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ÁREA DE CONCENTRAÇÃO ENDODONTIA

NATANAEL HENRIQUE RIBEIRO MATTOS

AVALIAÇÃO DA DIFUSÃO DOS ÍONS HIDROXILA EM RELAÇÃO AO MATERIAL OBTURADOR REMANESCENTE EM DENTES SUBMETIDOS A RETRATAMENTOS ENDODONTICOS POR SISTEMAS ROTATÓRIOS DE NÍQUEL TITÂNIO

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Tese apresentada ao Programa de Pós-Graduação em Odontologia da Pontifícia Universidade Católica do Paraná, como requisito parcial à obtenção do título de Doutor em Odontologia, Área de Concentração em Endodontia.

Orientador: Prof. Dr. Luiz Fernando Fariniuk

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Curitiba, 14 de maio de 2015.

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LISTA DE ILUSTRAÇÕES

LISTA DE ABREVIATURAS E SIGLAS

µm	micrômetro
CN	Controle Negativo
CP	Controle Positivo
EDTA	ácido etileno diamino tetracético
et al.	et alli
KV	quilovolts
mA	miliampere
ml	mililitros
mm	milímetros
NiTi	Niquel Titânio
pH	potencial hidrogeniônico

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ARTIGO EM PORTUGUÊS

AVALIAÇÃO DA DIFUSÃO DOS ÍONS HIDROXILA EM RELAÇÃO AO MATERIAL OBTURADOR REMANESCENTE EM DENTES SUBMETIDOS A RETRATAMENTOS ENDODONTICOS POR SISTEMAS ROTATÓRIOS DE NÍQUEL TITÂNIO

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Resumo

Introdução: O objetivo deste trabalho foi avaliar a difusão dos íons hidroxila em dentes submetidos ao retratamento endodôntico, por meio da variação do pH, em razão direta da capacidade de limpeza em retratamentos endodônticos. **Material e Método:** 120 dentes humanos monorradiculados foram tratados e divididos em 6 grupos. 4 foram obturados com guta-percha e cimento AH-Plus e retratados após três meses pelos sistemas ProTaper e MTwo sendo: G1- ProTaper F1 (PTF1); G2- ProTaper F4 (PTF4); G3- Mtwo 20.06 (MT20); G4- Mtwo 40.04 (MT40) e os grupos Controle Negativo (CN) e Controle Positivo (CP), sem e com hidróxido de cálcio respectivamente. O tempo dispendido para o retratamento foi registrado. O material residual foi mensurado por meio de imagens obtidas em tomografia micro computadorizada e observadas no Programa Image Pro Plus. Excetuando-se o grupo CN, os dentes foram preenchidos com hidróxido de cálcio e colocados em frascos individuais contendo água deionizada. Mediu-se o pH em 7, 21, 45 e 60 dias. Os dados foram analisados e comparados pelos testes de Kolmorogov-Smirnov e Shapiro Wilk para verificação da normalidade e o de Tukey HSD de comparações múltiplas a 5%. **Resultados:** Os grupos MT40 e PTF4 foram mais efetivos na remoção de resíduos, porém iguais entre eles ($p>0,05$). Com relação ao pH, PTF1 dificultou a difusão do hidróxido de cálcio (2,07±0,41) diferindo estatisticamente de MT40 (2,55±0,43) e CP (2,49±0,43) ($p<0,05$). O sistema ProTaper foi mais rápido que o MTwo ($p<0,05$). **Conclusão:** A variação do pH ocorreu nos canais retratados endodonticamente, mostrando menor difusão de íons hidroxila quando a quantidade de resíduos foi superior a 59%

.

Palavras-chave: Endodontia. Hidróxido de cálcio. Retratamento endodôntico. pH. Difusão.

Introdução

Havendo a necessidade de se realizar um retratamento endodôntico, o principal objetivo deste é remover o material obturador que tenha sido a causa do insucesso, ou seja, restos teciduais necróticos e bactérias, inclusive as que sobreviveram por entre o material obturador. Para isso é necessário removê-lo e obter novo acesso ao forame apical (1). Inúmeras técnicas têm sido empregadas para esta finalidade sendo avaliadas por diversas metodologias (2-10). Entretanto, quase sempre, os autores relatam uma não efetividade na total remoção do mesmo (3, 4, 6-9).

A remoção eficiente permitiria melhor qualidade no preparo do canal, resultando em melhor chance de sucesso na nova intervenção (1). Além disso, possibilitaria que, na eventual necessidade de se colocar uma medicação intra-canal, esta pudesse se difundir através dos túbulos dentinários e eliminar microrganismos persistentes do tratamento primário ou que se desenvolveram após a falha deste (11).

A difusão de íons hidroxila através dos túbulos dentinários podem agir contra os microrganismos ali presentes e suas toxinas (12, 13), além de possuírem ação anti-inflamatória por desnaturarem alguns agentes pró-inflamatórios (14).

Devido a estas razões, têm se empregado o hidróxido de cálcio para tratamentos endodônticos necróticos primários, assim como nos retratamentos (11), justamente onde o *Enterococos Faecalis* é frequentemente encontrado, muito embora sua ação, nestes casos, seja questionada (15, 16). Estudos recentes demonstraram que nanopartículas de hidróxido de cálcio parecem ser mais efetivas devido a melhor penetração no interior dos túbulos dentinários (17). O mecanismo antimicrobiano do hidróxido de cálcio é possível pela difusão dos íons hidroxila através da dentina, ocasionando alteração no pH, promovendo a alcalinização do meio (15). Esta difusão está em função da diferença de concentração do interior do canal para as paredes dentinárias e do tamanho das partículas do hidróxido de cálcio (18). A penetração desta medicação no interior destas poderá ainda ser dificultada pela diminuição da permeabilidade do tecido. Thaler et al. (2008) (19), demonstraram que a idade pode interferir na permeabilidade da dentina interferindo na distribuição de medicamentos usados na desinfecção de canais. Pascon et al. (2012), relataram que a remoção do smear layer aumenta a permeabilidade de

dentes decíduos (20). Recentemente, Wang et al. (2013), demonstraram que a remoção do smear layer melhora significativamente a ação dos protocolos de desinfecção frente ao *Enterococus Faecalis* (21). Kazemipoor et al. (2012) verificaram que a variação do pH era diferente em dentes retratados e não retratados endodonticamente (22).

O objetivo deste trabalho foi analisar a difusão de íons hidroxila, por meio da aferição da variação do pH proveniente da medicação de hidróxido de cálcio em dentes submetidos a retratamento endodôntico por dois sistemas rotatórios de NiTi, objetivando comparar a melhor capacidade de limpeza entre ambos, em razão direta disto, analisando-se, paralelamente, a quantidade de resíduos por meio de tomografia computadorizada em feixe cônico, além do tempo de execução para tanto. A hipótese nula foi a de que não há diferença entre as médias de variações de pH em função da quantidade de resíduos remanescentes após o retratamento endodôntico.

Material e Método

Foram selecionados 120 dentes monorradiculados mandibulares, com coroas integras e sem restaurações, obtidos junto ao Banco de Dentes da PUCPR. O trabalho foi aprovado junto ao Comitê de Ética em Pesquisa de acordo com o parecer consubstanciado número 48588. Inicialmente os dentes foram armazenados em solução de formaldeído a 10%, durante 15 dias. Os indultos, cálculos e tecidos moles, foram removidos da superfície externa dos dentes por meio de curetas (Duflex-SSWhite, Rio de Janeiro, Brasil) sendo então armazenados em solução salina.

Foi realizado o acesso coronário com brocas diamantadas 1013 e 3080 (KG Sorensen, São Paulo, Brasil). A exploração do canal foi realizada com instrumento tipo K # 10 (Dentsply, Maillefer, Ballaigues, Suíça) o qual serviu para determinação do comprimento de trabalho, visualizando o mesmo ao alcançar o forame, subtraindo-se desta medida, 1mm. O preparo mecânico do canal radicular foi realizado utilizando-se a técnica coroa ápice com o emprego de instrumentos Flexofile (Dentsply, Maillefer, Ballaigues, Suíça) estabelecendo-se como diâmetro cirúrgico o #35. De acordo com a medida do comprimento, os 120 dentes foram

divididos em seis grupos de maneira que o tamanho médio fosse aproximado entre eles.

A cada troca de instrumento os canais foram irrigados e aspirados com 2,0 ml de hipoclorito de sódio a 1% (Myako do Brasil Ind. e com. Ltda., São Paulo, Brasil). Quatro grupos, ou seja, oitenta dentes foram então secos com pontas de papel absorvente (Dentsply, Latin América, Petrópolis, Brasil) #35 (diâmetro 0,35mm e conicidade 2%) e obturados pela técnica da condensação lateral, utilizando-se cones de guta-percha #35 (Tanari, Amazonas, Brasil), cones acessórios MF (Tanari, Amazonas, Brasil) e cimento Ah Plus. (Dentsply, De Trey, Konstanz, Alemanha).

Após obturados os dentes receberam um selamento coronário com Citodur (Dori Dent, Austria). A tomografia cone beam foi realizada com aparelho (Kodak 9000C 3D Carestream Health, Inc.) com 76µm de volume em exposição (voxel isotrópico) de 60KV em 10,8 segundos com 5mA, cada grupo de 5 dentes, nomeados em volumes de 1 a 16, em dispositivo de cera que proporcionou a mesma posição para futura tomografia e retornaram a solução salina para permaneceram armazenados por três meses em estufa a 37°C. Quarenta dentes não foram obturados pois compuseram os grupos controle positivo e negativo, e de igual maneira, retornaram à solução salina após o selamento coronário.

Após três meses, os grupos foram classificados como: G1- ProTaper F1 (PTF1), no qual os dentes foram retratados com o sistema ProTaper Universal (Dentsply, Maillefer, Ballaigues, Suíça) para retratamento, na sequencia de D1 até D3 e repreparados com instrumento #F1 (diâmetro 0,20 mm e conicidade 7%); G2- ProTaper F4 (PTF4), no qual os dentes foram retratados da mesma forma que o PTF1 ampliando-se o preparo com instrumentos # F2, #F3 e #F4 (diâmetro 0,40 mm e conicidade 6%); G3-M-Two 20.06 (MT20), no qual os dentes foram retratados por meio dos instrumentos R15.05 e R25.05 do Sistema MTwo e repreparados com instrumentos 10.04, 15.05 e 20.06 (diâmetro 0,20mm e conicidade 6%); G4- M-Two 40.04 (MT40), no qual os dentes foram retratados da mesma forma que o MT20 ampliando-se o preparo com instrumentos 25.06, 30.05, 35.04 e 40.04 (diâmetro 0,40mm e conicidade 4%).

Foram cronometrados os tempos de retratamento até o último instrumento estipulado para cada grupo. Durante a instrumentação os canais foram irrigados com 5,0 ml de hipoclorito de sódio a 1% a cada troca de instrumento e, ao final, secos e preenchidos com solução de EDTA a 17% (Biodinâmica Química e Farmacêutica

Ltda., Ibiporã, Brasil) durante três minutos, irrigados mais uma vez com 5,0ml de hipoclorito de sódio a 1% e, secos novamente. Após o retratamento dos quatro grupos, foram novamente obtidas as imagens tomográficas de maneira semelhante à primeira execução. Cronometrou-se os tempos desde o emprego do primeiro ao último instrumento. Após este procedimento os dentes foram preenchidos com 0,1ml de pasta de Hidróxido de Cálcio Ultracal XS (Ultradent Product Inc., South Jordan, UT, USA). O G5- Controle Negativo (CN) não recebeu a pasta de hidróxido de cálcio e o G6- Controle Positivo (CP), recebeu a solução de EDTA a 17%, então foram secos e preenchidos com a mesma pasta de hidróxido de cálcio.

Imediatamente após cada preenchimento com o hidróxido de cálcio os dentes foram selados coronariamente com citodur e resina composta fotoativada Z350 (3M, ESPE) e, tanto a parte coronária como o forame apical, foram selados com cianocrilato (Super bonder, Henckel, São Paulo) e resina epóxi (Araldite- Maxepoxi Industrial e Comercial Ltda. São Paulo, SP, Brasil). Posteriormente os dentes foram imersos em frascos individualizados contendo 30 ml de água deionizada pH 6,2 e medido o pH através de pHmetro (Quimis- Q400A) após sua calibração com soluções tampão de pH 4,0, 7,0 e 12,0. Para cada medição, o eletrodo do pHmetro era suavemente limpo com água deionizada e seco com papel toalha, a fim de eliminar resíduos que poderiam influenciar nas medições. Após a medição os dentes retornavam a estufa 37º C. Os mesmos procedimentos foram realizados com sete, vinte e um, quarenta e cinco e sessenta dias.

As imagens tomográficas foram observadas através de cortes horizontais com 15 cortes espaçados em 0,5mm para cada dente, e verticais com visualização de feixe oblíquo analisando-se cada dente em corte único. A porcentagem da área do material remanescente foi mensurada com o auxílio do programa Image Pró Plus (Media Cybernetics, Silver Spring, MD). Os dados foram tabulados e submetidos a análise estatística, aplicando-se os testes de Kolmogorov-Smirnov e Shapiro Wilk para verificação da normalidade, assim como Tukey HSD de comparações múltiplas (SPSS 19.0).

Resultados

Quanto ao pH

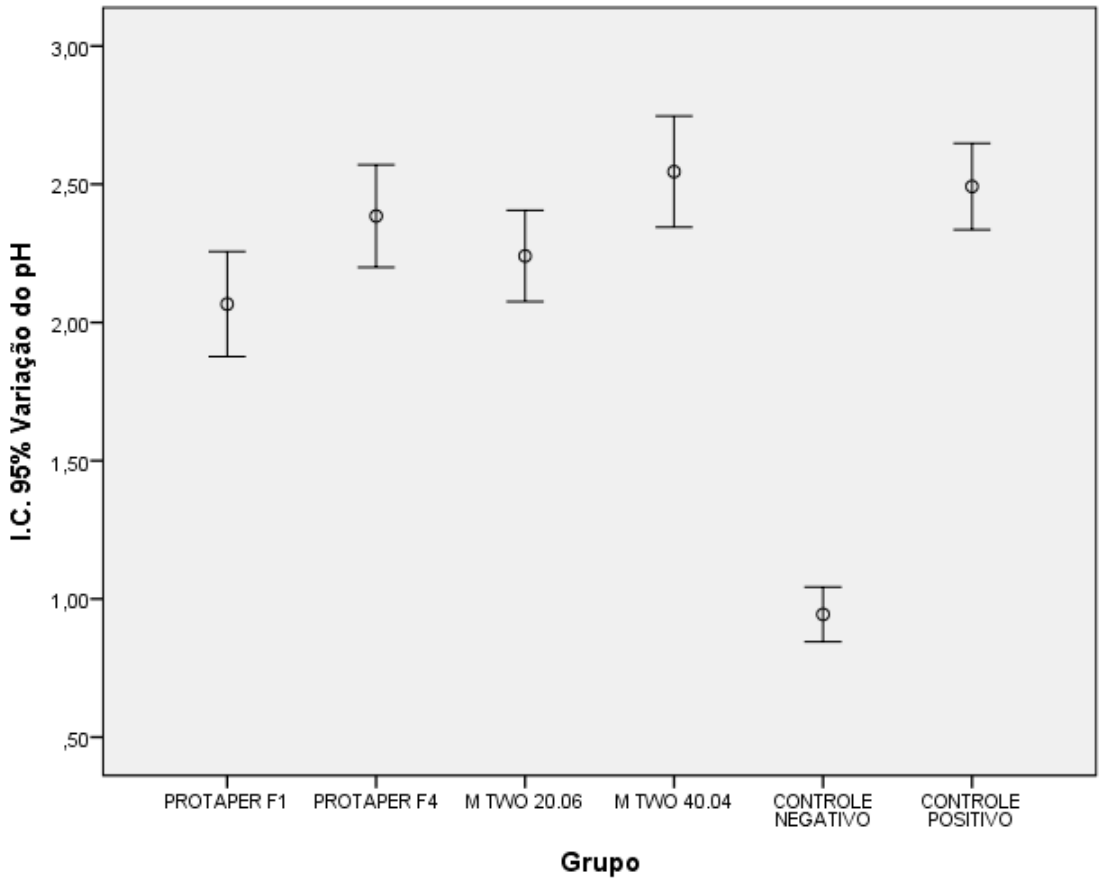
Com relação à variação do pH o grupo CN mostrou diferença significante frente a todos os grupos (Gráfico 1). Todos os dentes apresentaram aumento independente do grupo. (Tabela 1).

