduação sobre suas experiências de aprendizado nas disciplinas de Endodontia da FO-UFMG.

ARTIGO 1

The use of NiTi rotary instruments and stainless steel files by Brazilian undergraduate dental students

R. C. Martins[1], M. O. S. Seijo[1], E. F. Ferreira[2], S. M. Paiva[3], A. P. Ribeiro-Sobrinho[1]

[1]Department of Operative Dentistry, [2]Department of Social and Preventive Dentistry, [3]Department of Pediatric Dentistry and Orthodontics, Faculty of Dentistry, Federal University of Minas Gerais, Belo Horizonte-MG, Brazil

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Author for correspondence:

Renata Castro Martins

Carangola street 62/101 – Santo Antônio

30330-240, Belo Horizonte, MG, Brazil

Phone: +55 31 3293 27 86

e-mail: r.c.martins@uol.com.br

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Abstract

Aim: This study evaluated the use of nickel-titanium (NiTi) rotary instruments and hand stainless steel (SS) files by Brazilian undergraduate dental students to perform endodontic treatments.

Methodology: Data were collected via a questionnaire administered to undergraduate dental students enrolled in endodontics disciplines. The students were divided into three groups: G1, students who had treated straight canals with SS hand instruments; G2, students who had treated curved canals with SS hand instruments; and G3, students who had treated both straight and curved canals with NiTi rotary instruments. The number of endodontic treatments performed, types of teeth treated, students' income, time spent, difficulties encountered, quality of endodontic treatment, and characteristics of the technique employed were analysed.

Results: There was a 91.3% rate of return for the questionnaires. Lower molars were the most frequently treated teeth, followed by upper incisors. The Kruskal-Wallis test showed no differences in income ($p=0.528$) or in the characteristics of the technique employed ($p=0.560$) among the three groups. G3 students performed a greater number of endodontic treatments ($p=0.009$) in a smaller amount of time ($p<0.001$) than did G1 and G2 students. Difficulties were reported primarily by students in G2 and G3 and not G1 ($p=0.048$). The quality of endodontic treatments differed only between G1 and G2 ($p=0.045$).

Conclusion: The NiTi rotary instrument showed better efficiency and resolution for endodontic treatments than hand SS instruments, and should be included in undergraduate dental curriculum.

Introduction

Dental students' perspectives on their educational experiences are an essential component of curriculum planning; they can direct program changes that enhance learning. The importance of this feedback is well supported; however, it has received a little attention in dental school education planning (Henzi *et al*. 2005, Oliver *et al*. 2008).

Students consider dentistry one of the most difficult programs. In addition to its extensive program that requires dedication and financial resources, a number of factors, including clinical experience, the constant ranking and comparing of students, teacher/student relationships, patient/student relationships, the clinical application of theory, extracurricular opportunities, and self-confidence levels, can influence significantly the way students perceive and experience their education (Fugill 2005, Sofola & Jeboda 2006, Divaris *et al*. 2008).

Within the field of dentistry, endodontics is considered an especially difficult and stressful discipline. Because of the anatomical diversity of root canals, the need to provide care to patients and students' lack of self-confidence, many students do not feel adequately prepared for their assessments in the more difficult procedures, such as molar endodontic treatment. This insecurity may reflect insufficient clinical and didactic teaching of the dental curriculum (Rolland *et al*. 2007).

The chemo-mechanical instrumentation is the primary mean of removing the debris and microorganisms responsible for endodontic pathology. It must produce a continuous and progressively tapered shape that enhances irrigation and facilitates the tridimensional filling essential to successful treatment (Shilder 1974). Many debridement techniques have been proposed; however, the procedure remains a complex one that can be daunting for patients, clinicians and students.

Stainless steel hand instruments used for root canal shaping presents lack flexibility, which can result in procedural errors, such as transportation, ledges, or perforations. Nickel-titanium (NiTi) alloys have become popular for endodontic files because of their lower elastic modulus compared with stainless steel (SS), which facilitates the use of these instruments in curved canals (Walia *et al*. 1988). These instruments include design variables that allow clinicians to perform shaping procedures more easily, quickly, and

predictably (Gluskin *et al*. 2001, Baumann 2004, Peru *et al*. 2006). However, the introduction of NiTi rotary instruments to undergraduate training has met some resistance because of the risk of instrument fractures and the expensive infrastructure required (Hänni *et al*. 2003, Arbab-Chirani & Vulcain 2004, Parashos & Messer 2006), despite several reports indicating low numbers of such complications (Gluskin *et al*. 2001, Sonntang *et al*. 2003, Peru *et al*. 2006).

Students' perceptions of the instruments and techniques used for endodontic treatments must be collected to provide feedback about the quality of endodontic education. Therefore, the purpose of this study was to evaluate the use of NiTi rotary instruments and SS hand files for endodontic treatment by Brazilian undergraduate dental students enrolled in different endodontics disciplines during the second semester of 2009.

Material and Methods

This cross-sectional study was conducted with a group of 126 undergraduate dental students enrolled in endodontics disciplines during the second semester of 2009 at the Federal University of Minas Gerais, located in the city of Belo Horizonte, Brazil. The dental undergraduate program has a curriculum that consists of nine semesters and admits 144 new students annually (72 per semester). The endodontics disciplines occur during the fifth, sixth and eighth semesters of the program. During the fifth semester (Endodontics I), the students have their first contact with endodontics (theory and preclinical and clinical classes) and their first opportunities to execute simple endodontic treatments (single-rooted and/or double-rooted teeth), with an average of 30 hours of theory and 60 hours of clinical training. During the sixth semester (Endodontics II), the students execute more difficult endodontic treatments (multi-rooted teeth), with an average of 15 hours of theory and 60 hours of clinical training. In Endodontics I and II, the students use SS hand instruments to perform endodontic treatments. The endodontic discipline offered in the eighth semester (Endodontics III) is optional and includes a smaller number of undergraduate students than the endodontics disciplines required in the fifth and sixth semesters. The students enrolled in this optional discipline use NiTi rotary instruments to perform endodontic treatments, primarily of molars, and have an average of 15 hours of theory and 60 hours of practical

training. Independent of the instruments employed, the technique of choice was crown-down preparation.

The students were divided into 3 groups, according to the endodontics discipline in which they were enrolled:

Group 1 (G1; n=52): Endodontics I, in which fifth-semester undergraduate students perform endodontic treatments of incisors, canines and pre-molars using SS hand instruments (K-Flexofiles, Dentsply Maillefer, Ballaigues, Switzerland), using the Oregon technique (Marshall & Pappin 1980).

Group 2 (G2; n=62): Endodontics II, in which sixth-semester undergraduate students perform endodontic treatments of molars with SS hand instruments (K-Flexofiles, Dentsply Maillefer, Ballaigues, Switzerland), using the Buchanan technique (Buchanan 1989).

Group 3 (G3; n=12): Endodontics III, in which eighth-semester undergraduate students perform endodontic treatments of molars and, eventually, incisors, canines or premolars, with NiTi rotary endodontic instruments (ProTaper Universal, Dentsply Maillefer, Ballaigues, Switzerland), using the ProTaper technique (Ruddle 2001).

All endodontics disciplines include 4 hours per week of clinical practice. The students of G1 and G2 work in operator/assistant pairs, then each student meets a patient at each 15 days until the endodontic treatment is completed. The students of G3 work alone and meet a patient every week until the endodontic treatment is completed.

Approval for this study was provided by the Human Research Ethics Committee of the Federal University of Minas Gerais, Brazil (Protocol Number ETIC 0462.0.203.000-09). An information sheet was provided to each student explaining the purpose of the study, that the study was completely confidential, that participation was voluntary, and that no names would be used in the report. All students who agreed to participate signed an informed consent form.

A self-administered questionnaire consisting of nine open-ended questions and multiple-choice items was used for data collection. The questionnaire was administered to undergraduate students in G1, G2, and G3 during final examinations at the end of the semester. Some questions required a box to be ticked for response, with an option to add

additional comments if appropriate. Questions about the number of endodontic treatments performed, types of treated teeth, students' income, time spent on procedures, difficulties encountered, the quality of endodontic treatment performed, and the characteristics of the technique employed aimed to determine undergraduates' productivity and development in relation to their experience and number of semesters in the dental program.

A test-retest model was applied to assess answer variations from the same respondent at different times. Fifteen days after the first administration, the same questionnaire was administered a second time to eighteen students, corresponding to 14.30% percent of the total sample. Agreement between responses was measured with a weighted kappa coefficient, using GraphPad Software's Quick Calcs program.

The responses were selected on scales, and categorical responses were collated and analysed using Statistical Package for the Social Sciences (SPSS) version 17.0 for microcomputers. Descriptive statistics were obtained for all variables. Counts and percentages are reported for categorical variables, and mean and standard deviation (SD) are reported for continuous variables. Data obtained were subjected to a Kolmogorov-Smirnov test to determine their distribution. The absence of a normal distribution ($p<0.001$) led us to use a nonparametric Kruskal-Wallis test, and significance was determined at the 95% confidence level.

Results

Test-retest agreement measured by the weighted kappa coefficient was 0.839, with a confidence interval ranging from 0.666 to 0.883, demonstrating a high degree of reproducibility of the answers and, consequently, a high degree of reliability.

There was a 91.3% rate of return for the questionnaires, so the sample consisted of 115 dental students. Table 1 displays the distribution of counts and frequencies of all categorical variables in agreement among the groups.

There were no significant among-group differences in gender distribution ($p=0.834$). Female gender predominated in all groups.

The means and standard deviations (SD) of the number of endodontic treatments performed by students in G1, G2, and G3 were 1.61 ± 0.78, 1.34 ± 0.52, and 3.00 ± 1.34,

respectively. The statistical analysis showed significant differences between G3 and the other two groups (G1 and G2; p=0.009). The use of NiTi rotary instruments significantly favoured the efficiency and resolution of endodontic treatments, so the students in G3 performed a great number of endodontic treatments than those in G1 and G2. There was no statistical difference in the number of endodontic treatments performed by students in G1 and G2 (p=0.580).

A total of 185 endodontic treatments were performed by the students who participated in this study. Only one student in G2 did not specify what kind of teeth he treated during the semester. The count and frequency distribution for the number of endodontic treatments performed and the kinds of teeth treated according to group is presented in Table 2. In G1, the majority of endodontic treatments were performed in upper incisors (n=32 - 17.30%), followed by upper premolars (n=25 - 13.52%). The lower molars were the most frequently treated teeth in G2 (n=40 – 21.62%) and in G3 (n=15 - 8.11%), followed by upper molars (n=24 – 12.97% and n=8 - 4.32%).

Eighty six-students (74.8%) reported their income during endodontic treatments as good, 22 (19.1%) as reasonable, and 6 (5.2%) as bad. Only one student in G1 (0.9%) did not answer this question (Table 1). No statistical difference was noted between the groups (p=0.528), showing that students in G1, G2, and G3 had similar views of their income during endodontic treatments.

The time required to perform endodontic treatments was considered by the majority of the students as long (n=64 – 55.7%), followed by appropriate (n=38 – 33%). Only G3 students regarded the time spent as fast (n=8 – 7%). A total of 5 G1 students (4.3%) did not answer this question (Table 1). There was a significant difference when G1 and G2 were compared with G3 (p<0.001), showing that the NiTi rotary endodontic instruments used by G3 students allowed them to perform treatments more quickly. Between G1 and G2, there was no statistical difference (p=0.549).

Seventy students (60.9%) reported experiencing difficulties during endodontic treatments. However, 45 students (39.1%), 26 of whom were from G1, reported no difficulties (Table 1). A statistical difference in difficulties experiences during endodontic

treatment was found when G2 and G3 were compared with G1 (p=0.048), and no significant difference was found when G2 and G3 were compared (p=0.362).

Considering the quality of endodontic treatment performed, 97 students (84.3%) classified their treatments as good. Seventeen students (14.8%), 13 of whom were in G2, classified their treatments as adequate, and only one student in G1 (0.9%) classified them as bad (Table 1). A statistical difference was found when G1 and G2 were compared (p=0.045). No difference was detected between G1 and G3 (p=0.283) or G2 and G3 (p=0.68).

Fifty-eight students (50.4%) attributed positive characteristics to the technique they used during endodontic treatment. A total of 29 students (25.3%) did not answer this question. Only G1 and G2 students reported negative characteristics or a combination of positive and negative characteristics (Table 1), but there were no statistically significant differences among the groups on this question (p=0.560).

Discussion

Questionnaires have proven to be an effective method for capturing data related to educational issues. This study had a questionnaire response rate of 91.3%, which is adequate to provide meaningful data. However, great variability (63% to 100%) in return rates have been reported in other studies (Arbab-Chirani & Vulcain 2004, Sofola & Jeboda 2006, Rolland *et al*. 2007, Machado-Carvalhais *et al*. 2008, Sonntag *et al*. 2008, Mala *et al*. 2009, Polyzois *et al*. 2010). This variability can occur because the way of a questionnaire is presented (i.e., e-mail, letter, in the classroom). For this study, the questionnaire was administered to undergraduate students during their final examinations, in the classroom. The high response rate can be attributed to this fact.

The majority of students in all three groups were female. This result is in accordance with other studies (Machado-Carvalhais *et al*. 2008, Sharda & Shetty 2008) showing a trend toward more female than male students at dental schools. Sofola & Jeboda (2006), on the other hand, found a balance of gender among Nigerian dental students.