Ao se analisar estatisticamente os grupos observou-se que o grupo PTF1, 2,07 (±0,41), mostrou diferença significativa em relação ao melhor grupo, MT40 e ao CP.

Tabela 1. Valor médio da variação do pH em cada grupo nos dias avaliados

Grupo	*N*	*média*	*Desvio Padrão*	*Erro padrão*	*média*		*Minimo*	Maximo
					Limite inferior	Limite superior		
PTF1	20	2,07	0,41	0,09	1,88	2,26	1,35	2,86
PTF4	20	2,39	0,40	0,09	2,20	2,57	1,63	3,19
MT20	20	2,24	0,35	0,08	2,08	2,41	1,55	2,82
MT40	20	2,55	0,43	0,10	2,34	2,75	1,55	3,30
CN	20	0,94	0,21	0,05	0,84	1,04	0,62	1,30
CP	20	2,49	0,33	0,07	2,34	2,65	1,97	3,18
Total	120	2,11	0,65	0,06	1,99	2,23	0,62	3,30

Gráfico 1. Análise de variância com relação à variação do pH



Quanto aos resíduos nas paredes

A análise de resíduos dos cortes tomográficos verticais e horizontais demonstraram que o sistema MTwo tendeu a remover mais resíduos. PTF1 mostrou um percentual de resíduos de 59,08 (±17,67) para os cortes verticais e 60,26 (±16,63) para os horizontais perfazendo uma média de 59,67%. Já MT20 obteve 57,75 (±15,50) nos verticais e 58,15 (±13,08) nos horizontais resultando em 57,95% de percentual médio. Esses valores não apresentaram significância entre eles. Já nos grupos com instrumentos adicionais PTF4 apresentou 29,91 (±17,06) na avaliação vertical e 29,45 (±17,25) na horizontal, resultando numa média de 29,68%. Por sua vez MT40 obteve 22,51 (± 13,33) e 23,52 (±17,12) respectivamente, obtendo a média de 22,72%. De igual maneira não houve significância quando a comparação foi feita entre ambos os grupos, existindo, porém, diferença entre os dois critérios adotados, com ou sem instrumentos adicionais (Tabela 2).

Tabela 2. Percentual de resíduos remanescentes nas paredes do canal

Descriptives

		N	Média	Desvio Padrão	Erro Padrão	Média		Minimo	Maximo
						Limite Inferior	Limite superior		
Percentual de resíduos nas paredes dos canais em cortes verticais	PTF1	20	59,08	17,67	3,95	50,81	67,35	22,67	82,04
	PTF4	20	29,91	17,06	3,81	21,93	37,90	-	54,62
	MT20	20	57,75	15,50	3,47	50,49	65,00	25,99	86,77
	MT40	20	22,51	13,33	2,98	16,27	28,75	3,62	48,35
	Total	80	42,31	22,70	2,54	37,26	47,36	-	86,77
Percentual de resíduos nas paredes dos canais em cortes horizontais	PTF1	20	60,26	16,63	3,72	52,48	68,04	32,21	91,68
	PTF4	20	29,45	17,25	3,86	21,37	37,52	5,16	63,95
	MT20	20	58,15	13,08	2,93	52,02	64,27	30,99	92,07
	MT40	20	23,52	17,12	3,83	15,50	31,53	1,61	64,92
	Total	80	42,84	22,93	2,56	37,74	47,94	1,61	92,07

Observou-se que o PTF1, tanto nos cortes verticais, quanto nos cortes horizontais obteve desempenho inferior, deixando mais resíduos nas paredes, sendo superior a 59%.

Quanto tempo de retratamento

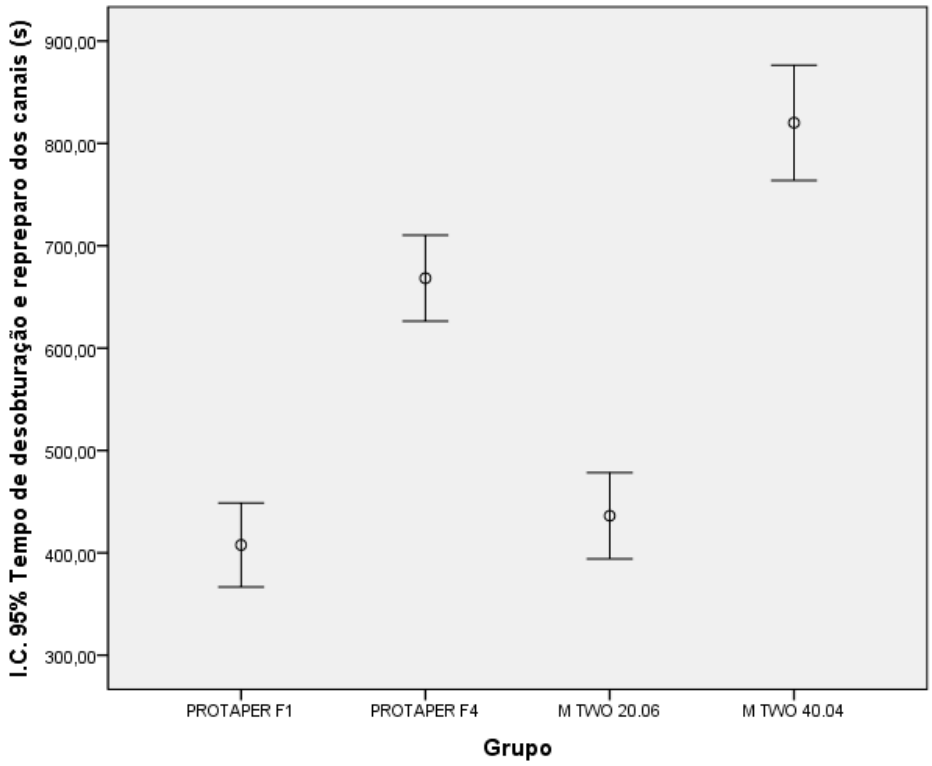
Considerando-se a variável tempo houve diferença significativa entre os grupos com instrumentos adicionais e os grupos sem estes (Tabela 3). Já entre ambas, considerando-se a reinstrumentação completa, os instrumentos ProTaper foram mais rápidos, onde se encontrou diferença significativa para estes (Gráfico 2).

Tabela 3. Tempo para execução do retratamento em segundos

Descritivos

			Média	Desvio Padrão	Erro Padrão	Média		Minimo	Maximo
						Limite Inferior	Limite Superior		
Tempo de desobstrução e reprepar o dos canais (s)	PTF1	20	407,65	87,73	19,62	366,59	448,71	270,00	583,00
	PTF4	20	668,30	89,61	20,04	626,36	710,24	480,00	826,00
	MT20	20	436,20	90,01	20,13	394,07	478,33	305,00	685,00
	MT40	20	820,15	120,27	26,89	763,86	876,44	570,00	990,00
	Total	80	583,08	196,29	21,95	539,39	626,76	270,00	990,00

Gráfico 2. Análise de variância para o tempo de retratamento entre os grupos



Discussão

A Hipótese nula foi rejeitada porque houve diferença entre as médias de variação do pH entre os grupos com maior e menor quantidade de material

obturador presente após o retratamento endodôntico, havendo variação menor quando a quantidade de resíduos era superior a 59%.

A avaliação da capacidade de remoção de material obturador tem sido avaliada por diversas metodologias, todas elas baseadas na medição da área de resíduos que permanecem após a intervenção endodôntica (2-10, 23, 24). Ao se comparar determinados instrumentos, alguns trabalhos mostraram resultados semelhantes (10, 23, 24) e outros com diferenças significativas (2-9) mas o que não se esclarece é que se essa quantidade de materiais obturadores remanescentes interfere na qualidade do tratamento, seja por proporcionar efetividade da medicação, se necessária, ou na futura adaptação da nova obturação às paredes do canal. A medição de área destes materiais se tornou cada vez mais apurada com a tomografia (23) e melhor ainda com a tomografia Cone Bean (7, 9, 10). Entretanto, a dúvida se estes materiais interferem nesses aspectos, ainda permanece.

Com a utilização da medicação intracanal com hidróxido de cálcio, seja ele utilizado com diversos veículos, associados ou não a outros fármacos, deseja-se, em qual situação for, que ocorra a dissociação dos íons cálcio e hidroxila através dos túbulos dentinários, elevando o pH do meio, ocasionando assim numa ação deletéria aos agentes infecciosos (25-31).

A permeabilidade dentinária também tem sido estudada por diversas maneiras, mostrando que fatores intrínsecos podem alterar esta permeabilidade como por exemplo a idade do dente e a quantidade de agressões sofridas por este, como cáries, abrasões e traumas de origens diversas (19). Fatores extrínsecos também podem influenciar na permeabilidade dentinária como por exemplo a presença de smear layer e, provavelmente, a presença de materiais aderidos às paredes dentinárias, obliterando a entrada dos túbulos dentinários e impedindo a difusão de substâncias ou mesmo interferindo na adesão, seja de materiais restauradores assim como materiais obturadores (32). Paredes mais limpas podem significar maior permeabilidade permitindo, nos casos de retratamentos endodônticos, uma melhor penetração da medicação intracanal, favorecendo a desinfecção do sistema endodôntico (21).

A elevação do pH poderá sofrer interferências pela capacidade tampão de dentina (33) embora Freire et al. (2010), citam que o hidróxido de cálcio com propileno glicol não é afetado pelo tamponamento da dentina (34).

Por outro lado, o veículo utilizado poderá influenciar na dissociação iônica. Neste estudo utilizou-se o Ultracal que possui veículo aquoso. Zmener et al. (2007), verificaram que o Ultracal apresentou progressivo aumento de sua alcalinidade ao longo dos 30 dias observados (35). Chamberlain et al. (2009) (26) e Heward et al. (2011) (29) também fizeram uso deste medicamento. Estudos demonstram que veículos aquosos poderiam difundir maior quantidade de íons ou mais rapidamente (35). Por sua vez Tanomaru et al. (2012) (31) não verificaram estas interferências.

Para verificar se a presença de maior quantidade de material obturador sobre as paredes dentinárias interfere na permeabilidade dentinária, optou-se em formar-se dois grupos subinstrumentados, ou seja, repassando instrumentos de menor calibre do que diâmetro cirúrgico estabelecido para as amostras. Grupos 1 e 3. Marques da Silva et al. (2012) (4) também utilizaram este método, valendo-se ainda do mesmo cimento obturador utilizado neste experimento, o Ah Plus, o que da mesma forma fora utilizado anteriormente (3, 5, 7, 9, 10). Este fato ficou comprovado pela avaliação da quantidade de área residual, obtida pela tomografia dos mesmos, pela qual se obteve a análise quantitativa no programa de Imagens Image Pro Plus, relacionando-a com a variação do pH ocasionada pela difusão dos íons hidroxila. A utilização de softwares para medição de áreas de resíduos proporciona maior fidelidade aos dados, comparados às avaliações visuais. Este programa foi também utilizado em outro estudo (2). Outros se utilizaram programa semelhante (5,24).

No presente estudo avaliou-se dois sistemas de instrumentos de grande utilização os quais já foram comparadas entre si na habilidade em se limpar paredes de canais já tratados (3, 4, 6). Outros avaliaram a performance destes, individualmente, frente a outros existentes no mercado (2, 5, 7-10).

A diferença entre os dois instrumentos avaliados, ProTaper e M-Two, com relação à quantidade de resíduos remanescentes, tanto em observação dos cortes no sentido vertical, assim como nos cortes no sentido horizontal, não demonstraram diferenças ($p>0,05$), divergindo dos resultados de Tasdemir et al. (2008) (3), em cujo estudo demonstraram superioridade dos instumentos ProTaper em relação aos M-Two, sem utilizarem, entretanto, os respectivos de retratamento. Bramante et al. (2010) (6) também encontraram resultados favoráveis ao sistema ProTaper, porém, desta feita, utilizando-se apenas os instrumentos de retratamento para os dois sistemas.

Diferenças significantes se mostraram entre os grupos que utilizaram ou não instrumentos adicionais. Em metodologia semelhante a este trabalho, na utilização destes dois sistemas, Marques Silva et al. (2012) (4) também não encontraram diferenças.

Um dos subgrupos sem instrumentos adicionais com o instrumento M-Two não apresentou diferença significativa entre os grupos instrumentados com adicionais e o controle positivo, sendo que o outro, com ProTaper, foi diferente do grupo MT40 e do controle positivo. Observou-se que, neste grupo, o percentual de resíduos foi em torno de 60%, ou seja, uma grande quantidade de material. Pode-se sugerir que este fato ocorreu devido ao desenho dos instrumentos, especialmente às espiras do instrumento Mtwo, que se tornam maiores e mais efetivas nas partes correspondentes à área cervical do canal, justamente onde os túbulos dentinários se encontram em maior número e mais abertos, favorecendo maior difusão.

Este trabalho observou o acréscimo do pH em uma solução externa, fato que também ocorreu em estudos prévios (25, 27-31). Em termos de valores obtidos, quanto a variação do pH em 60 dias, os resultados deste estudo foram mais próximos de Mori et al. (2009) (27) e Tanomaru et al. (2012) embora estes últimos utilizando-se de dentes bovinos (31). Resultados antagônicos foram encontrados em estudos que utilizaram metodologias diferenciadas, em que a variação do pH foi maior, mesmo em menor tempo de avaliação (28), ou também, da mesma forma com canais simulados (25).