The use of NiTi rotary instruments significantly favoured the execution of more endodontic treatments. Students who used NiTi rotary instruments (e.g., those in G3)

performed more treatments than students who used stainless steel hand files (e.g., those in G1 and G2). Many authors have reported the advantages of rotary preparation with NiTi instruments over hand preparation for both experienced and inexperienced operators. Students have obtained significantly better results in root canal preparation with NiTi rotary instruments, which allow them to prepare curved root canals with less transportation and greater conservation of tooth structure compared with canals prepared with stainless steel hand instruments (Gluskin *et al*. 2001, Sonntag *et al*. 2003, Peru *et al*. 2006). This technology has been proven to be significantly faster than the hand technique, with a potential effect on patient treatment time (Gluskin *et al*. 2001, Sonntag *et al*. 2003, Arbab-Chirani & Vulcain 2004, Peru *et al*. 2006). The reduced time required to perform endodontic treatments was observed in the present study. Only students in G3 considered the time required to perform endodontic treatment as fast, while the majority of students in G1 and G2 considered it long. During the fifth semester, G1 students have their first contact with the endodontic discipline (theory and preclinical and clinical training). Even shaping single-rooted and/or two-rooted teeth with straight canals can present difficulties inherent in a new training, such as achieving adequate isolation and open access, determining working length, and preparing and filling the canal (Rolland *et al*. 2007). During the sixth semester, G2 students execute endodontic treatments in multi-rooted teeth, which are considered more difficult by many undergraduate students because of their anatomic complexity, with different angles and radius of canal curvature (Pruett *et al*. 1997, Rolland *et al*. 2007). These facts, plus the SS instruments employed, result in more time to perform endodontic treatments. By their eighth semester, G3 students have already taken Endodontics I and II. Consequently, they have greater ability and more endodontic experience than students in the other groups. These facts, plus the use of NiTi rotary instruments, allow them to complete treatments with less time, which increases the number of endodontic treatments they are able to perform.

The majority of students considered their income during endodontic treatment as good. However, despite the absence of statistical difference, some students, essentially those in G1 and G2, classified their income as reasonable or as bad, indicating some dissatisfaction. At Federal University of Minas Gerais, all endodontics disciplines require

60 hours of practical training per semester (4 hours per week). Preclinical training, using extracted teeth, takes place before clinical training with patients. During the fifth semester, the students (G1) have 16 hours of preclinical training and 44 hours of clinical practice with patients. During the sixth and eighth semesters, G2 and G3 students have 8 hours of preclinical training and 52 hours of clinical practice with patients. However, because the students in G1 and G2 work in operator/assistant pairs during clinical treatment, each student meets a patient at each 15 days, so the student's hands-on experience with patients is reduced by half. Dental students commonly perceived clinical experience to be the most important aspect of their education (Gerzina *et al*. 2005, Ashley 2006, Cardall *et al*. 2008). They want as much exposure to patients and as much experience in the clinical setting as feasible (Cardall *et al*. 2008). They feel less prepared for exercises that are perceived to be more difficult, such as endodontic treatments. The limited time for preclinical and clinical training in endodontics can result in low self-confidence during clinical practice. Students' self-confidence can be increased by greater exposure to procedures and patients (Rolland *et al*. 2007). These facts can explain the dissatisfaction noted between some G1 and G2 students about their income during endodontic treatment

Difficulties during endodontic treatments were reported by a large number of G2 and G3 students, while a half of the G1 students reported no difficulties. G2 and G3 students performed endodontic treatments of molars, which have a complex anatomy and curvatures while G1 students performed endodontic treatment of straight canals. Despite the difficulties found during endodontic treatment, the students regarded their treatments as good. Some students, the majority of whom were from G2, classified their treatments as adequate, and only one student in G1 (0.9%) classified as his/her treatment as bad. Radiographic studies used to evaluate the technical quality of root fillings performed by undergraduate students showed the highest percentage of adequate fillings in upper incisors, and the highest percentage of inadequate fillings in molars (Lynch & Burke 2006, Er *et al*. 2006, Moussa-Badran *et al*. 2008, Khabbaz *et al*. 2010). This may be due to problems such as ledge formation or the blockage of canals by dentine during instrumentation of curved canals (Er *et al*. 2006), and can explain the results founded. However, Moussa–Badran *et al*. (2008) attributed the poor technical quality of root fillings

performed by undergraduate students to the time constraints of pre-clinical training in endodontics, with consequent concerns about competence during clinical practice. On the other hand, Er *et al*. (2006) believe that the need to treat a high number of teeth in a limited amount of time might be an important factor related to the generally poor quality of root fillings performed by undergraduate students. The endodontic teaching program varies from dental school to dental school in relation to the number of hours devoted to theory and preclinical and clinical training (Er *et al.* 2006, Lynch & Burke 2006, Moussa-Badran *et al*. 2008, Sonntag *et al*. 2008). Many schools consider preclinical education essential for teaching manual skills. In those cases, theory may be underemphasized (Sonntag *et al*. 2008). However, is very important that students have the opportunity to apply educational theory in dental clinical practice and learn to solve problems related to patient care (Gerzina *et al*. 2005, Crawford *et al*. 2007).

Regardless of the instruments employed, all groups used crown-down technique. Only students who used SS hand instruments (G1 and G2) to shape the root canals attributed negative characteristics (such as “complex”, “boring” and “laborious”) to the technique employed. On the other hand, students who used NiTi rotary instruments (G3) attributed positive characteristics (“easy”, “fast” and “efficient”) to the technique employed. Arbab-Chirani & Vulcain (2004) observed positive perceptions from students using rotary NiTi instruments. The students classified these instruments as easier to learn to use, more rapid, safer, and more effective for clinical use, and considered these endodontic techniques generally better than manual root canal preparations. The same results were obtained by Sonntag *et al*. (2003).

The NiTi rotary technique should be integrated into undergraduate dental education, because it seems advisable for practical endodontic training to initiate with rotary technique. This would allow students gain confidence prior to performing more complex manual techniques by introducing a simple working sequence that would provide an initial sense of achievement (Sonntag *et al*. 2003). This technique could be safely introduced into undergraduate dental curriculum, resulting in a substantial improvement in the quality of root canal preparation, particularly by inexperienced students (Peru *et al*. 2006). It could also have an important impact on the efficiency and outcome of endodontic treatments.

Despite a marked decline in the prevalence of caries in several countries, the expected corresponding decrease in the frequency of endodontic treatment has not been observed. Dental caries and their effects continue to be responsible for the majority of root canal treatments (Quadros *et al*. 2005, Reit *et al*. 2007). Moreover, the reduced tooth extraction rate consequently puts more teeth at risk for pulpal injury (Reit *et al*. 2007). In this study, lower molars were more often treated endodontically, followed by upper incisors, in accordance with Quadros *et al*. (2005). The high incidence of endodontic treatment in lower molars may be due to the fact that these are the first permanent teeth to erupt in the oral cavity and, therefore, are more susceptible to dental caries. The incorporation of rotary NiTi instruments by dental schools would allow endodontic treatments to be performed more quickly, which could positively impact the demand for endodontic treatment, increase resolution in public clinics, and reduce the wait for treatment.

Despite their advantages, rotary instruments are not being used for training by all universities (Arbab-Chirani & Vulcain 2004, Parashos & Messer 2006). The main problem with allowing inexperienced operators to use rotary instruments is the risk of instrument fracture (Vieira *et al*. 2008). However, prior experience with hand preparation techniques does not necessarily lead to improved preparation for rotary tool use (Sonntag *et al*. 2003). Fracture rate was not examined in the present study; however, Sonntag *et al*. (2003) found no difference in the fracture rates of manual and rotary NiTi files used by students. On the other hand, Iqbal *et al*. (2006) showed that NiTi rotary instruments have a greater tendency to separate in root canals than stainless steel hand instruments, but they classified the failure rate as low, even in the hands of endodontic students with limited experience. However, others parameters, such as instrumentation technique, instrument design, instrument size, clinical use, angle and radius of the canal curvature, and the presence of a torque-controlled motor, influence the fracture rate of NiTi files (Pruett *et al*. 1997, Yared & Kulkarni 2002, Vieira *et al*. 2008). Another reason that discourages the adoption of this technology is the cost of these instruments (Hänni *et al*. 2003, Arbab-Chirani & Vulcain 2004, Parashos & Messer 2006). In agreement with Arbab-Chirani & Vulcain (2004), all French schools have incorporated NiTi rotary techniques in their endodontic curriculum but

continue to teach the manual technique. It may be that the cost of these instruments continues to discourage their use (Hänni *et al*. 2003, Arbab-Chirani & Vulcain 2004, Parashos & Messer 2006).

Student feedback is a fundamental part of the assessment and/or evaluation of teaching processes. It allows students to express their views, provides valuable information about their learning and suggests necessary curriculum modifications (Oliver *et al*. 2008). Despite the limitations of this study, such as the small number of students evaluated, the feedback obtained showed that NiTi rotary instruments were more efficient and resolutive than SS hand instruments for performing endodontic treatments, which could offer an adequate cost/benefit relationship for public clinics that have a high demand for endodontic treatments. There are many reports on rotary instruments and their properties, but studies relating to their use in dental schools and their impact on endodontic teaching and public dental service are few and need to be evaluated.

Conclusion

The NiTi rotary instrument showed greater efficiency and resolution than hand SS instruments during endodontic treatments, facilitating the faster treatment of a larger number of teeth. Therefore, these instruments should be included in dental curriculum to increase students' self-confidence by using a simple working sequence and to increase the number of patients treated at public clinics.

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Table 1 – Distribution of counts and frequencies for all categorical variables according to group

	Group							
	G1		**G2**		**G3**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Gender								
Male	18	15.6	16	13.9	4	3.5	**38**	**33**
Female	33	28.7	37	32.2	7	6.1	**77**	**67**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Number of endodontic treatments								
1	26	22.6	36	31.3	2	1.7	**64**	**55.7**
2	21	18.3	16	13.9	2	1.7	**39**	**33.9**
3	3	2.6	1	0.9	2	1.7	**6**	**5.2**
4 or more	1	0.9	0	0	5	4.3	**6**	**5.2**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Income during treatment								
Good	40	34.8	37	32.2	9	7.8	**86**	**74.8**
Reasonable	9	7.8	12	10.4	1	0.9	**22**	**19.1**
Bad	1	0.9	4	3.5	1	0.9	**6**	**5.2**
Did not answer	1	0.9	0	0	0	0	**1**	**1**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Time spent								
Fast	0	0	0	0	8	7	**8**	**7**
Appropriate	21	18.3	15	13	2	1.7	**38**	**33**
Long	25	21.7	38	33	1	0.9	**64**	**55.7**
Did not answer	5	4.3	0	0	0	0	**5**	**4.3**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Difficulties								
Yes	25	21.7	36	31.3	9	7.8	**70**	**60.9**
No	26	22.6	17	14.8	2	1.7	**45**	**39.1**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Quality of treatment								
Good	46	40	40	34.8	11	9.6	**97**	**84.3**
Adequate	4	3.5	13	11.3	0	0	**17**	**14.8**
Bad	1	0.9	0	0	0	0	**1**	**0.9**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**
Characteristics of technique employed								
Positive	26	22.6	24	20.9	8	7.0	**58**	**50.4**
Positive and negative	5	4.3	7	6.1	0	0	**12**	**10.4**
Negative	7	6.1	9	7.8	0	0	**16**	**13.9**
Did not answer	13	11.3	13	11.3	3	2.6	**29**	**25.2**
Total	**51**	**44.3**	**53**	**46.1**	**11**	**9.6**	**115**	**100**

Table 2 – Distribution of counts and frequencies of number of endodontic treatments performed by students and kind of teeth treated, according to group

Teeth	Group							
	G1		G2		G3		Total	
	N	%	n	%	N	%	n	%
Upper								
central incisor	18	9.73	0	0	1	0.54	**19**	**10.27**
lateral incisor	14	7.57	1	0.54	2	1.08	**17**	**9.19**
canine	4	2.16	0	0	0	0	**4**	**2.16**
1st premolar	14	7.57	1	0.54	2	1.08	**17**	**9.19**
2nd premolar	11	5.95	0	0	4	2.16	**15**	**8.11**
1st molar	0	0	21	11.35	5	2.70	**26**	**14.05**
2nd molar	0	0	3	1.62	3	1.62	**6**	**3.24**
Total	**61**	**32.98**	**26**	**14.05**	**17**	**9.18**	**104**	**56.21**
Lower								
central incisor	4	2.16	1	0.54	0	0	**5**	**2.70**
lateral incisor	1	0.54	0	0	0	0	**1**	**0.54**
canine	6	3.24	0	0	0	0	**6**	**3.24**
1st premolar	6	3.24	0	0	0	0	**6**	**3.24**
2nd premolar	5	2.70	0	0	1	0.54	**6**	**3.24**
1st molar	0	0	29	15.67	12	6.49	**41**	**22.16**
2nd molar	0	0	11	5.95	3	1.62	**14**	**7.57**
Not specified*	0	0	2	1.08	0	0	**2**	**1.08**
Total	**22**	**11.88**	**43**	**23.24**	**16**	**8.65**	**81**	**43.79**

*One student reported that he performed two endodontic treatments. but did not specify the kind of teeth

ARTIGO 2

Endodontic teaching in a Brazilian dental school: students' perceptions

Marilia O. S. Seijo, M.Sc.[1], Efigênia F. Ferreira, Ph.D.[2], Antônio P. Ribeiro Sobrinho, Ph.D.[4], Saul M. Paiva, Ph.D.[3], Renata C. Martins, Ph.D.[5]

[1]Postgraduate student - Department of Operative Dentistry
[2]Associate Professor - Department of Social and Preventive Dentistry
[3]Associate Professor - Department of Pediatric Dentistry and Orthodontics
[4]Associate Professor - Department of Operative Dentistry
[5]Postdoctoral research fellow - Department of Operative Dentistry
All at the Faculty of Dentistry, Federal University of Minas Gerais, Brazil

Author for correspondence:
Renata Castro Martins
Carangola street 62/101 – Santo Antônio
30330-240, Belo Horizonte, MG, Brazil
Phone: +55 31 3293 27 86
e-mail: r.c.martins@uol.com.br

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Endodontic teaching in a Brazilian dental school: students' perceptions

Abstract

Including students' perceptions in the educational process is considered a key component in monitoring the quality of academic programs. The aim of this study was to evaluate endodontic teaching in a public dental school in Brazil from the students' perspectives. A total of 126 self-administered, structured questionnaires were distributed to dental students graduating in 2009. The questionnaires were given during the final examinations to investigate their perceptions about endodontic learning. There was a 91.3% rate of return for the questionnaires. The obtained answers were discussed and analyzed, and they generated qualitative data showing students' perceptions in relation to their experience while engaging in the Endodontic curriculum. The principal points that can affect endodontic teaching according to the undergraduate students were the following: patients' absences and delays, selection of patients, pre-clinical and clinical training, difficulties founded, type of technique employed, and the teachers' orientation during endodontic treatment. The students' perceptions provided valuable information regarding the development of the discipline and the relationship between teachers and students. This study intends to contribute to the enhancement of endodontic teaching.