Quanto ao tempo de execução a lima ProTaper demonstrou ser mais rápida, especialmente na utilização dos instrumentos específicos para a remoção do material obturador, fato este já citado por Bramante et al. (2010) (6). Uma das razões seria a própria quantidade de instrumentos utilizados, que no caso do sistema Mtwo compreenderia um a mais entre os grupos 1 e 3 e dois a mais entre os grupos 2 e 4. Solomonov et al. (2012) (7) e Mandani et al. (2015) (10) descrevem, para o tempo de retratamento com limas ProTaper, resultados muito semelhantes aos achados neste estudo.

De acordo com a metodologia empregada a variação do pH, foi influenciada pela quantidade de resíduos, desde que estejam presentes em grandes quantidades.

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ARTIGO EM INGLÊS

EVALUATION OF THE DIFFUSION OF HYDROXYL IONS REGARDING THE MATERIAL IN TEETH SHUTTER REMAINING SUBJECT TO ENDODONTIC RETREATMENT BY NICKEL TITANIUM ROTARY SYSTEMS

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Abstract

Introduction: The aim of this study was to evaluate the diffusion of hydroxyl ions in teeth submitted to endodontic retreatment, by varying the pH, in proportion to the cleaning ability in endodontic retreatment. **Methods**: 120 human mandibular teeth were treated and divided into 6 groups. 4 were filled with gutta-percha and sealer AH-Plus and retreated after three months by MTwo and ProTaper systems as follows: G1- ProTaper F1 (PTF1); G2 ProTaper F4 (PTF4); G3 Mtwo 20:06 (MT20); G4-Mtwo 40.04 (MT40) and negative control groups (CN) and Positive Control (PC) with and without calcium hydroxide respectively. The time taken to retreatment was recorded. The residual material was measured by means of images obtained in micro computed tomography and observed in the Image Pro Plus. Except for the negative control group, the teeth were filled with calcium hydroxide and placed in individual vials containing deionized water. PH was measured at 7, 21, 45 and 60 days. The data were analyzed and compared by Kolmorogov-Smirnov and Shapiro-Wilk tests to verify the normality and the multiple comparisons Tukey HSD to 5%. **Results**: MT40 and PTF4 groups were more effective in removing waste, but equal to each other ($p > 0.05$). With respect to pH, PTF1 hindered the diffusion of calcium hydroxide (2.07 ± 0.41) were significantly different from MT40 (2.55 ± 0.43) and CP (2.49 ± 0.43) ($p < 0$, 05). The ProTaper system was faster than MTwo ($p < 0.05$). **Conclusion**: The pH variation occurred in endodontically retreated canals, showing lesser of hydroxyl ions when the amount of waste was more than 59%

Keywords: Endodontics. Calcium hydroxide. Endodontic retreatment. pH. Diffusion.

Introduction

If there is a need to perform an endodontic retreatment, the main objective of this is to remove the material that has been the cause of failure, necrotic tissue debris and bacteria, including those that survived through the filling material. For this we must remove it and get new access to the apical foramen (1). Numerous techniques have been employed for this purpose being evaluated by different methodologies (2-10). However, almost always, the authors report a non-effectiveness in the total removal of the same (3, 4, 6-9).

The efficient removal would improve the quality of root canal preparation, resulting in better chance of success in the new intervention (1). Also, would allow the possible need to put an intra-canal medication, it could spread through the dentinal tubules and eliminate persistent microorganisms from primary treatment or that developed after the failure of this (11).

The diffusion of hydroxyl ions through the dentinal tubules can act against those present microorganisms and their toxins (12, 13), besides having anti-inflammatory action by denature some pro-inflammatory agents (14).

Because of these reasons, calcium hydroxide have been used in primary necrotic endodontic treatment, retreatment as in (11), precisely where the Enterococcus faecalis is often found, although its action in these cases is questioned (15, 16). Recent studies have shown that calcium hydroxide nanoparticles seem to be more effective due to better penetration into the dentinal tubules (17). The antimicrobial mechanism of the calcium hydroxide is possible by diffusion of hydroxyl ions through the dentin, resulting in change in pH, promoting environment alkalinization (15). This diffusion occour by the difference of the concentration within the root canal to the dentinal walls and the size of the particles of calcium hydroxide (18). The penetration of these drugs within these may still be hampered by decreasing the permeability. Thaler et al. (2008) (19) demonstrated that age can interfere with the permeability of dentin interfering with the distribution of drugs used in the disinfection of root canals. Pascon et al. (2012) reported that removal of smear layer increases the permeability of primary teeth (20). Recently, Wang et al. (2013) demonstrated that removal of the smear layer significantly improves the action of the disinfection protocols to Enterococcus faecalis (21). Kazemipoor et al. (2012) found

that the change in pH was different in endodontically not retreated and retreated teeth (22).

The objective of this study was to analyze the diffusion of hydroxyl ions through the measurement of pH variation from the calcium hydroxide medication in teeth subjected to endodontic retreatment with two rotary NiTi systems, aiming to compare the best cleaning performance between them, in direct reason for this, analyzing up, in parallel, the amount of waste by means of cone beam computed tomography in addition to the runtime to make this. The null hypothesis was that there is no difference between the mean pH variations in the quantity of waste remaining after endodontic retreatment.

Material and Method

120 mandibular single root teeth, with intact crowns and without restorations, obtained from the Teeth Bank of PUCPR. The study was approved by the Ethics Research Committee in accordance with the opinion embodied number 48588. Initially, the teeth were stored in 10% formaldehyde solution for 15 days. Teeth were debrided of any exterior hard and soft tissues by curettes (Duflex-SSWhite, Rio de Janeiro, Brazil) and then stored in saline.

Coronary access was performed with diamond burs 1013 and 3080 (KG Sorensen, São Paulo, Brazil). The operation of the canal was performed with instrument K # 10 (Dentsply, Maillefer, Ballaigues, Switzerland) which served to determine the working length, viewing it to reach the foramen, subtracting this measure 1mm. The mechanical preparation of the root canal was performed using crown-down technique with Flexofile instruments (Dentsply, Maillefer, Ballaigues, Switzerland) establishing itself as the # 35 surgical diameter. According to the measure of length 120 samples were divided into six groups so that the average size was approximately between them.

Every instrument of exchange the canals were irrigated and aspirated with 2.0 ml of sodium hypochlorite 1% (Myako of Brazil Ind. And. Ltda., São Paulo, Brazil). Four groups, that is, eighty teeth were then dried with absorbent paper points (Dentsply, Latin America, Petrópolis, Brazil) # 35 (0.35 mm diameter and taper 2%) and filled by the lateral condensation technique, using gutta-percha # 35 (Tanari,

Amazonas, Brazil), gutta MF accessories (Tanari, Amazonas, Brazil) and Ah Plus cement. (Dentsply De Trey, Konstanz, Germany).

After filled teeth received a coronary sealing with Citodur (Dori Dent, Austria). Cone beam tomography was performed with apparatus (Kodak 9000C 3D Carestream Health, Inc.) with 76µm volume in exposure (isotropic voxel) of 10.8 seconds at 60 kV 5mA, each group of teeth 5, named in amounts of 1 to 16, wax device that provided the same position and returned to saline and stored for three months at 37 ° C. Forty teeth were not filled because composed the positive and negative control groups, and equally, returned to saline after coronal sealing.

After three months, the groups were classified as: G1 ProTaper F1 (PTF1), in which the teeth were retreated with the ProTaper Universal system (Dentsply, Maillefer, Ballaigues, Switzerland) for retreatment, the sequence of D1 to D3 and with instrument # F1 (diameter 0.20 mm taper 7%); G2 ProTaper F4 (PTF4), in which the teeth are depicted in the same way that the widening PTF1 preparation with instruments # F2 # F3 and F4 # (diameter 0.40 mm, taper 6%); G3- M Two- 20.06 (MT20), wherein the teeth are depicted by means of the instruments and R15.05 R25.05 MTwo for retreatment and instruments 10.04, 15.05 and 20.06 (0.20 mm diameter and taper 6%); G4 M-Two 40.04 (MT40), in which the teeth were retreated in the same way that the MT20 widening preparation with instruments 25.06, 30.05, 35.04 and 40.04 (0.40 mm diameter and taper 4%).

The retreatment times were timed to the last instrument set for each group. During instrumentation, the canals were irrigated with 5.0 ml of sodium hypochlorite 1% every instrument of exchange and, finally, dried and filled with EDTA solution 17% (Biodynamics Chemicals & Pharmaceuticals Ltda., Ibiporã, Brazil) for three minutes irrigated once again with sodium hypochlorite 5.0ml of 1%, and dried again. After retreatment the four groups were exposed to tomographic images similar to the first time. After this procedure, the teeth were filled with 0.1 mL of calcium hydroxide paste Ultracal XS (Product Inc. Ultradent, South Jordan, UT, USA). The G5 Negative Control (NC) has not received the calcium hydroxide paste and the G6- Positive Control (CP) received the EDTA solution to 17%, then dried and filled with the same calcium hydroxide.

Immediately after each filling with calcium hydroxide teeth were coronally sealed with citodur and polymerized composite resin Z350 (3M ESPE) and both coronary part as the apical foramen, were sealed with cyanoacrylate (Super bonder,

Henckel, São Paulo) and epoxy resin (Araldite- Maxepoxi Industrial and Comercial Ltda. São Paulo, SP, Brazil). Later the teeth were immersed in individual flasks containing 30 ml of deionized water pH 6.2 and pH measured by pHmeter (Quimis-Q400A) after its calibration with pH buffer solutions 4.0, 7.0 and 12.0. For each measurement, the pH meter electrode was gently cleaned with deionized water and dried with paper towels in order to dispose of waste that could influence the measurements. After measuring the teeth returned to 37º C. The same procedures were performed with seven, twenty one, forty-five and sixty days.

The tomographic images were observed by horizontal cuts 15 cuts spaced at 0.5 mm for each tooth, with oblique and vertical beam viewing analyzing each tooth in a single cut. The percentage of the remaining material area was measured with Image Pro Plus software (Media Cybernetics, Silver Spring, MD). Data were tabulated and submitted to statistical analysis, applying the Kolmogorov-Smirnov and Shapiro-Wilk test to verify the normality, and multiple comparisons Tukey HSD (SPSS 19.0).

Results

pH

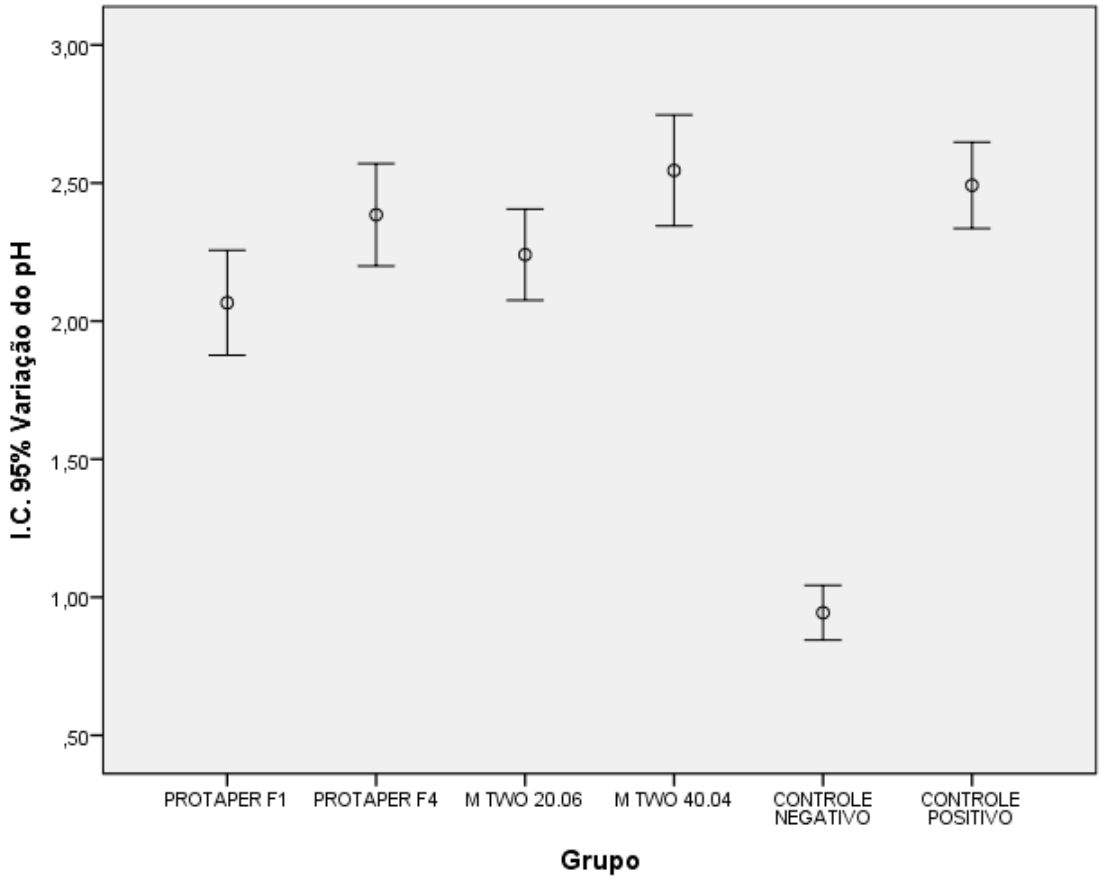
Regarding the change in pH the CN group showed significant differences compared to all groups (Figure 1). All teeth were independently increased the group. (Table 1).

When statistically analyzing the groups was observed that the PTF1 group, 2.07 (± 0.41), showed a significant difference from groups MT40 and the CP.

Table 1. Average value of pH variation in each group in the evaluated days

Group	*N*	*mean*	*Std Dev*	*Std error*	*mean*		*minimum*	maximum
					Lower limit	Upper limit		
PTF1	20	2,07	0,41	0,09	1,88	2,26	1,35	2,86
PTF4	20	2,39	0,40	0,09	2,20	2,57	1,63	3,19
MT20	20	2,24	0,35	0,08	2,08	2,41	1,55	2,82
MT40	20	2,55	0,43	0,10	2,34	2,75	1,55	3,30
CN	20	0,94	0,21	0,05	0,84	1,04	0,62	1,30
CP	20	2,49	0,33	0,07	2,34	2,65	1,97	3,18
Total	120	2,11	0,65	0,06	1,99	2,23	0,62	3,30

Graphic 1. Analysis of variance with respect to the variation of pH



As waste walls

Residual analysis of vertical and horizontal tomographic slices demonstrated that MTwo system tended to remove more waste. PTF1 showed a percentage of residues of 59.08 (± 17.67) for the vertical cuts and 60.26 (± 16.63) for horizontal totaling an average of 59.67%. MT20 already obtained 57.75 (± 15.50) in vertical and 58.15 (± 13.08) in the horizontal resulting in 57.95% of average percentage. These values were not significant between them. In the groups with additional instruments presented PTF4 29.91 (± 17.06) vertically evaluation and 29.45 (± 17.25) horizontally, resulting in an average of 29.68%. In turn MT40 got 22.51 (± 13.33) and 23.52 (± 17.12) respectively, with an average of 22.72%. Similarly there was no significance when the comparison was made between the two groups, although there are differences between the two criteria adopted, with or without additional instruments (Table 2).