Key words: dental, education, students, perceptions, learning, teaching, endodontic

INTRODUCTION

The perception of undergraduate students on their experience in dental school must be considered in all discussions and decisions of dental education. Students can be valuable assets in providing feedback and suggestions for curriculum revision and for improvement of the learning environment.[1] Feedback is a fundamental part of the assessment and evaluation process. An effective evaluation provides important information, which contributes to both the success of the student and of the course. Additionally, it is essential to know how dental students prioritize the value of various components of their educational experience.[2] Unfortunately, the student voice often remains ignored when considering the future of dental education.[1]

Students taking healthcare courses show high levels of stress; therefore, dental students are stressed.[3] Several predictors of stress in healthcare students have been identified, such as financial security, work volume, competitive environment, availability of clinical equipment and materials, clinical training, self-confidence, and clinical supervision.[3,4,5]

In dental school, many students do not like their experiences because of the overly stressful learning environment.[1] The learning environment of the dental clinic is a challenging area for the teacher and the student. Students place high value on the technical expertise of their instructors. Thus, the effective student/teacher relationship has been suggested to be the foundation for student development .[6,7]

Within the field of dentistry, endodontic teaching is considered by many dental students to be complex, difficult and stressful because of the diverse anatomy of the root canals, the responsibility for patient care, and lack of self-confidence. Many students do not feel adequately prepared to take their assessments on difficult procedures such molar endodontic treatment. This insecurity can be a reflection of insufficient clinical and didactic teaching during the dental curriculum.[5] Dental students want as much exposure to patients and as much experience in the clinical setting as possible to make themselves more self-confident.[8]

The chemo-mechanical instrumentation of the root canal system is the primary method for removing debris and microorganisms that are responsible for endodontic pathology. A continuous and progressively tapered shape that enhances irrigation and

facilitates tridimensional filling must be established; this is essential for the success of endodontic treatment.[9] Many techniques of debridement have been proposed; however, it is still a complex procedure that can be daunting for the patients and the operator (clinicians or students).

Stainless steel (SS) hand instruments used to shape root canals presents lack flexibility; this can result in procedural errors, such as transportation, ledge, or perforation. Nickel-titanium (NiTi) alloys have become popular for use in endodontic files because of their great flexibility, when compared to SS, which facilities the use of these instruments in curved canals.[10] These instruments are made with variable designs that let clinicians perform shaping procedures more easily, quickly, and predictably.[11,12,13] These qualities reflect a greater clinical efficiency by allowing the clinician to assist a large number of patients with a high-quality technique. However, the introduction of NiTi rotary instruments to undergraduate training has met some resistance despite several reports indicating low numbers of complications.[11,13,14] This resistance occurs because of the risk of instrument fracture and the high cost of these instruments compared to SS files.[15,16,17]

The Federal University of Minas Gerais, in Belo Horizonte city, Brazil has a dentistry curriculum that consists of nine semesters and annually offers places to 144 new students (72 per semester). The endodontic disciplines occur at the 5º, 6º, and 8º semesters of the course. At the 5º semester (Endodontic I), the students have their first contact with endodontic discipline (theory, pre-clinical and clinical classes) and execute simple endodontic treatments (single-rooted and/or two-rooted teeth). On average, the students undergo 30 h of theory and 60 h of clinical training. At the 6º semester (Endodontic II), the students execute more difficult endodontic treatments (multi-rooted teeth) and undergo an average of 15 h of theory and 60 h of clinical training. The students at Endodontic I and II use SS hand instruments to perform endodontic treatments. The endodontic discipline at the 8º semester (Endodontic III) is an optional discipline during dental graduate school. A smaller number of undergraduate students enroll in this discipline. The students enrolled in this optional discipline have taken endodontic disciplines in previous semesters and have an average of 15 h of theory and 60 h of practical training. They use NiTi rotary instruments to perform endodontic

treatments on molars. Independent of the instruments employed, all endodontic clinics use the crown-down technique.

The perception of these students about the endodontic teaching had yet not been determined. As there is a complex relationship between student, teacher and educational environment, it is very important that the students provide feedback on the quality of their dental education. Therefore, this study aimed to evaluate endodontic teaching through the perception of students who were enrolled in this discipline in a public dental school in Brazil.

METHODOLOGY

This cross-sectional study was conducted with a group of 126 undergraduate dental students who were enrolled in the Endodontic disciplines during the second semester of 2009 at the Federal University of Minas Gerais, located in Belo Horizonte city, Brazil. The students were divided into three groups in agreement with the Endodontic disciplines that they were enrolled:

Group 1 (G1; n=52): Endodontic I discipline, where undergraduate students of 5º semester perform endodontic treatment on incisors, canines and premolars with SS hand instruments (K-Flexofiles, Dentsply Maillefer, Ballaigues, Switzerland) using the Oregon technique.[18]

Group 2 (G2; n=62): Endodontic II discipline, where undergraduate students of 6º semester perform endodontic treatments on molars with SS hand instruments (K-Flexofiles, Dentsply Maillefer, Ballaigues, Switzerland) using the Buchanan technique.[19]

Group 3 (G3; n=12): Endodontic III, where undergraduate students of 8º semester perform endodontic treatment on molars, and eventually incisors, canines or premolars, with NiTi rotary endodontic instruments (ProTaper Universal, Dentsply Maillefer, Ballaigues, Switzerland) using the ProTaper technique.[20]

Clinical training was 4 h of duration per week for all of the Endodontic disciplines. In the Endodontic disciplines I and II, the students work in pairs: an operator and an assistant. This way, each student meets the patient every 15 days until

the endodontic treatment is completed. During Endodontic discipline III, the students work alone and treat the patient every week.

Approval for the development of this study was received from the Human Research Ethics Committee of the Federal University of Minas Gerais, Brazil, (Protocol Number ETIC 0462.0.203.000-09). An information sheet was provided to each student explaining the purpose of the study, confidentiality, voluntary participation, and that no names would be used in the report. All of the students that agreed to participate in this study signed a consent form that was required by the ethics committee.

A self-administered questionnaire consisting of nine open-ended questions and multiple-choice items was used for data collection. The questionnaire was administered to undergraduate students of G1, G2, and G3 during their final examinations at the end of the semester. Some questions required a box to be marked for response, with an option to add additional comments if deemed appropriated. The questions focused on students' opinions about the following six general themes: "development during endodontic treatments", "time spent during endodontic treatments", "difficulties founded during endodontic treatments", "quality of endodontic treatments performed", "technique employed", and "suggestions to improve endodontic teaching".

Using the test-retest model to assess answer variations by the same respondent at different times, the same questionnaire was administered a second time 15 days after the first test to eighteen students, corresponding to 14.30% percent of the total sample. Agreement between responses on the two occasions was measured using the weight Kappa coefficient, using GraphPad Software's Quick Calcs program.

The comments made on the questionnaires were collated, read and analyzed qualitatively. General themes, such as "technique employed", were identified by the authors from the comments made by students. Comments were classified into themes by categories (e.g., positive and negative characteristics regarding the technique used in endodontic treatment).[5] Topics related to each category were empathized.

RESULTS

The agreement between responses on the two occasions (test-retest) measured by the weight Kappa coefficient was 0.839, with a confidence interval ranging from 0.666

to 0.883. This finding shows a high degree of reproducibility of the answers and a high degree of reliability.

The questionnaire response rate was 91.3%, which is adequate to provide meaningful data.

The majority of the students from the three groups considered their development to be good, but the responses ranged from reasonable to bad. Table 1 shows the categories classified into the general theme “development during endodontic treatments” and the topics related to each category.

Students of G3 classified the time spent during endodontic treatments as fast, while the majority of the students of G1 and G2 classified it as long. Table 2 shows the categories classified into the general theme “time spent during endodontic treatments” and the topics related to each category.

Difficulties during the endodontic treatments were expressed by the majority of the students in the three groups. Table 3 shows the categories classified into the general theme “difficulties founded during endodontic treatments” and the topics related to each category.

Regarding the quality of performed endodontic treatments, the majority of the answers from all the groups were classified as good; however, in groups G1 and G2 there were responses classified as reasonable or bad. Table 4 shows the categories classified into the general theme “quality of endodontic treatments performed” and the topics related to each category.

The majority of the students in all groups expressed that the technique that was used was good. Only students in G1 and G2 classified the technique to be reasonable or bad and related negative characteristics to the endodontic instruments that were used. Table 5 shows the categories classified into the general theme “technique employed” and the topics related to each category.

Table 6 shows the categories classified into the general theme “suggestions to improve endodontic teaching” and the topics related to each category.

DISCUSSION

The qualitative data required intense reading on the part of the researchers to identify the categories into general themes and the topics that related to each category, such as in other studies that use qualitative analysis of data.[1,5,6,8,21,22]

Similar to the present study, many other studies have shown that it is necessary to obtain regular evaluation and feedback because alterations can be made and mistakes corrected to improve the curriculum.[1,5,6,8,21,22,23]

It was observed that many topics related to each category had interrelation with different general themes. The topic "patients' absences and delays" was related to the following themes: "development during endodontic treatments", "time spent during endodontic treatments", and "suggestions to improve endodontic teaching". Comments such as "*…my development could be better if the patients did not absent or delay so much…*" (G2 student) denote the students' preoccupation with this problem, and this finding is confirmed by the suggestion to improve the discipline: "*…to restrict the patients' absences…"* (G1 student). Lack of appropriate patients was perceived as the most important problem detected by students.[5] These types of comments denote the frustration of the students because these events reflect greater time spent to perform the endodontic treatments and, consequently, in minor development during these treatments.

Another topic about patients, "patients' selection", was related to the theme "development during endodontic treatments". Endodontic treatment is secondary dental care that in many cases are referred to dental schools. However, a long time may pass until patients obtain endodontic care. Therefore, when they come for endodontic treatment the teeth needs gingival surgery before endodontic treatment or even extraction.[5] This situation is a problem for the patient and the student, and this preoccupation was noted in the suggestions: *"…the patients should be examined previously because many cases are not endodontic problems…"* (G1 student); or *"…to analyze if it will be possible to restore the teeth…"* (G2 student). This last comment also shows the difficulty students have in correctly diagnosing and treating the problem.[24] The students are encouraged to carefully select patients for competency exercises to reduce inevitable variability between them; however, this variability is impossible to avoid under realistic conditions.[5] These statements denote the anxiety of the students "to find" a patient that really needs endodontic treatment. This anxiety is a consequence of

the organized curriculum among traditional disciplines, which leads to fragmentation of knowledge and difficulties in establishing a correct diagnosis when considering all of the necessities of patients. Assessments should be carefully designed to allow for patient variability in enhancing student competency.[5] There is a necessity to organize disciplines around interdisciplinary themes. In most traditional dental school curriculums, the students are not engaged in the learning process. The principal objective of the school is to encourage each student to assume responsibility for his own learning. It helps students experience problems and solve problems based on pre-existing knowledge, inside of the clinical context.[24] One possible solution to this problem is the development of strategies where students perform dental treatment within a secondary care setting. This helps to overcome a number of problems regarding care of patients in the dental school setting, which provides a wide range of treatment options relevant to care and shifts the emphasis from student education to patient care. This will prepare the undergraduates for the "real world".[5]

The topics "clinical training" and "clinical experience" were related to the themes "development during endodontic treatments", "time spent during endodontic treatments", "difficulties founded during endodontic treatments", and "suggestions to improve endodontic teaching". The comments such as "*…the treatments are long because of lack of clinical experience…*" (G1 student) and suggestions such as "*…we should have more practical training to assist more patients and to perform more treatments…*" (G2 student) show the students' desire for more clinical experience. Students place a great deal of emphasis on practical application of their knowledge and learning through observation of the applications of their knowledge.[6,8,25] They cannot wait to get into the clinic and start working on patients. They want as much exposure to patients and as much experience in the clinical setting as feasible.[8] Students enjoy learning by practical demonstrations. They feel that this is 'real' life rather than theoretical, and it is easier to absorb the information.[26]

Many students indicated that the time for clinical training during the semester is limited. At Federal University of Minas Gerais, all Endodontic disciplines have 60 h of practical training during the semester, with 4 h per week. Students of G1 and G2 work in pairs (an operator and an assistant) during the patient's treatment so that each student treats the patient every 15 days. This reduces half of the time devoted to clinical

practice with patient. Working in pairs at 15 days each was cited by many of these students, mainly by G2 students, as a negative point. Responses such as "*…the sessions every 15 days delay the treatment and make students and patients stressed…*" (G2 student) and "*…the endodontic treatment performed by a pair difficult the clinical practice…*" (G2 student) illustrates this fact. Many responses suggest that clinical training should be every week and of a 2 h duration. This training should be alone and not in pairs. This finding shows the importance that students give to practical training and their intention to perform more endodontic treatments as well as have more practice and experience. In G3, the students work alone and treat the patient every week. If students of G1 and G2 worked alone every week, they could have more practical training and assist a great number of patients, which would reduce the stress of the students and patients.

It is essential to know what knowledge, skills, and behaviors the students need to effectively develop their skills. The topic "pre-clinical training" was also rated as very important to the skills of students. Comments such as "*…we should have more pre-clinical training…*" (G2 student) denoted that many students did not feel adequately prepared to complete their assessments. Procedures such as crown preparation and molar endodontics are listed as more difficult in the students' opinion.[5] The practice on extracted teeth has been a universal method of teaching pre-clinical endodontics; this training gives students the opportunity to gain expertise before treating patients.[27] At Federal University of Minas Gerais, the pre-clinical training by practicing on extracted teeth occurs before clinical training with the patient. Thus, students of G1 have 16 h of pre-clinical training and 44 h of clinical practice with patients. Students of G2 and G3 have 8 h of pre-clinical training and 52 h of clinical practice with patients. Students of G2 that performed endodontic treatments on molars felt the need for more pre-clinical training. This finding was observed from the following suggestion "*…to have the pre-clinical training be more efficient. At this year, there were only two classes of pre-clinical, and a few teeth to train…*" (G2 student).The students agree that pre-clinical training and clinical training are essential for their preparation for independent clinical practice.[6] Even students who felt they had a good learning experience related the few number of endodontic treatments performed with a little development. This situation was evidenced by the following comment: "*…my development was great in learning,*

but small in number of treatments performed…" (G2 student). This comment illustrates the importance that students attribute to clinic training.

On the other hand, if students do not have adequate clinical training, they can feel less prepared for exercises and activities that are perceived to be more difficult,[5] such as endodontic treatment of molar canals. In this way, students can feel fear or insecurity if the procedure that they need to do is considered complex. This is evident by the following responses: *"...the treatment is very time-consuming because of our inexperience and the great difficulty of achieving the root canals during both the shaping and the filling procedures…"* (G2 student) or "*…sometimes I have fear that I do not have adequate knowledge and clinical experience …"* (G1 student). One factor that is frequently associated with high student morale is clinical experience.[8] Clinical experience and confidence may not correlate with performance in simulation or written tests. The limited time in pre-clinical and clinical training in endodontics can result in low self-confidence during clinical practice. The problem of self-confidence can be reduced by greater exposure to procedures and patients. This helps students acquire the necessary skills through experience.[5]

The topic "lack of clinical experience" was also related to "development during endodontic treatments", "time spent during endodontic treatments", and "technique employed". More of the students in G1 and G2 considered the time spent during endodontic treatments to be long. They considered their development to be reasonable and it affected by the technique, especially students of G2. Only students of G3 classified the time spent as fast. Comments such as "*…the hand instrumentation takes too much time…"* (G2 student), "*…my development was limited by the technique…"* (G1 student), and *"…I was similar to my colleagues, but I think that we were slow…"* (G1 student) were related by students of G1 and G2. On the other hand, a comment such as "*…with the use of rotary instruments the treatment took less time…"* was expressed by a G3 student. These reactions in the groups with the technique employed was waited, because students of G1 and G2 used hand files to perform the root canals, while students of G3 employed NiTi rotary instruments. It must be remembered that students in G2 performed endodontic treatment with a greater degree of difficulty (curved canals) compared to students in G1 (straight canals).

The students that attributed positive characteristics to the technique employed show satisfaction because the technique makes endodontic treatment more efficiency. The negatives characteristics denoted by the dissatisfactions of the students with the technique were that it took too much time and that it was complex. Only students of G1 and G2 classified the Oregon and Buchanan's technique with negative characteristics. Comments such as "*…all techniques with manual instrumentation are stressful and very long…"* (G2 student) illustrate this fact. The desire to use rotary instruments in the endodontic clinic was noted by students of G1 and G2, such as in the suggestion from a G2 student "*… to use a rotary technique in Endodontic clinics…."* Perhaps if they had used NiTi rotary instruments to perform the root canals, their development would be better and more patients would be assisted. Studies have shown that inexperienced students are able to prepare curved root canals with rotary files with less transportation and greater conservation of tooth structure.[11,13,14] Actually, there is no consensus that students must first become competent with hand files before using rotary files. In accordance with Peru *et al*.[13], the NiTi rotary instruments can be safely introduced into the undergraduate dental curriculum with a substantial improvement in the quality and resolution of root canal preparation, particularly by inexperienced students. Many studies suggest a change in teaching where the students can perform root canals more easily and with less risk of procedural errors in less time improving clinical outcomes.[11,13,14]

This anxiety of the students often leads to skipping steps that are important for academics. This dissatisfaction leads to a feeling of anguish that causes poor self-assessment.[5] On the other hand, the students that considered endodontic treatments to be long said that they felt that the time spent was necessary. This fact is evidenced by these responses "*…in accordance with my ability…*" (G1 student); "*…with experience can be improved…*" (G1 student), or "*…compatible with my student position….*" (G2 student), which denote the necessity of students for more clinic training as discussed previously.

The topic "difficulties" was related with the general themes "development during endodontic treatments", "difficulties founded during endodontic treatments", "time spent during endodontic treatments", "quality of endodontic treatments performed", and "technique employed". The results showed that students have difficulties during exposure of radiographs; treatment of curved and narrow canals; during the phases of

access cavity, placement of the rubber dam, exploration, instrumentation and filling; and understanding and executing the specific technique. All these areas can lead to a high degree of stress, once endodontic teaching is considered by students as a complex, difficult and stressing learning process. According Rolland *et al*.[5], one the most cause cited is the root canals anatomy diversity, besides responsible for patient care and lack of self-confidence. Comments such as: "…*I have a great difficulty at x-rays' exposure with the rubber dam, which makes me lose time with repetitions*…" (G3 student); or "…*at the sessions where the radiographs are taken, there is little time to do other procedures…*" (G2 student); or "… *this discipline has high difficulty*…" (G2 student) confirm this observation. These responses denote stress and exhaustion of students.

This problem that occurs during the clinical treatments develops a stress that makes students more insecure in relation to their capacity to execute the treatment. The stress can be used until a certain level to increase the performance of student; however, if it reaches a determined point can become a trouble and intervene with the clinical performance of the students.[28] Dental students have been showed high levels of stress. Interestingly, clinical experience is the most frequently associated the stress experience because students perceived clinical experience to be the most important aspect of their dental education, regardless of year in school.[4,8,22]

Many answers show the great difficulty that students have at adequate X-rays exposure, harming their development and make them stressed, such as discussed previously. This fact also reflects the lack of theorical and practical knowledge about exposure of radiographs, and this fact appeared at the suggestions: "…*better training for radiography*…" (G1 student); and "…*to make sure that the graduations' student arrives at Endodontics I knowing how to take a X-ray with the bisection technique*…" (G1 student). The necessity of theorical contend integrates with the clinical practice also noted at many comments such as: "…*the theorical classes should be before practical classes*…" (G1 student), or "…*it is difficult to connect the theory with practice*…" (G1 student). Where the practical and theory are not taught together or linked effectively, students often perceive the two to be unrelated and have difficulty applying information and knowledge in a clinical situation.[25,26] For students, there is a challenge of putting theory into practice and how this could be best achieved. Putting theory into practice involved a strong connection between lectures, listening what the teacher has to say, and

other enabling resources, such as the availability of staff for informal discussion. Also, students have fears in making mistakes; however, it is important to learn from our mistakes. This insecurity can be a reflection of insufficient clinical and didactic teaching during the dental curriculum.[29] Studies have demonstrated that personal mistakes of the students also indicate that it would be better to be able to learn from other student's mistakes and to share their collective learning in this way though group discussions.[25] The necessity to share experiences and discuss clinical cases was suggested by many students. The undergraduate students should be engaged more actively in the learning process through reciprocity and cooperation among them, where good learning is collaborative and social, not competitive and isolated. The students can find better solutions to problems through collaboration than by work alone. Learning occurs when there is a connection between experiences with the reflection of the theory with the practice. Then, group learning improved the problem solving performance of the students at all ability levels.[24]

Despite the difficulties that were founded, the majority of the students classified the endodontic treatment performed as good. However, some G1 and G2 students classified the endodontic treatment performed by them as reasonable or bad. Students stated that the radiographic exams determine the quality of treatment. Statements such as "*… good, because the radiographs showed that the canals were instrumented and sealed until work length…*" (G3 student); or "*…reasonable, there was super extension of filling material…*" (G1 student) illustrate this fact. The radiographic evaluation is the method used to determine the technical outcome of endodontic treatment based on radiographic homogeneity and the length of root fillings.[29,30] For this reason, radiography training is fundamental in Endodontics.

Some students related the quality of their endodontic treatments only at the teacher opinion, such as: "*...in accordance with teacher's opinion, the treatment was very good*…." (G1 student). This finding demonstrates that for this student only the opinion of the teacher was sufficient to his personal satisfaction. The students have related the import role tutors have in building of their self-confidence about their knowledge. The main qualities emphasized in a tutor are interpersonal, including being approachable and friendly and non-judgmental. The students want to act such as the teachers that they admire. However, it is necessary that students have a reflective

posture about their development. Reflecting effectively is a skilled activity requiring an ability to analyze practice actions and beliefs and to make judgments about their effectiveness.[25] Students have to be able to evaluate their own performance against established norms. These skills are examples of meta-cognition: "learning how to learn". Learning does take time, and, in a variety of learning situations, the needed is roughly proportional to the amount to be learned.[24] Therefore, the reflective practice is, however, crucial to dentists because they are dealing with people who are all individual and require us to be responsive and reflective rather than simply carrying out a routine task or ritual.[25]

Besides the opinion of teacher his orientation was cited by students as an important fact at learning. Comments such as "*…the teachers should stay until the end of the time at the clinics and supervise the students' work…"* (G1 student)*;* or "*…the teacher should have more patience…"* (G2 student) were observed. The effective clinical teachers are considered to be those who have empathy, are capable of providing support, exhibit flexibility, and have the ability to gauge student development, in addition to being interpretive, focused, and practical.[6] Henzi *et al*.[21] noted that one of the most prevalent negative themes gathered from students' comments about their clinic experience focused in teacher's inconsistent feedback and condescending feedback. Trust is the foundation for an effective student-teacher relationship. Having established trust, the students were willing to cooperate even though they did not like what they were being asked to do. Once the trust has been violated, students may avoid the teacher whenever possible. The professor who is not trusted misses opportunities to teach.[7] In this study, it was noted that the students require more attention of the teacher to feel backed and safe, especially those who are having the first contact with the discipline as the students in group G1. The fear of being intimidated or humiliated causes a blockade in the teacher-student relationship, and consequently, in the learning process.

On the other hand, this trust was established between some students and teacher. This fact can be observed in statements such as "*… I learned so much and had support of my pair and my teacher…"* (G1 student). This fact reflects that a good relationship between the teacher and students is fundamental for developing skills and increasing learning. The effective supervision of learners involves problem-solving by students and instructors together, along the feedback, and theory-pratice linking[6].

The feedback is very important to student learning and provides much information that can help the development the interaction between learning-teaching of students, teachers and education institutions. Studies indicate that learning is facilitated if it is actively monitored and feedback about progress is included.[24] According to this study, the principal points that can affect Endodontic teaching based on the perceptions of undergraduate students were as follows: patients' absences and delays, selection of patients, pre-clinical and clinical training, difficulties founded and type of technique employed during endodontic treatment, and teachers' orientation. The importance of knowing students' perceptions relating to the development of dental learning is fundamental to creating strategies to enhance dental teaching, specifically endodontics. More studies evaluating student's perceptions are necessary to increase consistency of results and enhance dental teaching.

CONCLUSION

To keep improving the educational experience of students, it is important to receive regular feedback from students and, most importantly, to use this feedback to improve the areas of concern that they highlight. The principal points that can affect Endodontic teaching based on the perceptions of undergraduate students were the following: patients' absences and delays, selection of patients, pre-clinical and clinical training, difficulties founded, type of technique employed, and teachers' orientation during endodontic treatment. The students' perceptions brought valuable information about the development of the discipline and relationship between teachers and students with an intention to enhance endodontic teaching.