Table 2. Percentage of remaining waste to the canal walls

Descriptives

		N	Mean	Std Deviation	Std error	mean		minimum	maximum
						Lower limit	Upper limit		
Percentage of waste in the root canal walls in vertical section	PTF1	20	59,08	17,67	3,95	50,81	67,35	22,67	82,04
	PTF4	20	29,91	17,06	3,81	21,93	37,90	-	54,62
	MT20	20	57,75	15,50	3,47	50,49	65,00	25,99	86,77
	MT40	20	22,51	13,33	2,98	16,27	28,75	3,62	48,35
	Total	80	42,31	22,70	2,54	37,26	47,36	-	86,77
Percentage of waste in the root canal walls in horizontal section	PTF1	20	60,26	16,63	3,72	52,48	68,04	32,21	91,68
	PTF4	20	29,45	17,25	3,86	21,37	37,52	5,16	63,95
	MT20	20	58,15	13,08	2,93	52,02	64,27	30,99	92,07
	MT40	20	23,52	17,12	3,83	15,50	31,53	1,61	64,92
	Total	80	42,84	22,93	2,56	37,74	47,94	1,61	92,07

It was observed that the PTF1 both in vertical sections, the horizontal sections obtained in lower performance, leaving more than 59%residues in the walls.

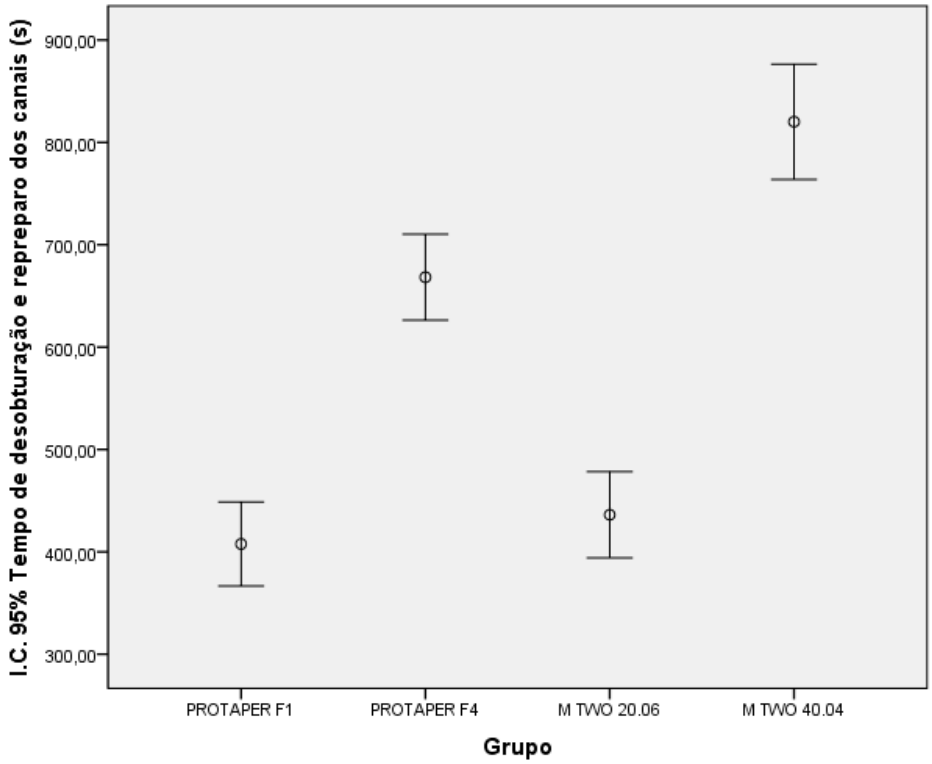
How long retreatment

Considering the time variable was no significant difference between the groups with additional tools and without these groups (Table 3). Among both, considering the complete reinstrumentação, the ProTaper instruments were faster, which was no significant difference for these (Graphic 2).

Table 3. Time for performing the treatment in seconds

Descritivos									
			Mean	Std Deviation	Std error	mean		minimum	maximum
						Lower limit	Upper limit		
Clearing time and root canal retreatment (s)	PTF1	20	407,65	87,73	19,62	366,59	448,71	270,00	583,00
	PTF4	20	668,30	89,61	20,04	626,36	710,24	480,00	826,00
	MT20	20	436,20	90,01	20,13	394,07	478,33	305,00	685,00
	MT40	20	820,15	120,27	26,89	763,86	876,44	570,00	990,00
	Total	80	583,08	196,29	21,95	539,39	626,76	270,00	990,00

Graphic 2. Analysis of variance for the treatment time between groups



Discussion

The null hypothesis was rejected because there were differences in pH range between groups with higher and lower amount of material present after endodontic retreatment, with less variation when the amount of waste was more than 59%.

The evaluation of filling capacity material removal has been assessed by several methods, all based on measuring the waste area that remain after endodontic therapy (2-10, 23, 24). Comparing instruments, some studies showed similar results (10, 23, 24) and others with significant differences (2-9) but what is not clear is that this amount of remaining filling materials interferes with the quality of treatment, is for providing effectiveness of the medication, if necessary, or the future adaptation of the new shutter the root canal walls. Area measurement of these materials has become increasingly more accurate with CT (23) and even better with CT Cone Bean (7, 9, 10). However, doubt if these materials interfere in these respects, still remains.

With the use of intracanal medication with calcium hydroxide, whether used for several vehicles, with or without other drugs, you want to, what the situation is, to occur dissociation of calcium and hydroxyl ions through the dentinal tubules, raising the pH of the medium, thus causing a deleterious effect to infectious agents (25-31).

The dentin permeability has also been investigated by different ways, showing that this intrinsic factors can alter permeability such as age of the tooth and the number of attacks suffered by the latter as caries, abrasions and injuries of various origins (19). Extrinsic factors may also influence the dentin permeability such as the presence of smear layer and probably the presence of material adhered to dentin walls, obliterating the entrance of dentinal tubules and preventing diffusion of substances or interfering with accession is materials restorative and filling materials (32). Cleaner walls can mean higher permeability allowing in cases of endodontic retreatment, better penetration of dressing used favoring the disinfection of the root canal system (21).

The increase in pH can be influenced by dentin buffer capacity (33) although Freire et al. (2010) showed that the calcium hydroxide with propylene glycol is not affected by dentin buffering (34).

Moreover, the vehicle used may influence the ionic dissociation. In this study we used Ultracal having an aqueous vehicle. Zmener et al. (2007) found that Ultracal showed progressive increase in alkalinity over 30 days (35). Chamberlain et al. (2009) (26) and Heward et al. (2011) (29) also use of this medicine. Studies have shown that aqueous carriers may diffuse greater quantity of ions or faster (35). In turn Tanomaru et al. (2012) (31) did not find these interference.

To verify that the presence of higher amount of filling material on the dentin walls interferes with the dentin permeability, it was decided to form two groups with low instrumentation, that is, passing instruments of smaller caliber than surgical diameter established for the samples. Groups 1 and 3. Marques da Silva et al. (2012) (4) also used this method, making use also of the same cement shutter used in this experiment, the Ah Plus, which similarly had been used previously (3, 5, 7, 9, 10). This fact was confirmed by a review of the amount of residual area, obtained by tomography thereof, by which obtained the quantitative analysis in Images Image Pro Plus program, relating it to the change in pH caused by the diffusion of hydroxyl ions. The use of software for measuring waste areas provides greater fidelity to the data, compared to the visual assessments. This program was also used in another study (2). Others used a similar program (5.24).

In the present study two major systems instruments were used. In which have been compared with each other in the ability to clean up the channel walls already

treated (3, 4, 6). Other evaluated the performance of these individually, as compared to other existing on the market (2, 5, 7-10).

The difference between both instruments, ProTaper and M-Two, with the quantity of residual waste, both in observation of the cuts in the vertical direction as well as the cuts horizontally, showed no difference ($p > 0.05$) Results diverging Tasdemir et al. (2008) (3), in which the study demonstrated superiority in relation to ProTaper to M-Two, however, without retreatment instruments. Bramante et al. (2010) (6) also found favorable results to ProTaper system, but this time using only the retreatment instruments for both systems.

Significant differences were found between groups using or not additional instruments. In methodology similar to this work, the use of these two systems, Marques Silva et al. (2012) (4) did not find differences.

One of the subgroups without additional instruments with M-Two instrument showed no significant difference between the groups with additional instrumented and the positive control, and the other, with ProTaper, was different from the MT40 group and the positive control. It was observed that, in this group the percentage waste was around 60%, ie, a large amount of material. It might be suggested that this occurred due to the design of the instruments, especially the turns of Mtwo instrument, which become larger and more effective in sections corresponding to the cervical area of the canal, just where the dentinal tubules are more numerous and more open favoring higher diffusion.

This study observed the pH increase in external solution, also occurred in previous studies (25, 27-31). In terms of obtained values, the pH changes within 60 days, the results of this study were closer to Mori et al. (2009) (27) and Tanomaru et al. (2012) although the latter using bovine teeth (31). Conflicting results were found in studies using different methodologies in which the change in pH was greater, even shortest evaluation time (28), and also similarly with simulated channels (25).

As for the file runtime ProTaper shown to be faster, especially in the use of specific tools for removing the filling material, and this was already described by Bramantc et al. (2010) (6). One reason it would be the amount of the instruments used, in which case the system would comprise a Mtwo groups with more 1 instrument and 3, two more between groups 2 and 4. Solomonov et al. (2012) (7) and Mandani et al. (2015) (10) describe, for the time of retreatment with ProTaper files, very similar results to the findings in this study.

According this methodology pH change was influenced by the amount of waste, since they are present in large quantities.

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APÊNDICE A – ILUSTRAÇÕES

Figura 1. Captura de imagem para avaliação dos resíduos em Tomografia CB

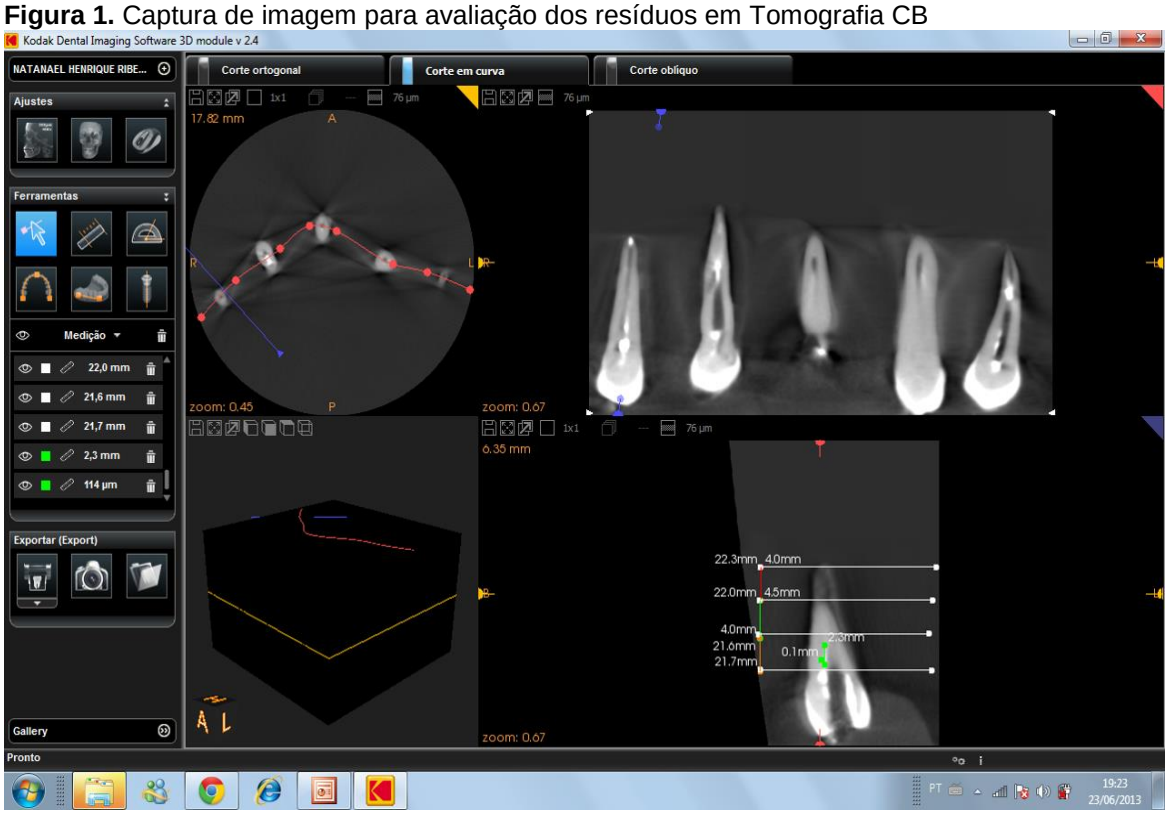


Gráfico 1. Análise de variância do percentual de resíduos remanescentes nos cortes verticais

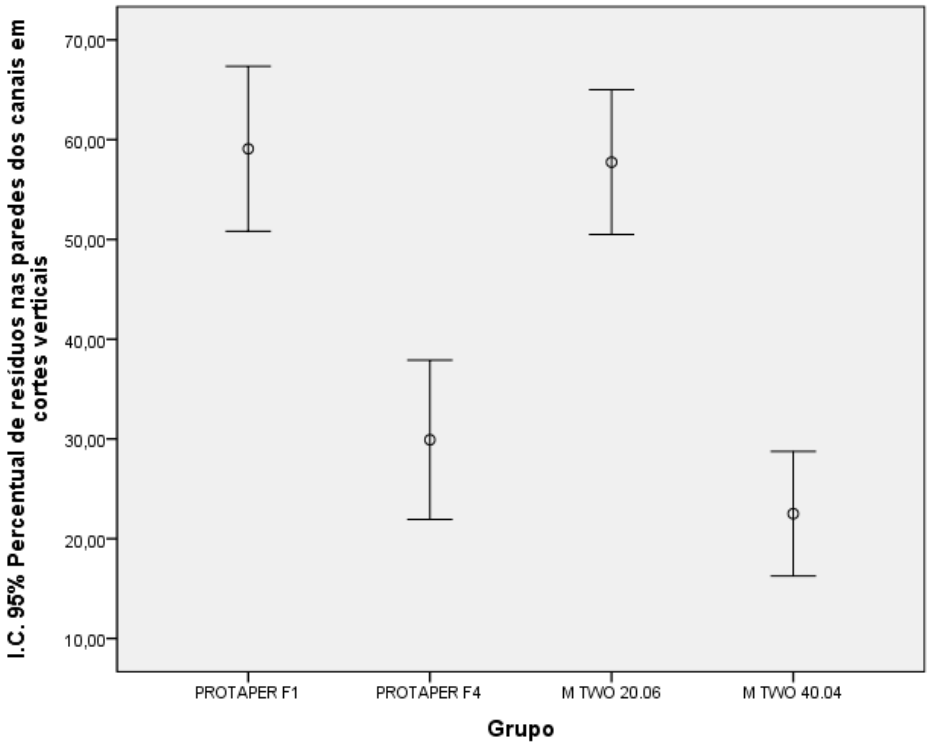


Gráfico 2. Análise de variância do percentual de resíduos remanescentes nos cortes horizontais