ACKNOWLEDGMENT

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Table 1 – Categories and topics related for the general theme "development during endodontic treatments"

Development during endodontic treatments	
Categories	**Topics related**
discipline development	• selection, absences or patients' delays; • amount of clinical training; • teacher orientation
clinical training	• difficulties or lack of clinical experience; • number of endodontic treatment performed; • time spent during endodontic treatment
association of categories*	• difficulties, lack of clinical experience and/or time spent during endodontic treatment; • clinical dynamics and teacher orientation

*The category "association of categories" showed more than one category of response

Table 2 – Categories and topics related for the general theme “time spent during endodontic treatments”

Time spent during endodontic treatments	
Categories	**Topics related**
adversities founded	• patients’ absences and/or holidays; • exhaustion of students and patients; • lack of clinical experience; • difficulties at exposure of radiographs and/or canals anatomy
discipline’s structure	• amount of clinical teaching; • time necessary to conclude the endodontic treatment; • technique employed
association of categories*	• lack of clinical experience and time necessary to conclude the endodontic treatment; • patients’ lacks and/or holidays, amount of clinical teaching, and/or time necessary to conclude the endodontic treatment; • lack of clinical experience and difficulties founded

*The category “association of categories” showed more than one category of response

Table 3 – Categories and topics related for the general theme “difficulties founded during endodontic treatments”

Difficulties founded during endodontic treatments	
Categories	**Topics related**
stages of shaping and root fillings	• access cavity and identification of root canals; • placement of rubber dam; • exploration and shaping of root canals; • determination of working length; • exposure of radiographs; • root canals filling
theorical and practical domain	• to lack of clinical experience; • domain of theorical content
association of categories*	• exploration and shaping of curved and narrow root canals, exposure of radiographs, and/or root canals filling; • lack of clinical experience, shaping and filling root canal, and/or exposure of radiographs; • another reasons (e.g.: extensive coronary destruction, instruments fractured, ledge, transport, patient fear, and comprehension of technique)

*The category “association of categories” showed more than one category of response

Table 4 – Categories and topics related for the general theme “quality of endodontic treatments performed”

Quality of endodontic treatments performed	
Categories	**Topics related**
with scientific and technique fundament	• chemomechanical preparation and/or root canals filling; • radiographic analysis; • difficulties or procedures errors; • integration of theory and practice
without scientific and technique fundament	• quality related; • previous study related; • correct execution of technique related; • supervision and opinion of the professor related; • difficulty or dissatisfaction related; • technique employed

Table 5 – Categories and topics related for the general theme “technique employed”

Technique employed	
Categories	**Topics related**
positive characteristics	• facility to execute and efficiency; • quality, time spent; • adequacy to the cases;
negative characteristics	• difficulties; • quality and/or time spent
positive and negative characteristics	• difficult x efficiency; • quality/time spent x efficiency; • difficult x facility

Table 6 – Categories and topics related for the general theme “suggestions to improve endodontic teaching”

Suggestions to improve endodontic teaching	
Categories	**Topics related**
dynamics of clinical teaching in Endodontic	• patients’ selection; • pre-clinical training; • clinical patient care; • individual work; • clinic’s dynamic
theorical and practical content in Endodontic	• theorical content; • insertion of new techniques at clinical practice; • teacher’s orientation; • radiographic’s orientation and available equipment
association of categories*	• patients’ selection, pre-clinical training, and/or clinical patient care; • patients’ selection, infrastructure and available equipment, and/or clinical patient care; • teacher’s orientation, infrastructure and available equipment, and/or clinical patient care

*The category “association of categories” showed more than one category of response

CONSIDERAÇÕES FINAIS

CONSIDERAÇÕES FINAIS

O emprego dos instrumentos rotatórios de NiTi durante a execução de tratamentos endodônticos, por alunos de graduação, se mostrou mais eficiente e resolutivo quando comparado aos instrumentos manuais de aço inoxidável. Este fato pode refletir em um importante impacto no aprendizado dos alunos e no serviço de saúde. Através do emprego destes instrumentos os estudantes tiveram a chance de ter contato com uma tecnologia de ponta, comprovadamente segura e eficiente, e que possibilitou a execução de um maior número de tratamentos endodônticos, de forma rápida, menos cansativa, e com grande qualidade técnica. Isto resultou em uma maior experiência clínica para os alunos e menor estresse, fatos essenciais para que se sintam mais confiantes e seguros diante dos desafios clínicos. Aliado a isso, o emprego destes instrumentos permitiu assistir a um maior número de pacientes atendidos no serviço público. A incorporação de tecnologias avançadas no currículo odontológico, como os instrumentos rotatórios de NiTi, na atenção de pacientes assistidos pelo SUS, deve ser revista e discutida, pois apesar da pequena amostra de estudantes participantes desta pesquisa, esta tecnologia teve uma grande aceitação pelos alunos, pelo uso de uma sequência simples e produtiva de trabalho, o que poderá contribuir para a resolução da demanda reprimida por tratamentos endodônticos, aumentando a resolutividade do serviço, diminuindo as longas filas de espera por um tratamento, e possibilitando uma adequada relação custo/benefício.

A percepção dos alunos de graduação, avaliada neste estudo trouxe informações valiosas sobre o ensino de Endodontia na FO-UFMG, com a intenção de contribuir para o aprimoramento da disciplina. De acordo com este estudo, os principais fatores citados pelos estudantes que podem afetar o aprendizado em Endodontia foram: atrasos, faltas e seleção dos pacientes; treinamento pré-clínico e clínico; dificuldades encontradas; tipo de técnica empregada; e orientação dos professores. Os relatos dos estudantes, de uma forma geral, enfatizaram a Endodontia como uma disciplina difícil, estressante, e cansativa, tanto para os alunos quanto para os pacientes, principalmente quando se utiliza instrumentos manuais de aço-inoxidável para realizar os tratamentos endodônticos. Os alunos se mostraram ansiosos e preocupados com a aquisição de experiência clínica. Desta forma, os alunos sentiram a necessidade de maior tempo de treinamento pré-clínico e clínico para que pudessem realizar um maior número de

tratamentos endodônticos, aumentando a experiência clínica e segurança. Os atrasos, faltas de pacientes, seleção inadequada dos casos e dificuldades encontradas, como tomadas radiográficas, isolamento absoluto, anatomia dos canais radiculares, bem como, as fases operatórias de abertura coronária, exploração, instrumentação, e obturação do SCR, foram citados como responsáveis por um maior tempo gasto para se concluir os tratamentos endodônticos e, consequentemente, por um menor número de tratamentos endodônticos realizados. Uma boa relação aluno-professor, baseada em atenção, paciência e orientação, se mostrou essencial no ensino da disciplina. Alunos que se sentiram apoiados por seus professores se mostraram mais confiantes e seguros para a execução dos procedimentos clínicos, enquanto que alunos que se sentiram desamparados por seus professores durante as atividades práticas, se sentiram inseguros e com maiores dificuldades durante a execução dos tratamentos endodônticos.

Como toda pesquisa, este estudo apresentou limitações, como o número pequeno de alunos participantes, e o fato dos dados serem baseados nas respostas dadas pelos estudantes através de questionários. Na tentativa de contornar a primeira limitação, estudos avaliando a percepção dos alunos por um período maior, ou com uma maior freqüência poderiam contribuir para aumentar a consistência dos resultados encontrados. Quanto ao fato de ter sido usado questionário neste estudo, pode ter existido o viés de informação e confiabilidade. Partiu-se do pressuposto que todas as respostas dadas pelos alunos continham informações verdadeiras, não sendo possível averiguar a veracidade das mesmas. Uma alternativa para se complementar este estudo, seria o uso de entrevistas.

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Considerações iniciais

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ANEXOS

ANEXO 1

AUTORIZAÇÃO DO COEP

UNIVERSIDADE FEDERAL DE MINAS GERAIS
COMITÊ DE ÉTICA EM PESQUISA - COEP

Parecer nº. ETIC 0462.0.203.000-09

Interessado(a): Profa. Efigênia Ferreira e Ferreira
Departamento de Odontologia Social
Faculdade de Odontologia - UFMG

DECISÃO

O Comitê de Ética em Pesquisa da UFMG – COEP aprovou, no dia 11 de novembro de 2009, após atendidas as solicitações de diligência, o projeto de pesquisa intitulado **"Tecnologias avançadas na atenção de pacientes assistidos pelo SUS na Faculdade de Odontologia da UFMG"** bem como o Termo de Consentimento Livre e Esclarecido.

O relatório final ou parcial deverá ser encaminhado ao COEP um ano após o início do projeto.

Profa. Maria Teresa Marques Amaral
Coordenadora do COEP-UFMG

Av. Pres. Antonio Carlos, 6627 – Unidade Administrativa II - 2º andar – Sala 2005 – Cep:31270-901 – BH-MG
Telefax: (031) 3409-4592 - e-mail: coep@prpq.ufmg.br

ANEXO 2

UNIVERSIDADE FEDERAL DE MINAS GERAIS
FACULDADE DE ODONTOLOGIA
DEPARTAMENTO DE ODONTOLOGIA RESTAURADORA

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO DO ACADÊMICO

Você está sendo convidado a participar da pesquisa de Pós-Doutorado "Tecnologias avançadas na atenção de pacientes assistidos pelo SUS na Faculdade de Odontologia da UFMG", desenvolvida pela cirurgiã-dentista Renata de Castro Martins (Telefones: (31) 3293 2786 - (31) 9968 4475, que irá avaliar se os tratamentos de canais realizados na Faculdade de Odontologia da UFMG estão resolvendo os casos de forma rápida e eficiente, e se os pacientes estão satisfeitos com o atendimento.

Os resultados desta pesquisa serão utilizados pela equipe de pesquisadores para trabalhos científicos, e em momento algum haverá divulgação dos seus dados pessoais como nome, endereço e telefone. A pesquisa será feita através de uma entrevista, com perguntas sobre o tratamento de canal que você realizou, como aluno de graduação, na Faculdade de Odontologia da UFMG, e suas impressões com o tratamento. Não existem perguntas certas ou erradas, o que importa é a verdadeira forma como aconteceu o tratamento de canal e quais foram suas impressões. Você pode decidir participar ou não da pesquisa, ou desistir em qualquer momento, sem prejuízo algum para você. Você não terá custo e nem recebimento para participar.

Os resultados deste estudo são de grande importância, e por isso, a sua colaboração e sinceridade são de grande valor. Se você precisar de mais esclarecimentos pode ligar para a equipe de pesquisadores (Renata de Castro Martins – Telefones: (31) 3293 2786 / (31) 9968 7544; Antônio Paulino Ribeiro Sobrinho – Telefone: (31) 9970 7063; Efigênia Ferreira e Ferreira – Telefone: (31) 9983 2256), ou procurar o COEP-MG, na Av. Antônio Carlos, 6627 - Unidade Administrativa II - 2º andar - Sala 2005 - Campus Pampulha - Belo Horizonte, MG, Telefone: (31) 3409-4592.

Eu _____ declaro ter sido devidamente esclarecido (a) sobre os objetivos da pesquisa de Pós-Doutorado "Tecnologias avançadas na atenção de pacientes assistidos pelo SUS na Faculdade de Odontologia da UFMG" e a forma como os dados serão coletados. Minha participação reflete o meu interesse em colaborar com a pesquisa. É minha escolha participar ou não. A minha decisão em não participar da pesquisa, ou em desistir a qualquer momento, não me trará prejuízo algum.

Belo Horizonte, ____ de _____ de _____.

Assinatura do acadêmico

Renata de Castro Martins_____
Antônio Paulino Ribeiro Sobrinho_____
Efigênia Ferreira e Ferreira_____

Pesquisadores responsáveis

ANEXO 3
UNIVERSIDADE FEDERAL DE MINAS GERAIS
FACULDADE DE ODONTOLOGIA
DEPARTAMENTO DE ODONTOLOGIA RESTAURADORA

QUESTIONÁRIO PARA O ACADÊMICO

Data da coleta de dados: _____
Nome do aluno: _____

1 – Clínica onde foi realizado o tratamento endodôntico:
( ) Clínica de Endodontia I
( ) Clínica de Endodontia II
( ) Clínica de Instrumentos Rotatórios

2 – Quantos tratamentos endodônticos você executou durante este semestre?_____

3 – Quais os dentes você executou tratamento endodôntico?

17	16	15	14	13	12	11	21	22	23	24	25	26	27
47	46	45	44	43	43	41	31	32	33	34	35	36	37

4 – Qual a sua opinião sobre o seu rendimento durante as sessões do(s) tratamento(s) endodôntico(s)?
_____
_____

5 – Qual a sua opinião sobre a duração do(s) tratamento(s) endodôntico(s)?
_____
_____

6 – Você teve alguma dificuldade durante a execução do(s) tratamento(s) endodôntico(s)?
( ) sim ( ) não
Em caso afirmativo, qual a dificuldade encontrada?
_____
_____

7 – Em sua opinião, o(s) tratamento(s) endodôntico(s) que você realizou ficou (ficaram):
( ) bom(s) ( ) mais ou menos ( ) ruim(s)
Por que? _____

8 – Qual a técnica que você empregou nesta disciplina, e qual sua opinião sobre ela?
_____
_____

9 - Você tem alguma sugestão para melhorar o tratamento endodôntico nesta disciplina?
_____
_____

ANEXO 4

INTERNATIONAL ENDODONTIC JOURNAL

The Official Journal of the British Endodontic Society, the European Society of Endodontology, the Flemish Society of Endodontology, the Irish Endodontic Society and the Lebanese Society of Endodontology
Edited by: PMH Dummer
Print ISSN: 0143-2885
Online ISSN: 1365-2591
Frequency: Monthly
Current Volume: 43 / 2010
ISI Journal Citation Reports® Ranking: 2009: Dentistry, Oral Surgery & Medicine: 13 / 64
Impact Factor: 2.223

Author Guidelines

Content of Author Guidelines: 1. General, 2. Ethical Guidelines, 3. Manuscript Submission Procedure, 4. Manuscript Types Accepted, 5. Manuscript Format and Structure, 6. After Acceptance
Relevant Documents: Copyright Form
Useful Websites: Submission Site, Articles published in *International Endodontic Journal*, Author Services, Blackwell Publishing's Ethical Guidelines, Guidelines for Figures

1. GENERAL

International Endodontic Journal publishes original scientific articles, reviews, clinical articles and case reports in the field of Endodontology; the branch of dental sciences dealing with health, injuries to and diseases of the pulp and periradicular region, and their relationship with systemic well-being and health. Original scientific articles are published in the areas of biomedical science, applied materials science, bioengineering, epidemiology and social science relevant to endodontic disease and its management, and to the restoration of root-treated teeth. In addition, review articles, reports of clinical cases, book reviews, summaries and abstracts of scientific meetings and news items are accepted.