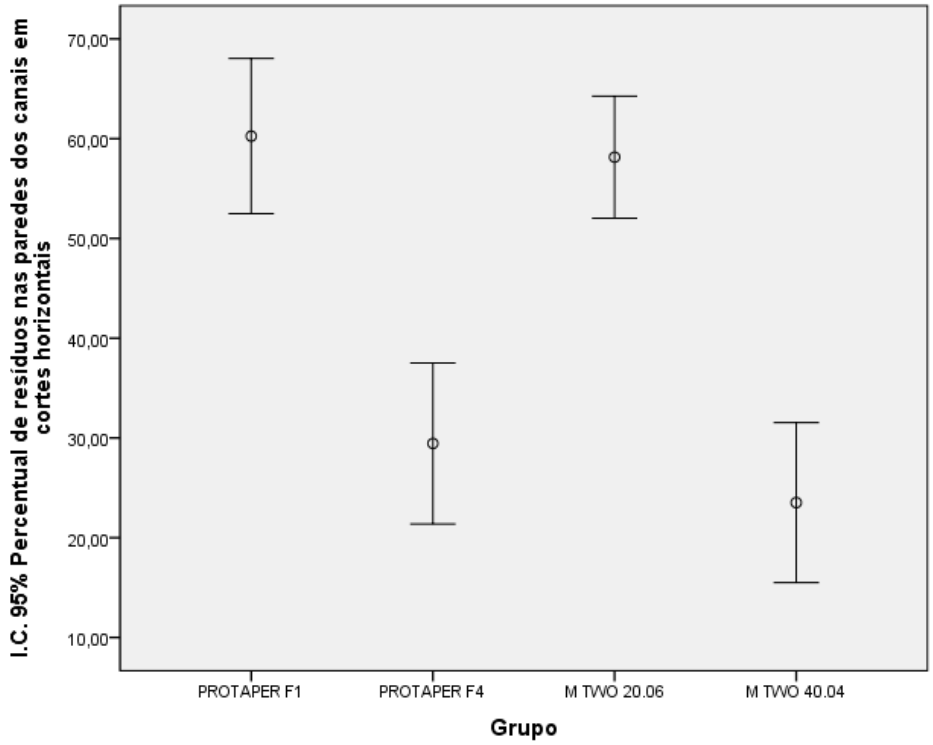


Gráfico 3. Variação do pH

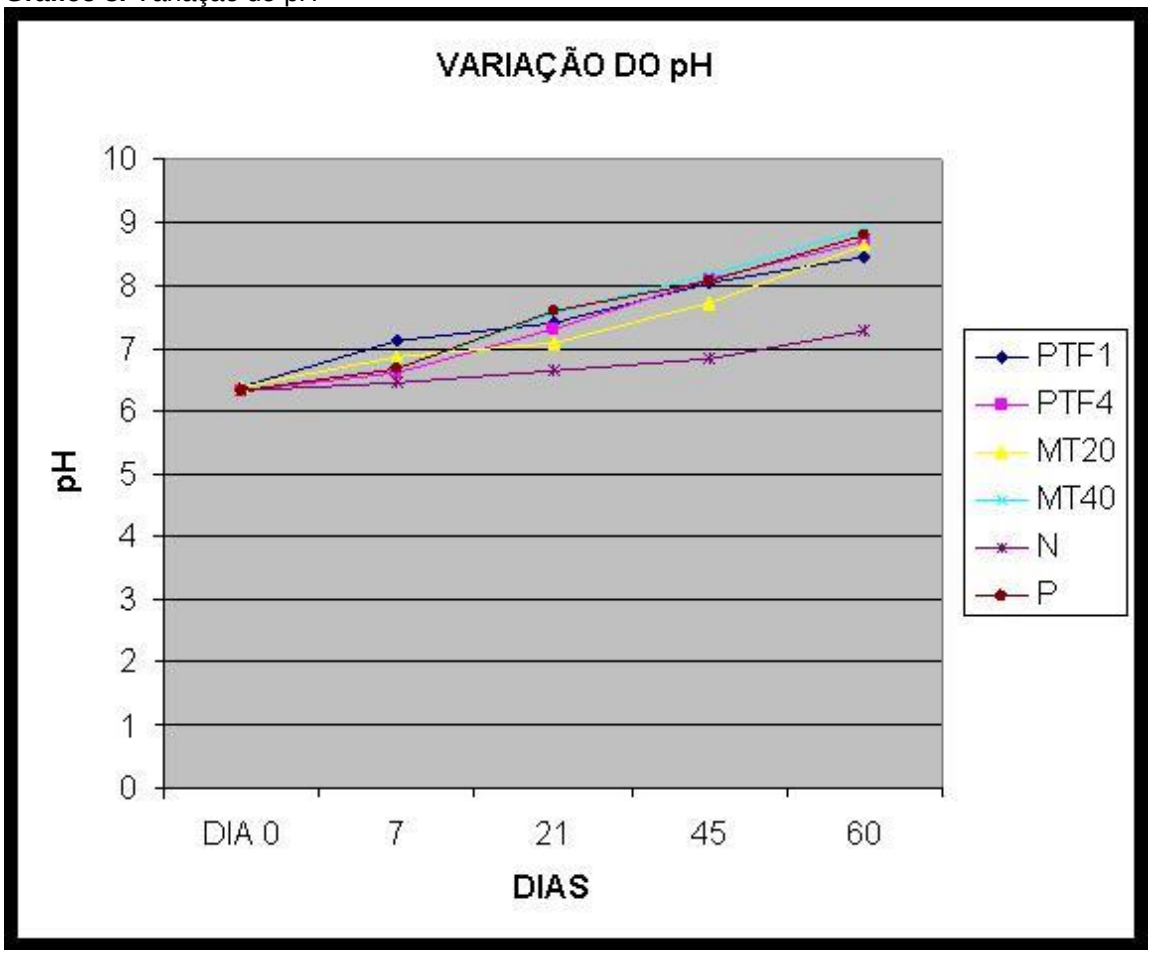


Tabela 1. Variação do pH em cada dente por grupo

Dente	*PTF1*	*PTE4*	*MT20*	*MT40*	*CN*	*CP*
1	2,2	2,59	1,82	2,55	0,89	2,73
2	1,87	3,19	2,59	2,15	1,12	2,79
3	1,71	2,55	2,4	2,64	0,69	2,92
4	2,14	2,56	2,23	2,26	0,82	2,44
5	1,79	2,32	1,98	2,71	1,21	2,23
6	1,89	2,2	2,23	2,47	1,18	2,42
7	1,47	2,46	2,23	2,89	0,96	2,7
8	2,17	1,63	1,55	2,64	0,78	2,48
9	2,53	2,23	2,19	2,88	0,96	3,18
10	1,91	1,94	2,25	3,3	1	2,81
11	2,86	2,3	2,15	2,98	1,3	2,84
12	1,98	2,67	1,86	3,07	1,23	2,21
13	2,18	2,81	1,58	2,67	1,24	2,1
14	1,47	1,86	2,56	2,81	0,85	2,11
15	2,41	2,36	2,49	2,85	0,85	2,23
16	2,33	2,63	2,82	1,55	0,85	2,42
17	2,13	2,28	2,64	1,92	0,62	1,97
18	1,35	2,87	2,17	2,24	0,67	2,17
19	2,16	1,67	2,36	2,21	0,66	2,28
20	2,78	2,58	2,71	2,12	1	2,81
média	2,0665	2,385	2,2405	2,5455	0,944	2,492

Tabela 2. Valores médios do pH nos dias avaliados

GRUPOS	0 DIA	7 DIAS	21 DIAS	45 DIAS	60 DIAS
PTF1	6,3865	7,096	7,412	8,044	8,453
PTF4	6,325	6,6065	7,301	8,092	8,71
MT20	6,386	6,8525	7,079	7,7275	8,6265
MT40	6,3315	6,659	7,551	8,163	8,877
CN	6,3275	6,442	6,6395	6,8365	7,2715
CP	6,306	6,6525	7,575	8,0755	8,798

ANEXO A – BANCO DE DENTES

Pontifícia Universidade Católica do Paraná
Escola de Saúde e Biociências
Clínica de Odontologia

PUCPR
MARISTA

BANCO DE DENTES -PUCPR

Ao CEP

O Banco de Dentes da PUCPR por meio de sua coordenação informa que os dentes solicitados pelos pesquisadores: Natanael Henrique Ribeiro Mattos e Luiz Fernando Farinink , com o Título: Avaliação da Difusão do Hidróxido de Cálcio em Dentes Submetidos a Retratamento Endodôntico por Sistemas Rotatórios de Níquel Titânio. Encontram-se à sua disposição após o parecer favorável de seu projeto por comitê de ética em Pesquisa.
Observação: Após a realização da pesquisa os dentes deverão ser devolvidos ao Banco de Dentes da PUCPR.

Atenciosamente,

Curitiba, 11 de julho 2012

Profª Drª Beatriz Helena Sotile França
Coordenadora do Banco de Dentes da PUCPR

Rua Imaculada Conceição, 1155, Prado Velho, CEP 80215-901, Curitiba, Paraná, Brasil
Caixa Postal 17315, CEP 80240-980, Tel.: (41) 3271-1574, Fax: (41) 3271-1714, www.pucpr.br

ANEXO B – PARECER CONSUBSTANCIADO E DO COMITÊ DE ÉTICA

Plataforma Brasil - Ministério da Saúde

Associação Paranaense de Cultura - PUCPR

PROJETO DE PESQUISA

Título: AVALIAÇÃO DA DIFUSÃO DO HIDRÓXIDO DE CÁLCIO EM DENTES SUBMETIDOS A RETRATAMENTO ENDODÔNTICO POR SISTEMAS ROTATÓRIOS DE NÍQUEL TITÂNIO

Área Temática:

Pesquisador: Luiz Fernando Fariniuk **Versão:** 2

Instituição: Pontifícia Universidade Católica do Parana - PUCPR **CAAE:** 01702212.4.0000.0020

PARECER CONSUBSTANCIADO DO CEP

Número do Parecer: 48588

Data da Relatoria: 27/06/2012

Apresentação do Projeto:

Análise da limpeza dos canais radiculares através da direta proporção da permeabilidade da dentina permitindo a difusão de íons cálcio e alterando ou não o pH da superfície externa do dente.

Objetivo da Pesquisa:

Comparar a capacidade de limpeza no retratamento endodôntico dos dois instrumentos rotatórios analisados.

Avaliação dos Riscos e Benefícios:

A pesquisa não apresenta riscos pois não envolve seres humanos. Não há benefícios diretos ao sujeito de pesquisa.

Comentários e Considerações sobre a Pesquisa:

A metodologia é complexa pelo número de estudos e grupos, sendo a metodologia coerente com os objetivos apresentados.

Considerações sobre os Termos de apresentação obrigatória:

Apresentado TCUD e autorização para uso do banco de dentes da instituição.

Recomendações:

sem recomendações

Conclusões ou Pendências e Lista de Inadequações:

O projeto está claro e de acordo com a resoluçao 196/96 do sistema CEP/CONEP

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

ANEXO C – TERMO DE COMPROMISSO DE UTILIZAÇÃO DE DADOS

Termo de Compromisso de Utilização de Dados

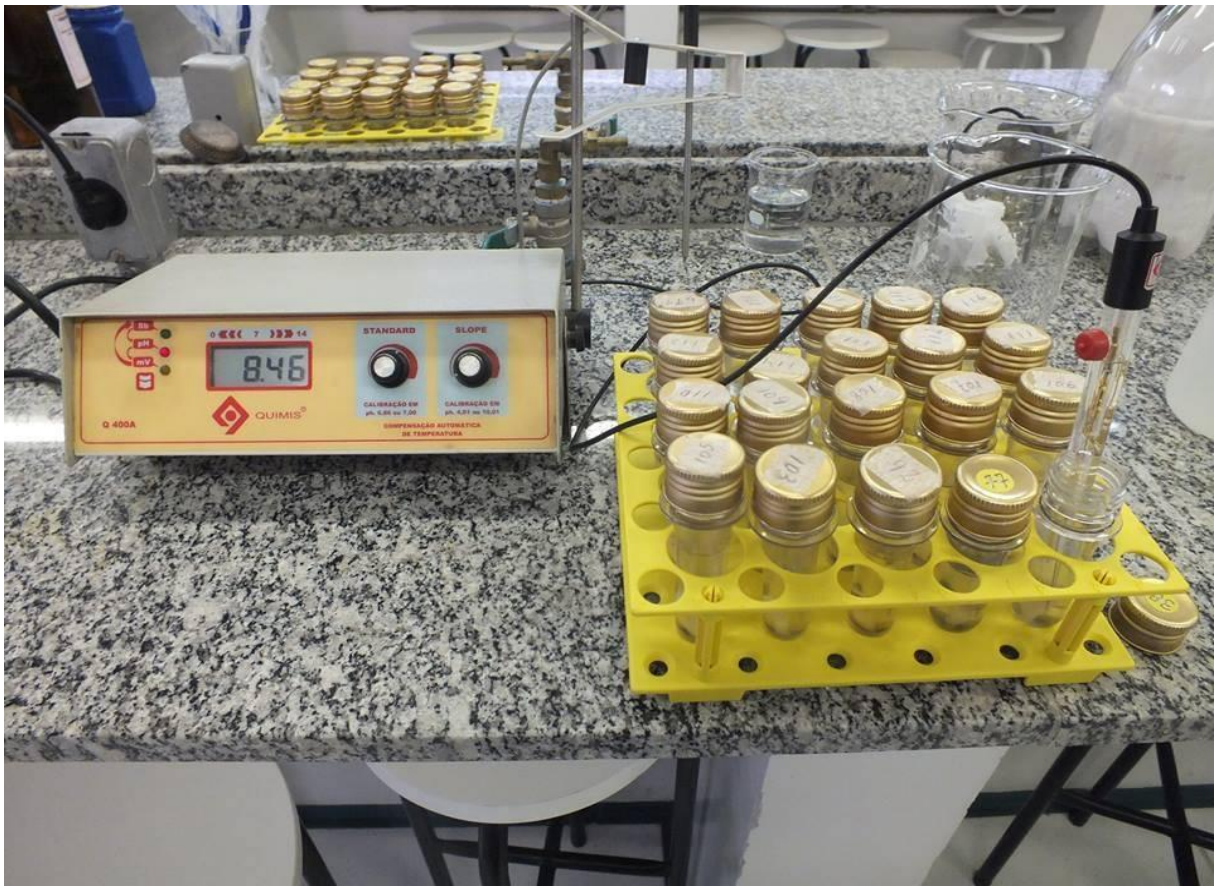
Nós Luiz Fernando Fariniuk e Natanael Henrique Ribeiro Mattos, abaixo assinado(s), pesquisadores envolvidos no projeto de título: **AVALIAÇÃO DA DIFUSÃO DO HIDRÓXIDO DE CÁLCIO EM DENTES SUBMETIDOS A RETRATAMENTO ENDODÔNTICO POR SISTEMAS ROTATÓRIOS DE NÍQUEL TITÂNIO,** nos comprometemos a manter a confidencialidade sobre os dados coletados nos arquivos do projeto, bem como a privacidade de seus conteúdos, como preconizam os Documentos Internacionais e a Res. 196/96 do Ministério da Saúde.

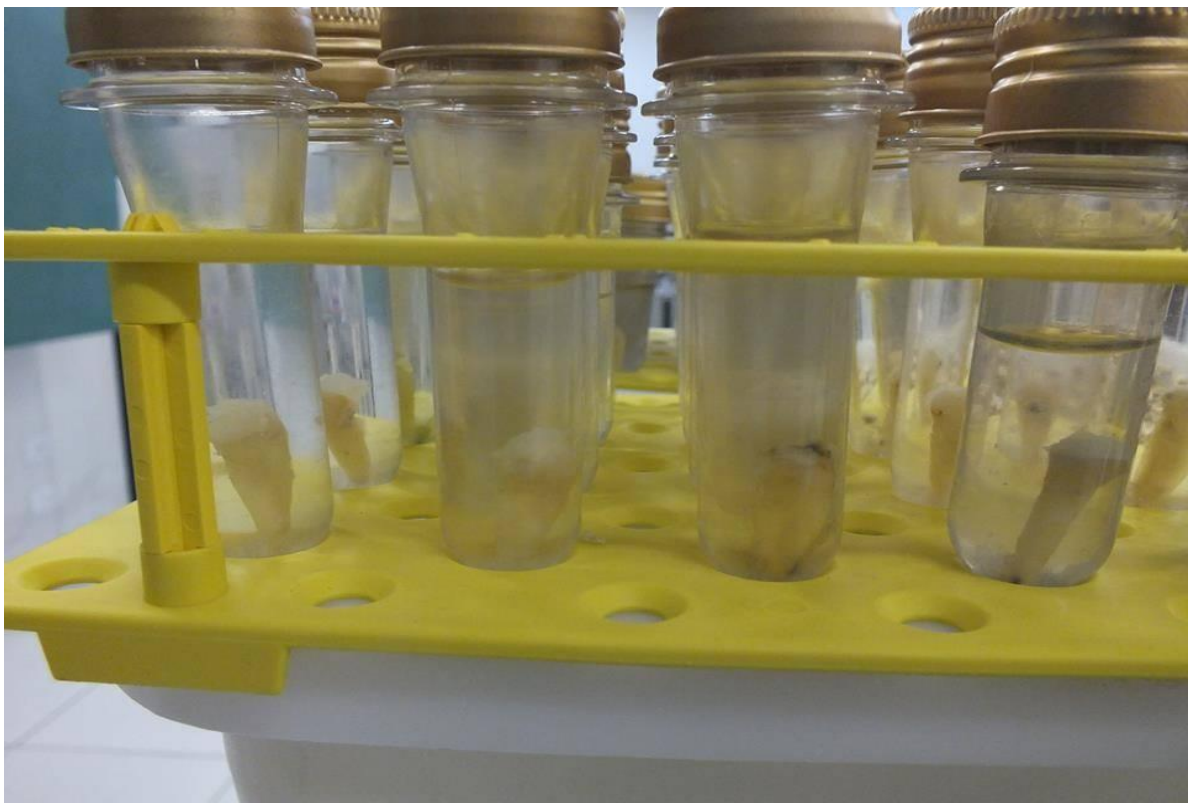
Informo que os dados a serem coletados dizem respeito a Retratamento Endodôntico ocorridos entre as datas de: *Maio 2012 a Dezembro de 2012*

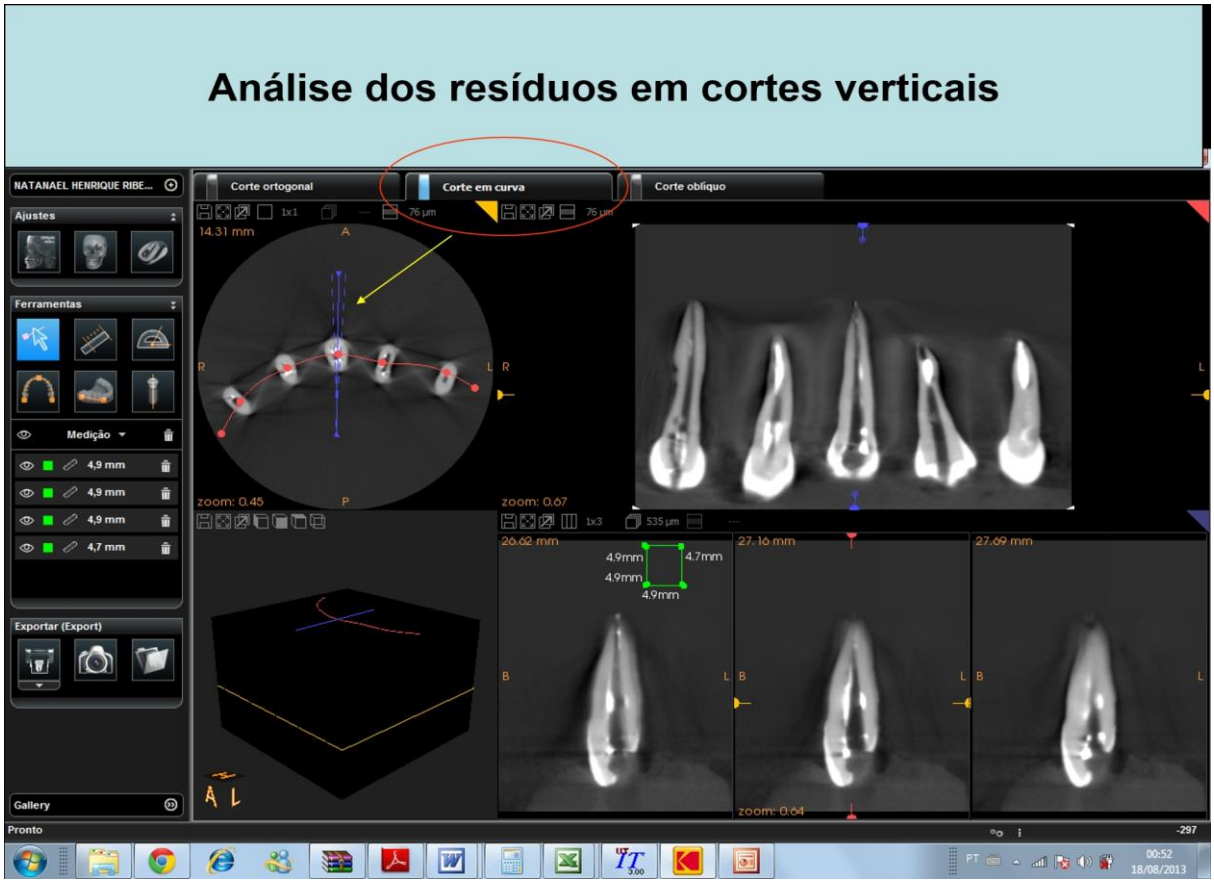
Curitiba, 29 de maio de 2012

Nome	R.G.	Assinatura
LUIZ FERNANDO FARINIUK	4568742-02	
NATANAEL HENRIQUE RIBEIRO MATTOS	10011078	

ANEXO D – METODOLOGIA COMPLEMENTAR






Análise dos resíduos em cortes verticais
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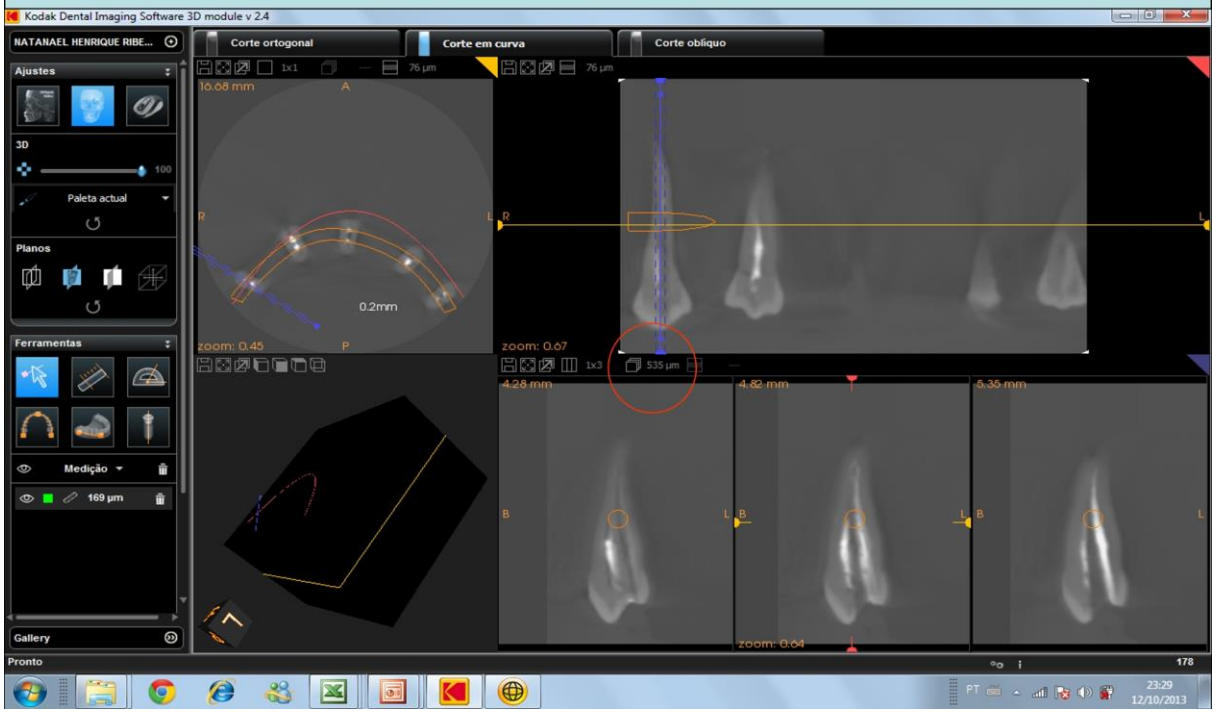
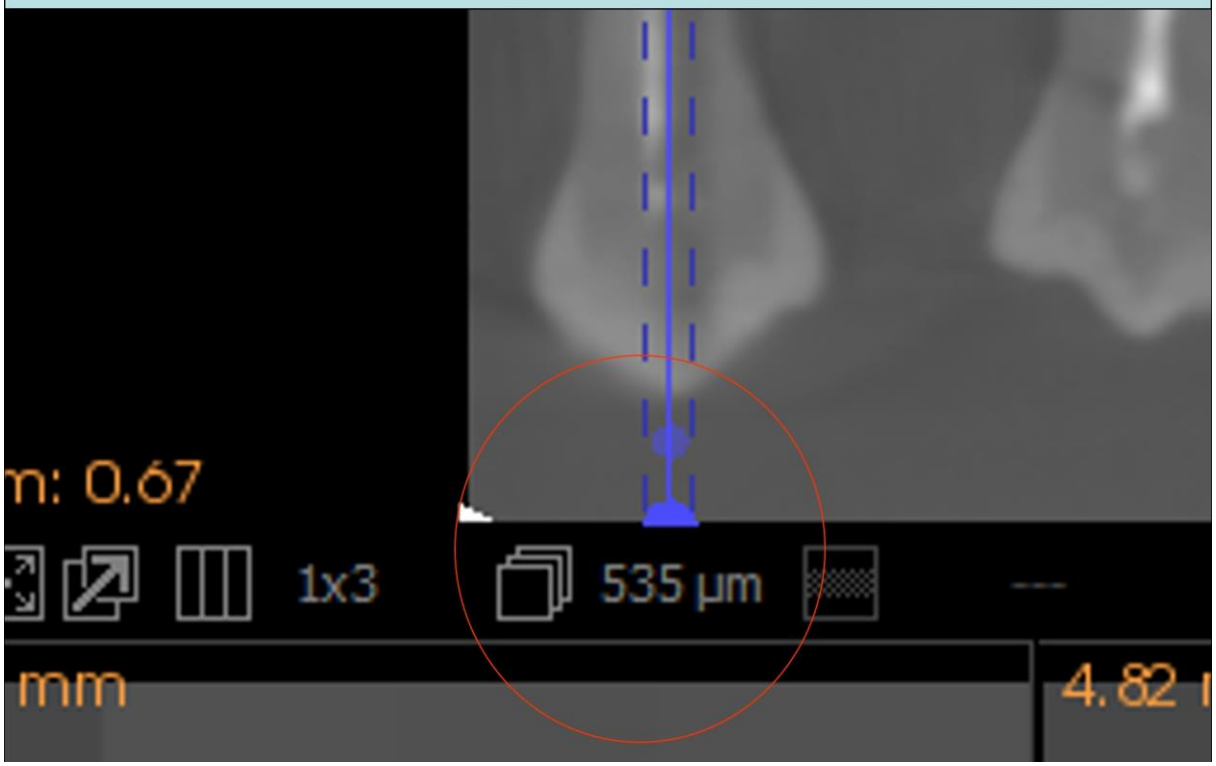
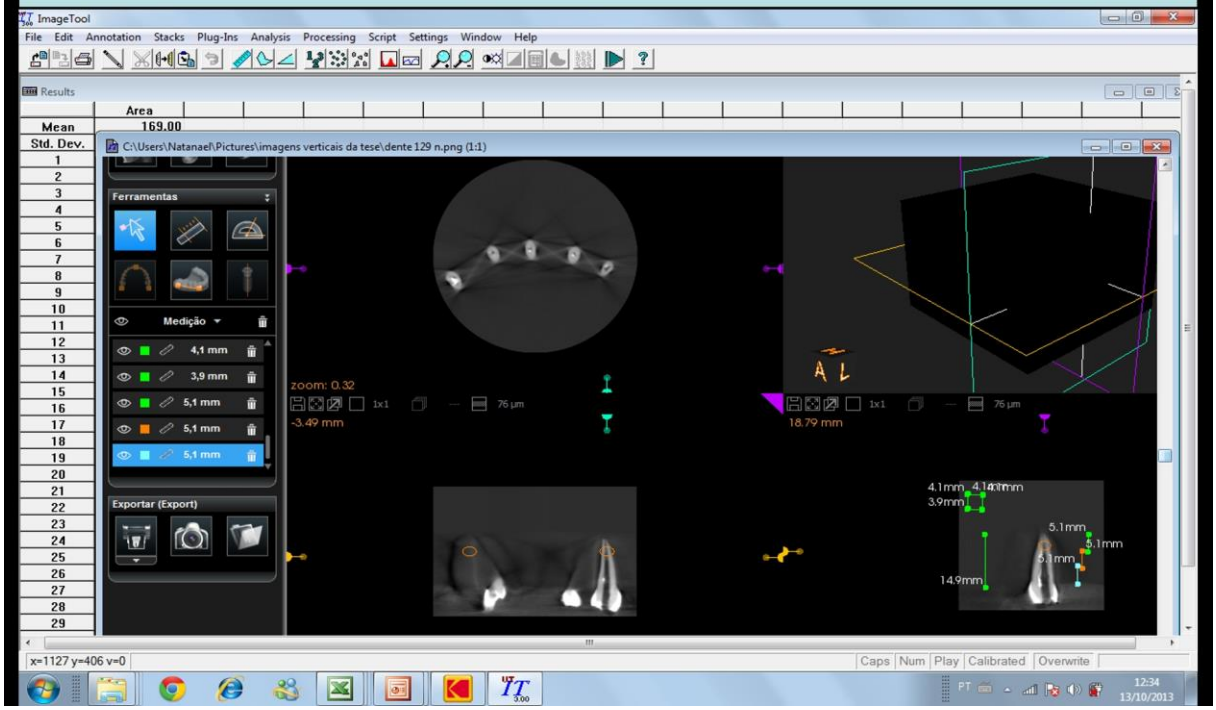
Análise dos resíduos em cortes verticais