Please read the instructions below carefully for details on the submission of manuscripts, the journal's requirements and standards as well as information concerning the procedure after a manuscript has been accepted for publication in *International Endodontic Journal*. Authors are encouraged to visit Blackwell Publishing Author Services for further information on the preparation and submission of articles and figures.

2. ETHICAL GUIDELINES

International Endodontic Journal adheres to the below ethical guidelines for publication and research.

2.1. Authorship and Acknowledgements

Authors submitting a paper do so on the understanding that the manuscript has been read and approved by all authors and that all authors agree to the submission of the manuscript to the Journal.

International Endodontic Journal adheres to the definition of authorship set up by The International Committee of Medical Journal Editors (ICMJE). According to the ICMJE, authorship criteria should be based on 1) substantial contributions to conception and design of, or acquisiation of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published. Authors should meet conditions 1, 2 and 3.

It is a requirement that all authors have been accredited as appropriate upon submission of the manuscript. Contributors who do not qualify as authors should be mentioned under Acknowledgements. **Acknowledgements**: Under acknowledgements please specify contributors to the article other than the authors accredited. Please also include specifications of the source of funding for the study and any potential conflict of interests if appropriate.

2.2. Ethical Approvals

Experimentation involving human subjects will only be published if such research has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki (version, 2002 www.wma.net/e/policy/b3.htm) and the additional requirements, if any, of the country where the research has been carried out. Manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and written consent of each subject and according to the above mentioned principles. A statement regarding the fact that the study has been independently reviewed and approved by an ethical board should also be included. Editors reserve the right to reject papers if there are doubts as to whether appropriate procedures have been used.

When experimental animals are used the methods section must clearly indicate that adequate measures were taken to minimize pain or discomfort. Experiments should be carried out in accordance with the Guidelines laid down by the National Institute of Health (NIH) in the USA regarding the care and use of animals for experimental procedures or with the European Communities Council Directive of 24 November 1986 (86/609/EEC) and in accordance with local laws and regulations.
All studies using human or animal subjects should include an explicit statement in the Material and Methods section identifying the review and ethics committee approval for each study, if applicable. Editors reserve the right to reject papers if there is doubt as to whether appropriate procedures have been used.

2.3 Clinical Trials

Clinical trials should be reported using the CONSORT guidelines available at www.consort-statement.org. A CONSORT checklist should also be included in the submission material.
The International Endodontic Journal encourages authors submitting manuscripts reporting from a clinical trial to register the trials in any of the following free, public clinical trials registries: www.clinicaltrials.gov, http://clinicaltrials-dev.ifpma.org/, http://isrctn.org/. The clinical trial registration number and name of the trial register will then be published with the paper.

2.4 DNA Sequences and Crystallographic Structure Determinations

Papers reporting protein or DNA sequences and crystallographic structure determinations will not be accepted without a Genbank or Brookhaven accession number, respectively. Other supporting data sets must be made available on the publication date from the authors directly.

2.5 Conflict of Interest and Source of Funding

International Endodontic Journal requires that all sources of institutional, private and corporate financial support for the work within the manuscript must be fully acknowledged, and any potential conflicts of interest noted. Grant or contribution numbers may be acknowledged, and principal grant holders should be listed. Please include the information under Acknowledgements.

2.6 Appeal of Decision

The decision on a paper is final and cannot be appealed.

2.7 Permissions

If all or parts of previously published illustrations are used, permission must be obtained from the copyright holder concerned. It is the author's responsibility to obtain these in writing and provide copies to the Publishers.

2.8 Copyright Assignment

Authors submitting a paper do so on the understanding that the work and its essential substance have not been published before and is not being considered for publication elsewhere. The submission of the manuscript by the authors means that the authors automatically agree to assign exclusive copyright to Wiley-Blackwell Publishing if and when the manuscript is accepted for publication. The work shall not be published elsewhere in any language without the written consent of the publisher. The articles published in this journal are protected by copyright, which covers translation rights and the exclusive right to reproduce and distribute all of the articles printed in the journal. No material published in the journal may be stored on microfilm or videocassettes or in electronic database and the like or reproduced photographically without the prior written permission of the publisher.
A completed Copyright Transfer Agreement Form (CTA), found at interscience.wiley.com/journal/iej must be received by the Editorial Office before any manuscript can be published.
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For questions concerning copyright, please visit Blackwell Publishing's Copyright FAQ

2.9 OnlineOpen

International Endodontic Journal offers authors the opportunity to publish their paper OnlineOpen. OnlineOpen is a pay-to-publish service from Blackwell that offers authors whose papers are accepted for publication the opportunity to pay up-front for their manuscript to become open access (i.e. free for all to view and download). Each OnlineOpen article will be subject to a one-off fee of $3000 to be met by or on behalf of the Author in advance of publication. Upon online publication, the article (both full-text and PDF versions) will be available to all for viewing and download free of charge. The print version of the article will also be branded as OnlineOpen and will draw attention to the fact that the paper can be downloaded for free.

Any authors wishing to publish their paper OnlineOpen will be required to complete the combined payment and Online Open Copyright Licence Form (Please note this form is for use with OnlineOpen material ONLY).Once complete this form should be sent to the Production Editor (address on the form) at the time of acceptance or as soon as possible after that (preferably within 24 hours to avoid any delays in processing). Prior to acceptance there is no requirement to inform the Production Editor that you intend to publish your paper OnlineOpen if you do not wish to. Authors wanting to publish their paper OnlineOpen should complete the Online Open Copyright Licence Form and not the Copyright Transfer Agreement.
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3. MANUSCRIPT SUBMISSION PROCEDURE

Manuscripts should be submitted electronically via the online submission site http://mc.manuscriptcentral.com/iej. The use of an online submission and peer review site enables immediate distribution of manuscripts and consequentially speeds up the review process. It also allows authors to track the status of their own manuscripts. Complete instructions for submitting a paper is available online and below. Further assistance can be obtained from iejeditor@cardiff.ac.uk.

3.1. Getting Started

Launch your web browser (supported browsers include Internet Explorer 5.5 or higher, Safari 1.2.4, or Firefox 1.0.4 or higher) and go to the journal's online Submission Site: http://mc.manuscriptcentral.com/iej
Log-in, or if you are a new user, click on 'register here'.
If you are registering as a new user.
- After clicking on 'register here', enter your name and e-mail information and click 'Next'. Your e-mail information is very important.
- Enter your institution and address information as appropriate, and then click 'Next.'
- Enter a user ID and password of your choice (we recommend using your e-mail address as your user ID), and then select your areas of expertise. Click 'Finish'.
If you are registered, but have forgotten your log in details, please enter your e-mail address under 'Password Help'. The system will send you an automatic user ID and a new temporary password.
• Log-in and select 'Author Centre '

3.2. Submitting Your Manuscript

• After you have logged into your 'Author Centre', submit your manuscript by clicking on the submission link under 'Author Resources'.
• Enter data and answer questions as appropriate. You may copy and paste directly from your manuscript and you may upload your pre-prepared covering letter.
• Click the 'Next' button on each screen to save your work and advance to the next screen.
• You are required to upload your files.
- Click on the 'Browse' button and locate the file on your computer.
- Select the designation of each file in the drop down next to the Browse button.
- When you have selected all files you wish to upload, click the 'Upload Files' button.
• Review your submission (in HTML and PDF format) before completing your submission by sending it to the Journal. Click the 'Submit' button when you are finished reviewing.

3.3. Manuscript Files Accepted

Manuscripts should be uploaded as Word (.doc) or Rich Text Format (.rft) files (not write-protected) plus separate figure files. GIF, JPEG, PICT or Bitmap files are acceptable for submission, but only high-resolution TIF or EPS files are suitable for printing. The files will be automatically converted to HTML and PDF on upload and will be used for the review process. The text file must contain the entire manuscript including title page, abstract, text, references, tables, and figure legends, but no embedded figures. In the text, please reference figures as for instance 'Figure 1', 'Figure 2' etc to match the tag name you choose for the individual figure files uploaded. Manuscripts should be formatted as described in the Author Guidelines below. Please note that any manuscripts uploaded as Word 2007 (.docx) will be automatically rejected. Please save any .docx file as .doc before uploading.

3.4. Blinded Review

Manuscript that do not conform to the general aims and scope of the journal will be returned immediately without review. All other manuscripts will be reviewed by experts in the field (generally two referees). International Endodontic Journal aims to forward referees´ comments and to inform the corresponding author of the result of the review process. Manuscripts will be considered for fast-track publication under special circumstances after consultation with the Editor.

International Endodontic Journal uses double blinded review. The names of the reviewers will thus not be disclosed to the author submitting a paper and the name(s) of the author(s) will not be disclosed to the reviewers.

To allow double blinded review, please submit (upload) your main manuscript and title page as separate files.

Please upload: • Your manuscript without title page under the file designation 'main document'

• Figure files under the file designation 'figures'

• The title page and Acknowledgements where applicable, should be uploaded under the file designation 'title page'

All documents uploaded under the file designation 'title page' will not be viewable in the html and pdf format you are asked to review in the end of the submission process. The files viewable in the html and pdf format are the files available to the reviewer in the review process.

3.5. Suspension of Submission Mid-way in the Submission Process

You may suspend a submission at any phase before clicking the 'Submit' button and save it to submit later. The manuscript can then be located under 'Unsubmitted Manuscripts' and you can click on 'Continue Submission' to continue your submission when you choose to.

3.6. E-mail Confirmation of Submission

After submission you will receive an e-mail to confirm receipt of your manuscript. If you do not receive the confirmation e-mail after 24 hours, please check your e-mail address carefully in the system. If the e-mail address is correct please contact your IT department. The error may be caused by some sort of spam filtering on your e-mail server. Also, the e-mails should be received if the IT department adds our e-mail server (uranus.scholarone.com) to their whitelist.

3.7. Manuscript Status

You can access ScholarOne Manuscripts any time to check your 'Author Centre' for the status of your manuscript. The Journal will inform you by e-mail once a decision has been made.

3.8. Submission of Revised Manuscripts

To submit a revised manuscript, locate your manuscript under 'Manuscripts with Decisions' and click on 'Submit a Revision'. Please remember to delete any old files uploaded when you upload your revised manuscript.

4. MANUSCRIPT TYPES ACCEPTED

Original Scientific Articles: must describe significant and original experimental observations and provide sufficient detail so that the observations can be critically evaluated and, if necessary, repeated. Original Scientific Articles must conform to the highest international standards in the field.

Review Articles: are accepted for their broad general interest; all are refereed by experts in the field who are asked to comment on issues such as timeliness, general interest and balanced treatment of controversies, as well as on scientific accuracy. Reviews should generally include a clearly defined search strategy and take a broad view of the field rather than merely summarizing the authors´ own previous work. Extensive or unbalanced citation of the authors´ own publications is discouraged.

Mini Review Articles: are accepted to address current evidence on well-defined clinical, research or methodological topics. All are refereed by experts in the field who are asked to comment on timeliness, general interest, balanced treatment of controversies, and scientific rigor. A clear research question, search strategy and balanced synthesis of the evidence is expected. Manuscripts are limited in terms of word-length and number of figures.

Clinical Articles: are suited to describe significant improvements in clinical practice such as the report of a novel technique, a breakthrough in technology or practical approaches to recognised clinical challenges. They should conform to the highest scientific and clinical practice standards.

Case Reports: illustrating unusual and clinically relevant observations are acceptable but they must be of sufficiently high quality to be considered worthy of publication in the Journal. On rare occasions, completed cases displaying non-obvious solutions to significant clinical challenges will be considered. Illustrative material must be of the highest quality and healing outcomes, if appropriate, should be demonstrated.

Supporting Information: *International Endodontic Journal* encourages submission of adjuncts to printed papers via the supporting information website (see submission of supporting information below). It is encouraged that authors wishing to describe novel procedures or illustrate cases more fully with figures and/or video may wish to utilise this facility.

Letters to the Editor: are also acceptable.

Meeting Reports: are also acceptable.

5. MANUSCRIPT FORMAT AND STRUCTURE

5.1. Format

Language: The language of publication is English. It is preferred that manuscript is professionally edited. A list of independent suppliers of editing services can be found at www.blackwellpublishing.com/bauthor/english_language.asp. All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication

Presentation: Authors should pay special attention to the presentation of their research findings or clinical reports so that they may be communicated clearly. Technical jargon should be avoided as much as possible and clearly explained where its use is unavoidable. Abbreviations should also be kept to a minimum, particularly those that are not standard. The background and hypotheses underlying the study, as well as its main conclusions, should be clearly explained. Titles and abstracts especially should be written in language that will be readily intelligible to any scientist.

Abbreviations: International Endodontic Journal adheres to the conventions outlined in Units, Symbols and Abbreviations: A Guide for Medical and Scientific Editors and Authors. When non-standard terms appearing 3 or more times in the manuscript are to be abbreviated, they should be written out completely in the text when first used with the abbreviation in parenthesis.