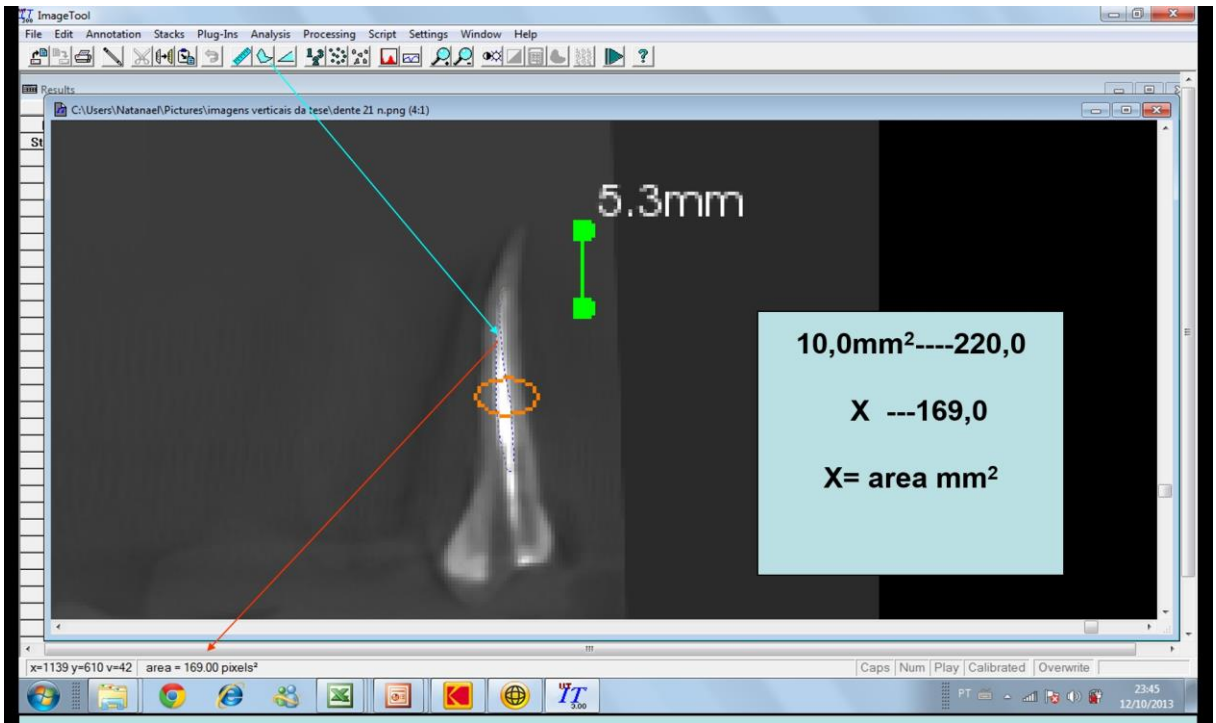


Análise dos resíduos em cortes verticais

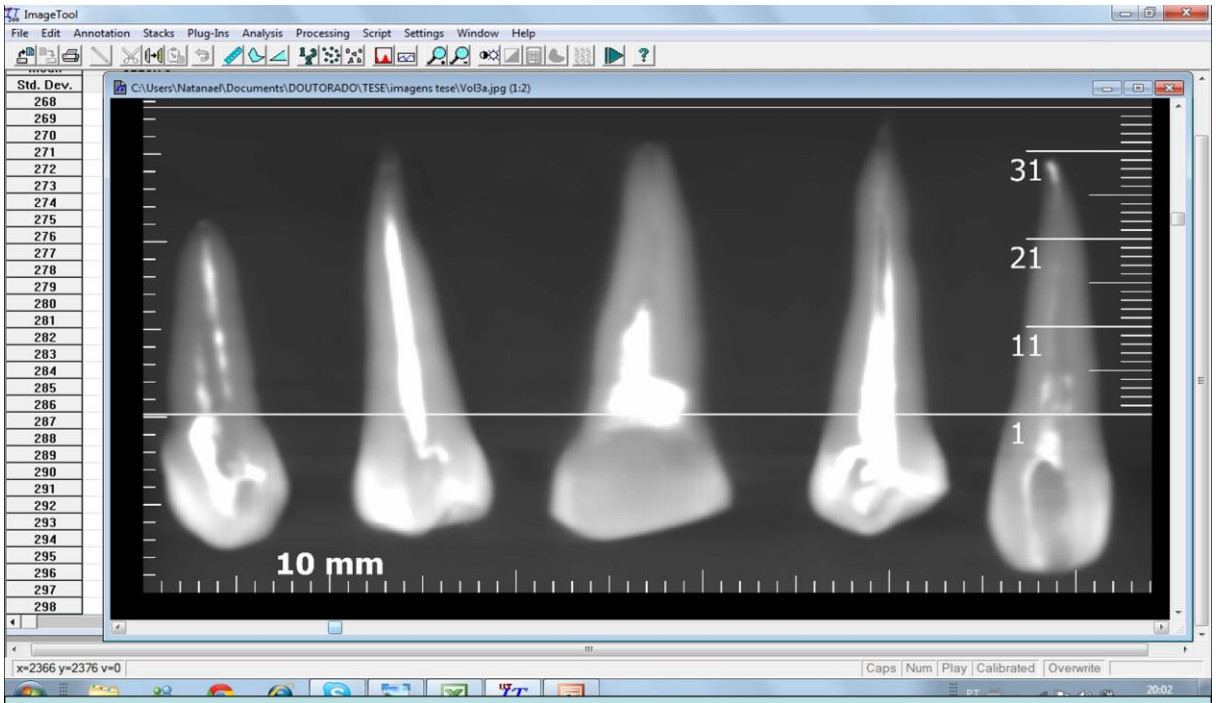


Análise dos resíduos em cortes verticais- Imagem capturada Pelo Image Pro PLus

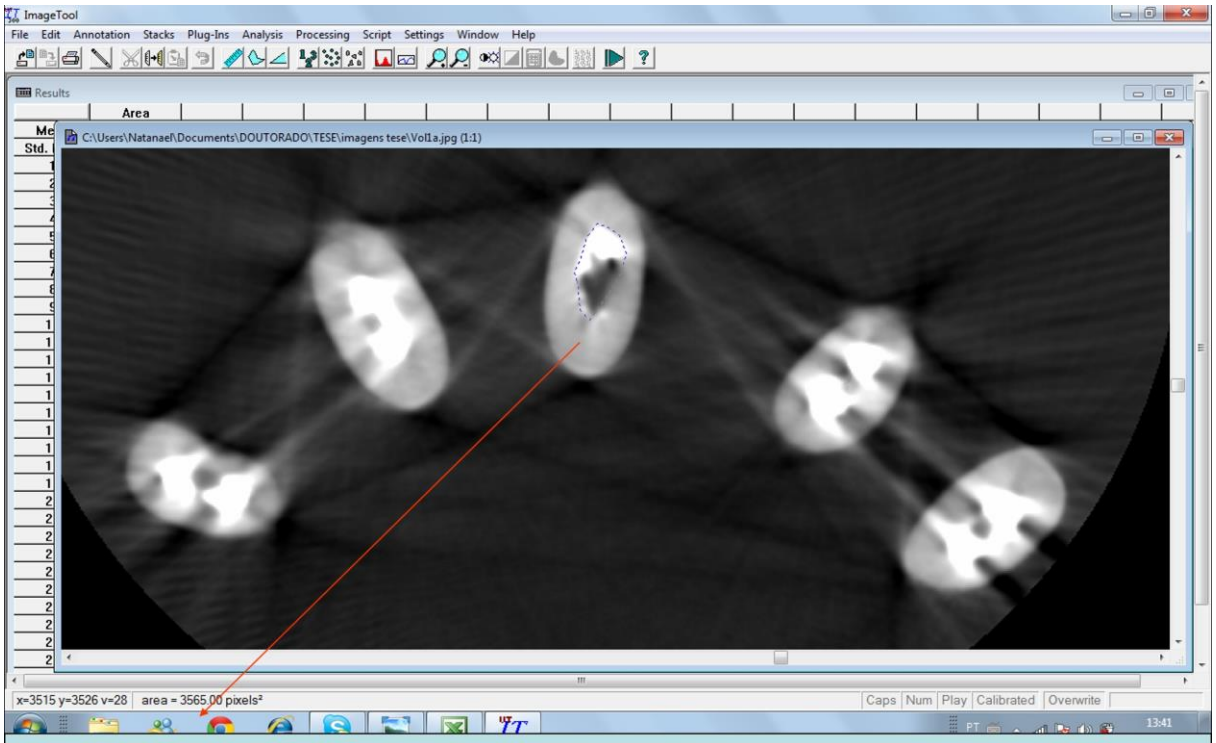




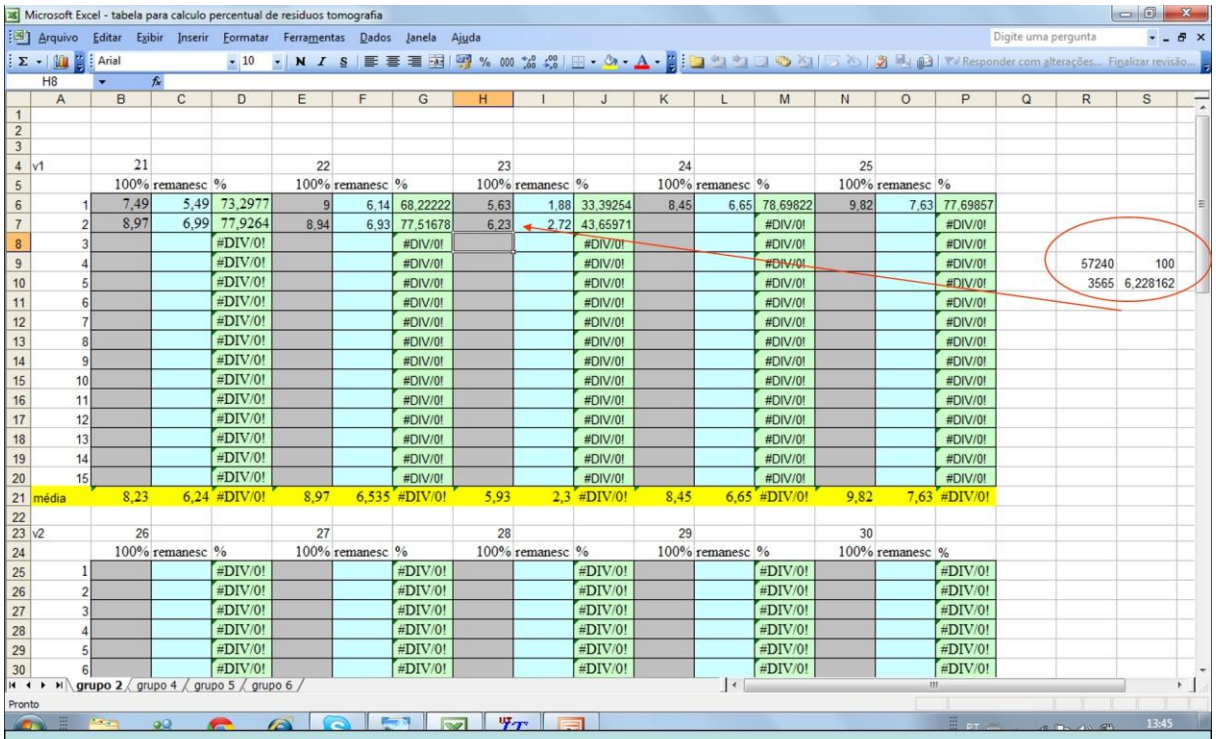
Análise dos resíduos em cortes verticais- Imagem capturada Pelo Image Pro Plus



Análise dos resíduos em cortes horizontais



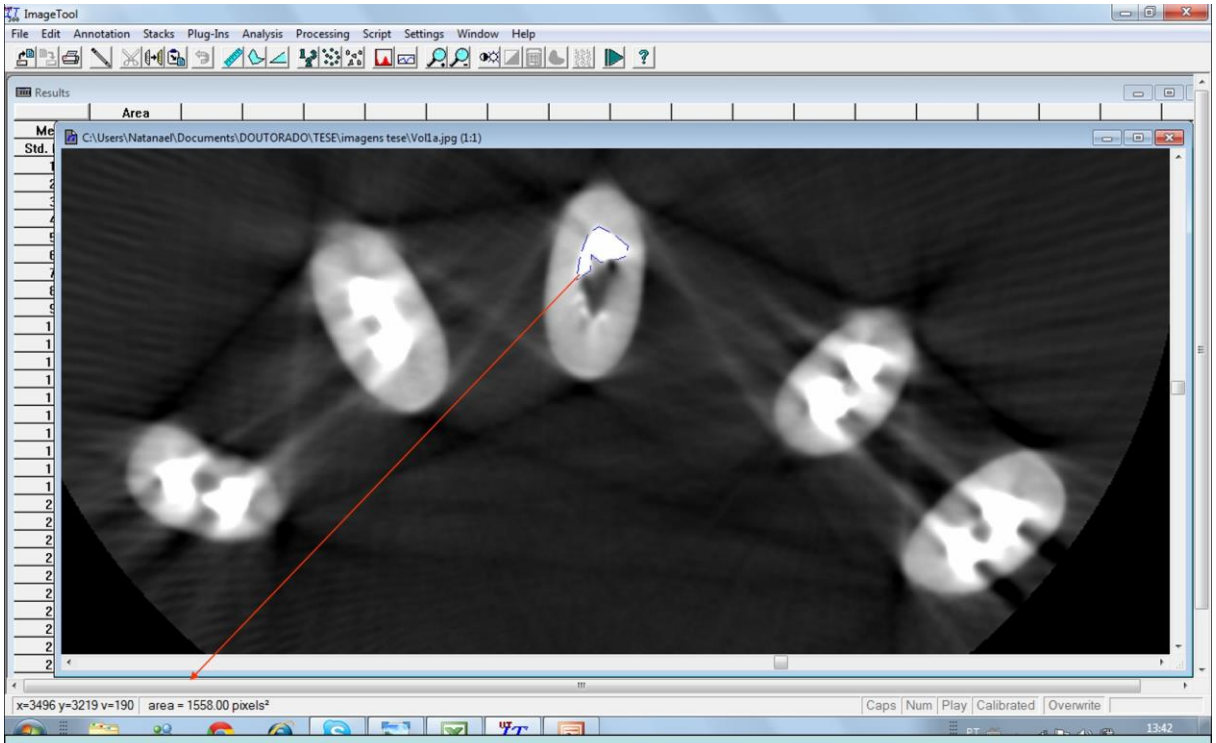
Análise dos resíduos em cortes horizontais