5.2. Structure

All manuscripts submitted to *International Endodontic Journal* should include Title Page, Abstract, Main Text, References and Acknowledgements, Tables, Figures and Figure Legends as appropriate

Title Page: The title page should bear: (i) Title, which should be concise as well as descriptive; (ii) Initial(s) and last (family) name of each author; (iii) Name and address of department, hospital or institution to which work should be attributed; (iv) Running title (no more than 30 letters and spaces); (v) No more than six keywords (in alphabetical order); (vi) Name, full postal address, telephone, fax number and e-mail address of author responsible for correspondence.

Abstract for Original Scientific Articles should be no more than 250 words giving details of what was done using the following structure:

• **Aim**: Give a clear statement of the main aim of the study and the main hypothesis tested, if any. • **Methodology**: Describe the methods adopted including, as appropriate, the design of the study, the setting, entry requirements for subjects, use of materials, outcome measures and statistical tests. • **Results**: Give the main results of the study, including the outcome of any statistical analysis. • **Conclusions**: State the primary conclusions of the study and their implications. Suggest areas for further research, if appropriate.

Abstract for Review Articles should be non-structured of no more than 250 words giving details of what was done including the literature search strategy.

Abstract for Mini Review Articles should be non-structured of no more than 250 words, including a clear research question, details of the literature search strategy and clear conclusions.

Abstract for Case Reports should be no more than 250 words using the following structure:

• **Aim**: Give a clear statement of the main aim of the report and the clinical problem which is addressed. • **Summary**: Describe the methods adopted including, as appropriate, the design of the study, the setting, entry requirements for subjects, use of materials, outcome measures and analysis if any. • **Key learning points**: Provide up to 5 short, bullet-pointed statements to highlight the key messages of the report. All points must be fully justified by material presented in the report.

Abstract for Clinical Articles should be no more than 250 words using the following structure:

•**Aim:** Give a clear statement of the main aim of the report and the clinical problem which is addressed.
•**Methodology:** Describe the methods adopted.
•**Results:** Give the main results of the study.
•**Conclusions:** State the primary conclusions of the study.

Main Text of Original Scientific Article should include Introduction, Materials and Methods, Results, Discussion and Conclusion

Introduction: should be focused, outlining the historical or logical origins of the study and gaps in knowledge. Exhaustive literature reviews are not appropriate. It should close with the explicit statement of the specific aims of the investigation, or hypothesis to be tested.

Material and Methods: must contain sufficient detail such that, in combination with the references cited, all clinical trials and experiments reported can be fully reproduced.

(i) Clinical Trials should be reported using the CONSORT guidelines available at www.consort-statement.org. A CONSORT checklist should also be included in the submission material.

(ii) Experimental Subjects: experimentation involving human subjects will only be published if such research has been conducted in full accordance with ethical principles, including the World Medical

Association Declaration of Helsinki (version, 2002 www.wma.net/e/policy/b3.htm) and the additional requirements, if any, of the country where the research has been carried out. Manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and written consent of each subject and according to the above mentioned principles. A statement regarding the fact that the study has been independently reviewed and approved by an ethical board should also be included. Editors reserve the right to reject papers if there are doubts as to whether appropriate procedures have been used.

When experimental animals are used the methods section must clearly indicate that adequate measures were taken to minimize pain or discomfort. Experiments should be carried out in accordance with the Guidelines laid down by the National Institute of Health (NIH) in the USA regarding the care and use of animals for experimental procedures or with the European Communities Council Directive of 24 November 1986 (86/609/EEC) and in accordance with local laws and regulations.

All studies using human or animal subjects should include an explicit statement in the Material and Methods section identifying the review and ethics committee approval for each study, if applicable. Editors reserve the right to reject papers if there is doubt as to whether appropriate procedures have been used.

(iii) Suppliers: Suppliers of materials should be named and their location (Company, town/city, state, country) included.

Results: should present the observations with minimal reference to earlier literature or to possible interpretations. Data should not be duplicated in Tables and Figures.

Discussion: may usefully start with a brief summary of the major findings, but repetition of parts of the abstract or of the results section should be avoided. The Discussion section should progress with a review of the methodology before discussing the results in light of previous work in the field. The Discussion should end with a brief conclusion and a comment on the potential clinical relevance of the findings. Statements and interpretation of the data should be appropriately supported by original references.

Conclusion: should contain a summary of the findings.

Main Text of Review Articles should be divided into Introduction, Review and Conclusions. The Introduction section should be focused to place the subject matter in context and to justify the need for the review. The Review section should be divided into logical sub-sections in order to improve readability and enhance understanding. Search strategies must be described and the use of state-of-the-art evidence-based systematic approaches is expected. The use of tabulated and illustrative material is encouraged. The Conclusion section should reach clear conclusions and/or recommendations on the basis of the evidence presented.

Main Text of Mini Review Articles should be divided into Introduction, Review and Conclusions. The Introduction section should briefly introduce the subject matter and justify the need and timeliness of the literature review. The Review section should be divided into logical sub-sections to enhance readability and understanding and may be supported by up to 5 tables and figures. Search strategies must be described and the use of state-of-the-art evidence-based systematic approaches is expected. The Conclusions section should present clear statements/recommendations and suggestions for further work. The manuscript, including references and figure legends should not normally exceed 4000 words.

Main Text of Clinical Reports and Clinical Articles should be divided into Introduction, Report, Discussion and Conclusion,. They should be well illustrated with clinical images, radiographs, diagrams and, where appropriate, supporting tables and graphs. However, all illustrations must be of the highest quality

Acknowledgements: *International Endodontic Journal* requires that all sources of institutional, private and corporate financial support for the work within the manuscript must be fully acknowledged, and any potential conflicts of interest noted. Grant or contribution numbers may be acknowledged, and principal grant holders should be listed. Acknowledgments should be brief and should not include thanks to anonymous referees and editors. See also above under Ethical Guidelines.

5.3. References

It is the policy of the Journal to encourage reference to the original papers rather than to literature reviews. Authors should therefore keep citations of reviews to the absolute minimum.

We recommend the use of a tool such as EndNote or Reference Manager for reference management and formatting. EndNote reference styles can be searched for here: www.endnote.com/support/enstyles.asp. Reference Manager reference styles can be searched for here: www.refman.com/support/rmstyles.asp

In the text: single or double authors should be acknowledged together with the year of publication, e.g. (Pitt Ford & Roberts 1990). If more than two authors the first author followed by *et al.* is sufficient, e.g. (Tobias *et al.* 1991).

Reference list: All references should be brought together at the end of the paper in alphabetical order and should be in the following form.
(i) Names and initials of up to six authors. When there are seven or more, list the first three and add *et al.*
(ii)Year of publication in parentheses
(iii) Full title of paper followed by a full stop (.)
(iv) Title of journal in full (in italics)
(v) Volume number (bold) followed by a comma (,)
(vi) First and last pages
Examples of correct forms of reference follow:

Standard journal article

Bergenholtz G, Nagaoka S, Jontell M (1991) Class II antigen-expressing cells in experimentally induced pulpitis. *International Endodontic Journal* **24**, 8-14.

Corporate author

British Endodontic Society (1983) Guidelines for root canal treatment. *International Endodontic Journal* **16**, 192-5.

Journal supplement

Frumin AM, Nussbaum J, Esposito M (1979) Functional asplenia: demonstration of splenic activity by bone marrow scan (Abstract). *Blood* **54** (Suppl. 1), 26a.

Books and other monographs

Personal author(s)

Gutmann J, Harrison JW (1991) *Surgical Endodontics*, 1st edn Boston, MA, USA: Blackwell Scientific Publications.

Chapter in a book

Wesselink P (1990) Conventional root-canal therapy III: root filling. In: Harty FJ, ed. *Endodontics in Clinical Practice*, 3rd edn; pp. 186-223. London, UK: Butterworth.

Published proceedings paper

DuPont B (1974) Bone marrow transplantation in severe combined immunodeficiency with an unrelated MLC compatible donor. In: White HJ, Smith R, eds. Proceedings of the Third Annual Meeting of the International Society for Experimental Rematology; pp. 44-46. Houston, TX, USA: International Society for Experimental Hematology.

Agency publication

Ranofsky AL (1978) Surgical Operations in Short-Stay Hospitals: United States-1975. DHEW publication no. (PHS) 78-1785 (Vital and Health Statistics; Series 13; no. 34.) Hyattsville, MD, USA: National Centre for Health Statistics.8

Dissertation or thesis

Saunders EM (1988) In vitro and in vivo investigations into root-canal obturation using thermally softened gutta-percha techniques (PhD Thesis). Dundee, UK: University of Dundee.

URLs

Full reference details must be given along with the URL, i.e. authorship, year, title of document/report and URL. If this information is not available, the reference should be removed and only the web address cited in the text.
Smith A (1999) Select committee report into social care in the community [WWW document]. URL http://www.dhss.gov.uk/reports/report015285.html
[accessed on 7 November 2003]

5.4. Tables, Figures and Figure Legends

Tables: Tables should be double-spaced with no vertical rulings, with a single bold ruling beneath the column titles. Units of measurements must be included in the column title.

Figures: All figures should be planned to fit within either 1 column width (8.0 cm), 1.5 column widths (13.0 cm) or 2 column widths (17.0 cm), and must be suitable for photocopy reproduction from the printed version of the manuscript. Lettering on figures should be in a clear, sans serif typeface (e.g. Helvetica); if possible, the same typeface should be used for all figures in a paper. After reduction for publication, upper-case text and numbers should be at least 1.5-2.0 mm high (10 point Helvetica). After reduction, symbols should be at least 2.0-3.0 mm high (10 point). All half-tone photographs should be submitted at final reproduction size. In general, multi-part figures should be arranged as they would appear in the final version. Reduction to the scale that will be used on the page is not necessary, but any special requirements (such as the separation distance of stereo pairs) should be clearly specified.

Unnecessary figures and parts (panels) of figures should be avoided: data presented in small tables or histograms, for instance, can generally be stated briefly in the text instead. Figures should not contain

more than one panel unless the parts are logically connected; each panel of a multipart figure should be sized so that the whole figure can be reduced by the same amount and reproduced on the printed page at the smallest size at which essential details are visible.
Figures should be on a white background, and should avoid excessive boxing, unnecessary colour, shading and/or decorative effects (e.g. 3-dimensional skyscraper histograms) and highly pixelated computer drawings. The vertical axis of histograms should not be truncated to exaggerate small differences. The line spacing should be wide enough to remain clear on reduction to the minimum acceptable printed size.
Figures divided into parts should be labelled with a lower-case, boldface, roman letter, a, b, and so on, in the same typesize as used elsewhere in the figure. Lettering in figures should be in lower-case type, with the first letter capitalized. Units should have a single space between the number and the unit, and follow SI nomenclature or the nomenclature common to a particular field. Thousands should be separated by a thin space (1 000). Unusual units or abbreviations should be spelled out in full or defined in the legend. Scale bars should be used rather than magnification factors, with the length of the bar defined in the legend rather than on the bar itself. In general, visual cues (on the figures themselves) are preferred to verbal explanations in the legend (e.g. broken line, open red triangles etc.)
Figure legends: Figure legends should begin with a brief title for the whole figure and continue with a short description of each panel and the symbols used; they should not contain any details of methods.
Permissions: If all or part of previously published illustrations are to be used, permission must be obtained from the copyright holder concerned. This is the responsibilty of the authors before submission.
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5.5. Supporting Information

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ANEXO 5

JOURNAL OF DENTAL EDUCATION

Instructions for Authors

The Journal of Dental Education is a distinguished monthly journal published continuously since 1936. It provides coverage of a wide variety of scientific and educational research in dental and allied dental education. Internationally recognized as the premier journal for academic dentistry, the JDE publishes articles on such topics as innovative testing methodologies, curriculum reform, faculty development, the impact on oral health research of recent findings in such areas as genetics and the brain, dental and allied dental admissions, professional and educational ethics, and systematic reviews of clinical trials regarding oral, dental, and craniofacial diseases and disorders. The JDE is one of only a few scholarly journals that are publishing the most important work being done in dental and allied dental education and research today.

The Editor welcomes submissions that report research and address issues in the following areas:

1) Critical Issues in Dental Education;
2) Milieu in Dental Schools and Practice;
3) Educational Methodologies;
4) Evidence-Based Dentistry;
5) Faculty Development;
6) Transfer of Advances in Sciences into Dental Education;
7) International Perspectives on Dental Education; and
8) From the Students' Corner.

Authors from outside North America are welcome to submit articles in any of these eight areas, as well as the International Perspectives section, which is dedicated to work that is primarily relevant to the author's geographic area. Students are also welcome to submit articles in any of the eight areas and are especially encouraged to submit to the From the Students' Corner section, which is open to an extremely wide range of subject matter. Authors who wish to submit manuscripts in areas beyond these eight should check with the Editor first.

All manuscripts must be written in English and submitted exclusively to the Journal of Dental Education in order to be considered for publication.

Preparing Manuscripts for Submission

The Journal of Dental Education has moved to an electronic submission and review workflow-based system. Working with ScholarOne Manuscripts, the JDE will now accepts all submission at http://mc.manuscriptcentral.com/jdentaled. Authors upload manuscripts directly to the website, receive email notifications, and track their submissions online through the editorial and review process. Online help is available throughout the process. It may be helpful to read the complete instructions first, posted online at the publisher's website, www.adea.org/publications/jde/Pages/Submitting-to-the-Journal-of-Dental-Education.aspx.

There is no charge for submission. Authors are urged to follow the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals." These requirements, developed by the International Committee of Medical Journal Editors and now in their fifth edition (1997), can be found in the New England Journal of Medicine 1997;336:309-15 and on that journal's website.

The following summarizes these requirements as well as specific JDE procedures. Note that these requirements pertain specifically to the initial submission of manuscripts. When an article has been or is close to being accepted, the editor will provide its author with the "Production Guide for JDE Authors," which should be followed in preparing the final version of the article for printing.

Document Preparation. Create the document on pages with margins of at least 1 inch (25 mm). Use double-spacing throughout, including title page, abstract, text, acknowledgments, references, tables, and legends for illustrations, and number pages consecutively. Begin each of the following sections on separate pages: title page, abstract and key words, text, acknowledgments, references, individual tables, and legends. Do not embed tables and figures in the body of the text. If figures or other illustrations are unusually large files, submit them as separate documents.

Title Page. The title page should carry: 1) the title of the article, which should be concise but informative; 2) first name, middle initial, and last name of each author, with highest academic degrees; 3) each author or coauthor's job title, department, and institution; 4) disclaimers if any; 5) name, address, phone, fax,

and email of author responsible for correspondence about the manuscript and requests for reprints; and 6) the source(s) in the form of grants, equipment, drugs, etc. See articles in the issue for examples.

Abstract and Key Words. The second page should carry the title and an abstract of no more than 150-200 words. The abstract should state the purposes of the study or investigation, basic procedures, main findings, and principal conclusions. Subheads should not be used in the abstract. Below the abstract, provide—and identify as such—three to ten key words or short phrases that will assist indexers in cross-indexing the article and that may be published with the abstract. Use terms from the Medical Subject Headings listed in Index Medicus.

Text. The body of the manuscript should be divided into sections preceded by appropriate subheads. Major subheads should be typed in capital letters at the left-hand margin. Secondary subheads should appear at the left-hand margin and be typed in upper and lower case and put in bold face. Tertiary subheads should be typed in upper and lower case and be underlined.

References. Number references consecutively in the order in which they are first mentioned in the text. Identify references by Arabic numerals, and place them as superscript numerals within the sentence. Do not link the references to their numbers as footnotes or endnotes. References cited only in tables or legends to figures should appear as a source note to the table or figure.

Follow the style of these general examples, which are based on the formats used in Index Medicus. Titles of journals should be abbreviated according to the Index Medicus style. If there are more than six authors, list the first six and use et al.

Book

1. Avery JK. Essentials of oral histology and embryology: a clinical approach. 2nd ed. St. Louis: Mosby, 2000. Chapter in an Edited Volume

2. Inglehart MR, Filstrup SL, Wandera A. Oral health and quality of life in children. In: Inglehart MR, Bragramian RA, eds. Oral health-related quality of life. Chicago: Quintessence Publishing Co., 2002:79-88.

Article in a Journal

3. Seale NS, Casamassimo PS. U.S. predoctoral education in pediatric dentistry: its impact on access to dental care. J Dent Educ 2003;67(1):23-9.

Report

4. Commission on Dental Education. Accreditation standards for dental education programs. Chicago: American Dental Association, 2002.

Tables. All tables must have a title and at least two columns. Arrange column headings so that their relation to the data is clear. Indicate explanatory notes to items in the table with reference marks (*, †). Cite each table in the text in the order in which it is to appear. Identify tables with Arabic numerals (e.g., Table 1).

Illustrations. Illustrations should not exceed 8 ½ x 11 inches, and all lettering should be at least 1 ½ mm high. Cite each figure in the text in the order in which it is to appear (e.g., Figure 1). Figures should not be used where tables are more economical. If your figures include scientific images in which fine detail is important, please call attention to this point to both the Editor and Managing Editor so that special procedures may be followed. If your article is accepted for publication, we may request illustrations in hard copy rather than electronic format. If you are asked to do so, submit two clear, unmounted glossy photographs or original line drawings of each figure (do not submit negatives), and place the name of the author and the figure number on the back of each illustration.

Human Subjects. It is the author's responsibility to obtain approval or exempt status from his or her institution's Human Subjects Institutional Review Board or Committee for studies involving human subjects. After securing approval from the required board or committee, the author will have a signed human consent form on every subject in the study. Failure to meet these two requirements is likely to place the manuscript under consideration in jeopardy and lead to a rejection.

Production Procedures

Review Process. Manuscripts will be peer-reviewed by individuals, selected by the Editor, who have expertise and experience pertinent to the topic of the article. The journal follows a blind peer review process, with close to 200 individuals serving as reviewers. The Editor and/or Associate Editor also review all manuscripts. The review process can take up to three months. Currently, approximately 55 percent of manuscripts are accepted, 30 percent are rejected, and the remaining submissions are returned to their authors with encouragement to revise and resubmit. If a manuscript is not accepted, the author will receive the reviewers' comments, but manuscript copies will not be returned.

Preparing the Final Manuscript. If the manuscript is accepted or provisionally accepted, an edited version will be returned to the author with the reviewers' comments for the author's approval, possible

rewriting, and retyping. At that time, the Editor will also provide the author with the "Production Guide for JDE Authors," which outlines the style and formatting requirements of this journal. After the author has made the requested changes, the manuscript is returned for final review and editing to the Editor. If acceptable, the Editor then sends the manuscript to the Managing Editor, Lynn Whittaker, who copyedits it and prepares it for printing.

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Page Proof Review. Authors will receive page proofs of their articles by fax, along with instructions for marking and returning it to the Managing Editor, who also reads the proof. You will have three to five business days to review the proofs and return them.

The JDE staff attempts to make sure that the entire publication cycle, from time of notification of acceptance of an article until its appearance in a published issue, is no more than three months.

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Following the launch of the online version of the JDE in the summer of 2004, copies of individual articles may also be acquired online, whether by the authors themselves or by other readers.

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Key Contact Information

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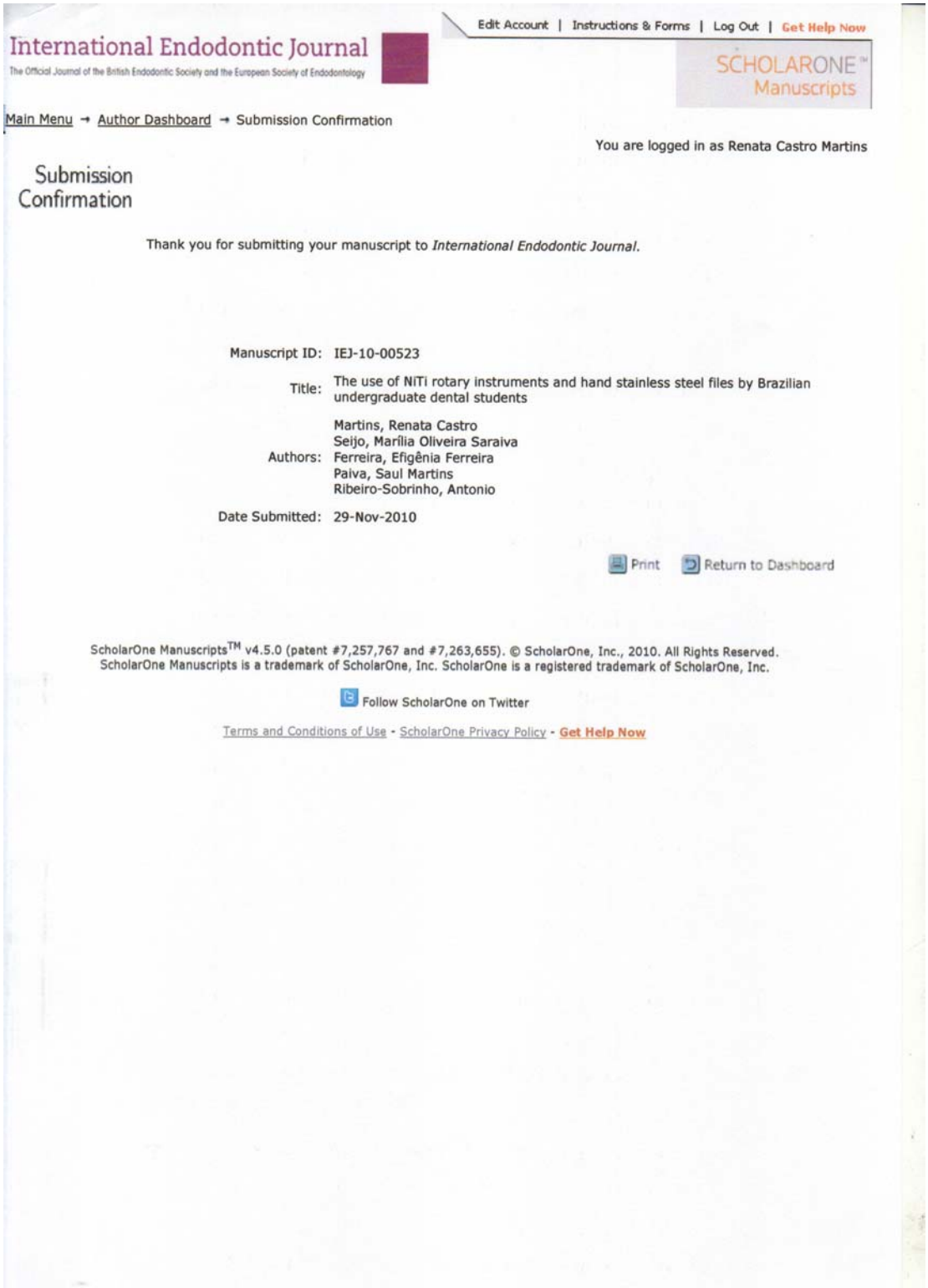

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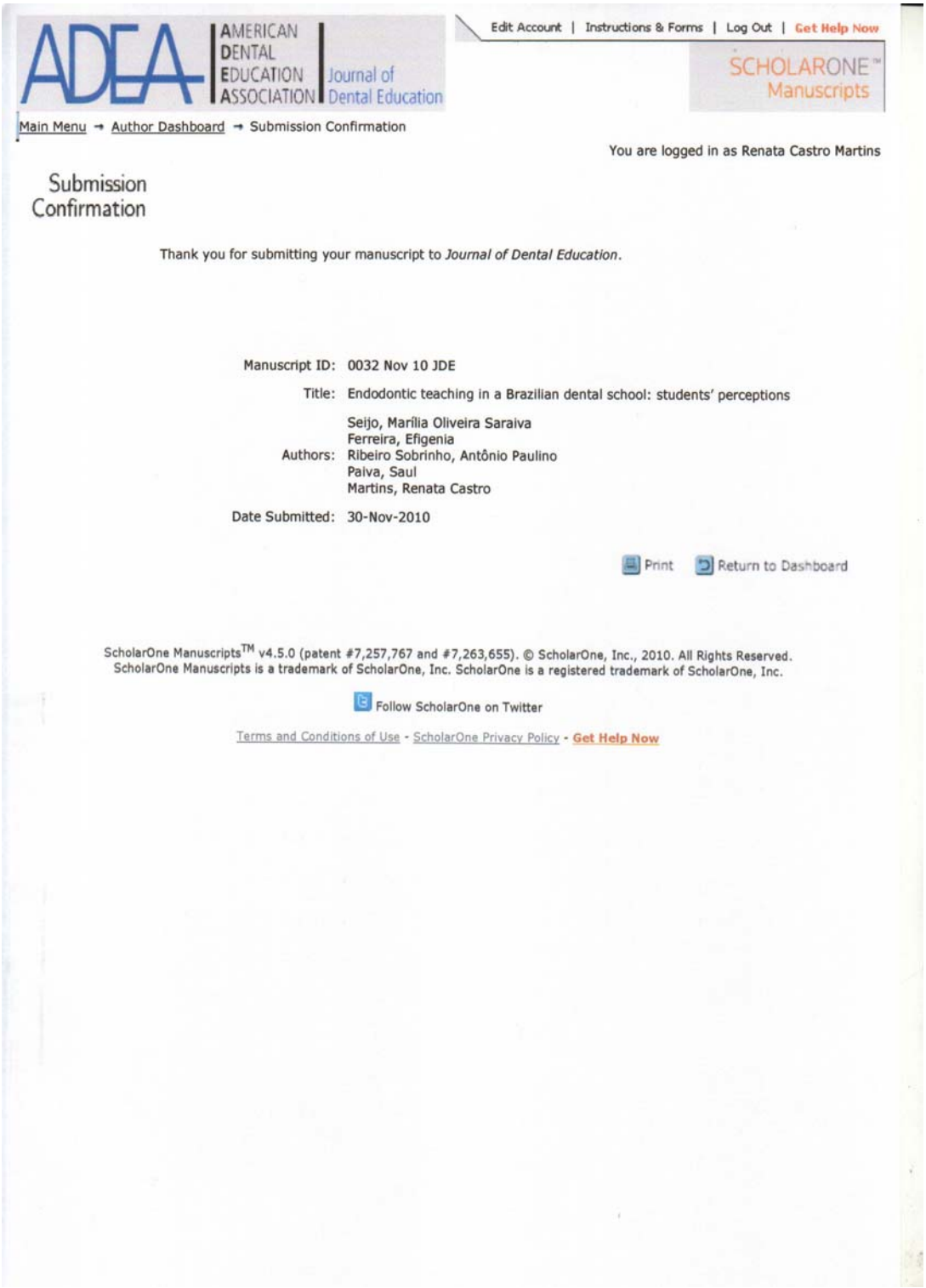

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Authors: Seijo, Marília Oliveira Saraiva
Ferreira, Efigenia
Ribeiro Sobrinho, Antônio Paulino
Paiva, Saul
Martins, Renata Castro

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