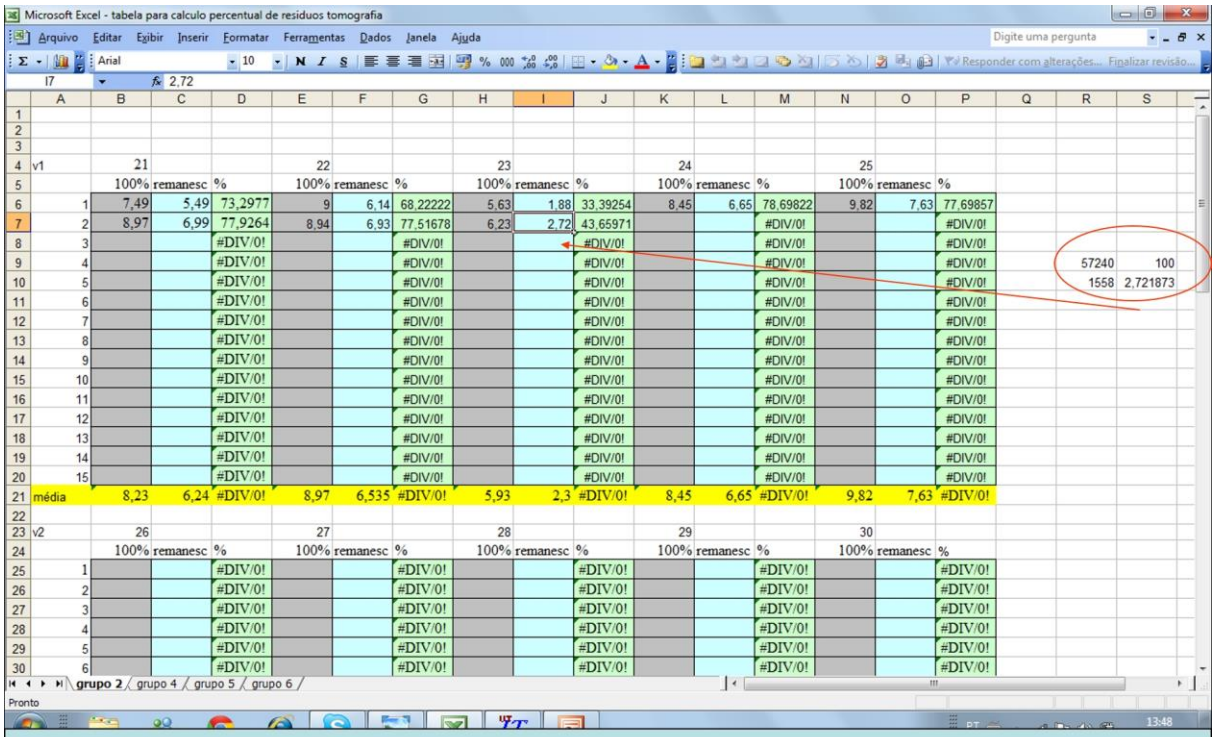
Microsoft Excel - tabela para calculo percentual de residuos tomografia

		21			22			23			24			25				
		100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%		
6	1	7,49	5,49	73,2977	9	6,14	68,22222	5,63	1,88	33,39254	8,45	6,65	78,69822	9,82	7,63	77,69857		
7	2	8,97	6,99	77,9264	8,94	6,93	77,51678	6,23	2,72	43,65971			#DIV/0!			#DIV/0!		
8	3			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
9	4			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!	57240	100
10	5			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!	3565	6,228162
11	6			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
12	7			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
13	8			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
14	9			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
15	10			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
16	11			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
17	12			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
18	13			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
19	14			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
20	15			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
21	média	8,23	6,24	#DIV/0!	8,97	6,535	#DIV/0!	5,93	2,3	#DIV/0!	8,45	6,65	#DIV/0!	9,82	7,63	#DIV/0!		
23	v2	26			27			28			29			30				
24		100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%		
25	1			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
26	2			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
27	3			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
28	4			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
29	5			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
30	6			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		

Análise dos resíduos em cortes horizontais



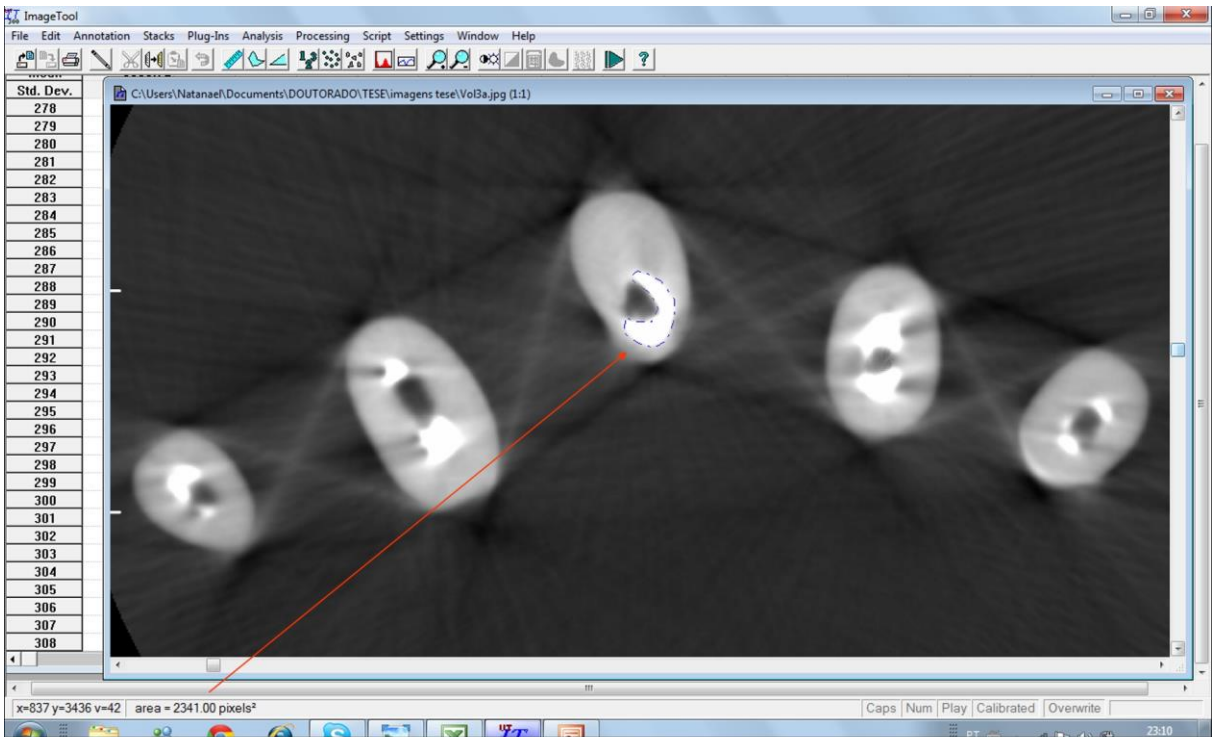
Análise dos resíduos em cortes horizontais



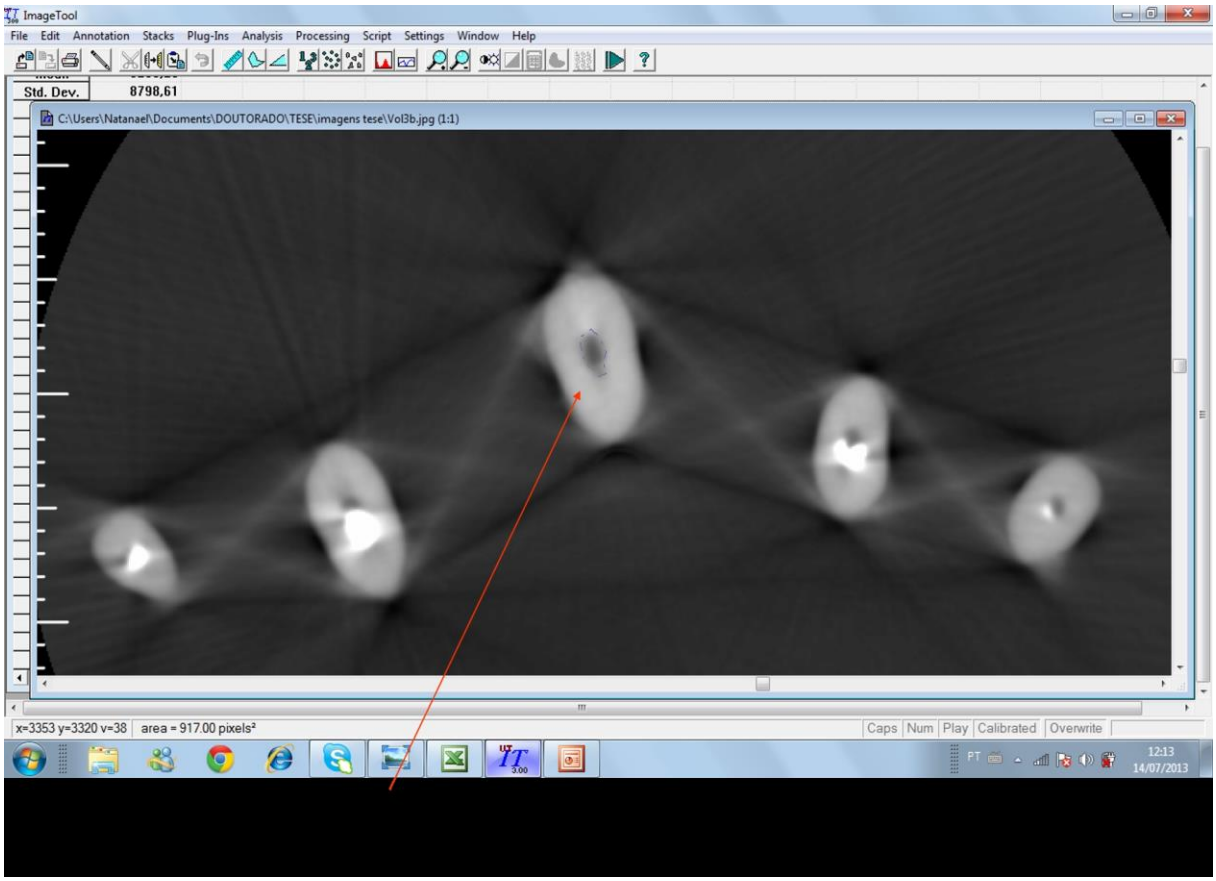
Microsoft Excel - tabela para calculo percentual de resíduos tomografia

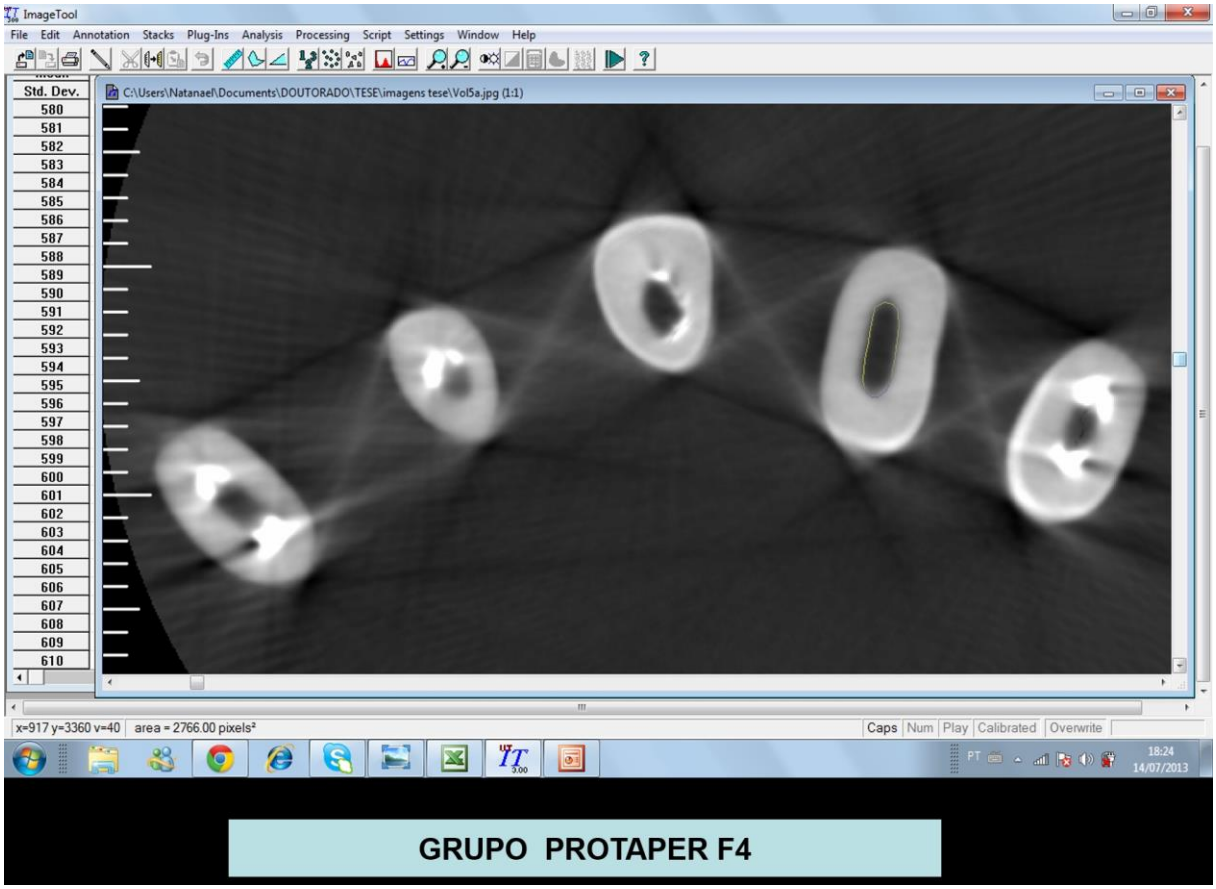
		21			22			23			24			25				
v1		100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%		
	1	7,49	5,49	73,2977	9	6,14	68,22222	5,63	1,88	33,39254	8,45	6,65	78,69822	9,82	7,63	77,69857		
	2	8,97	6,99	77,9264	8,94	6,93	77,51678	6,23	2,72	43,65971			#DIV/0!			#DIV/0!		
	3			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	4			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!	57240	100
	5			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!	1558	2,721873
	6			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	7			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	8			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	9			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	10			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	11			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	12			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	13			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	14			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	15			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
média		8,23	6,24	#DIV/0!	8,97	6,535	#DIV/0!	5,93	2,3	#DIV/0!	8,45	6,65	#DIV/0!	9,82	7,63	#DIV/0!		
v2		26			27			28			29			30				
		100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%	100%	remanesc	%		
	1			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	2			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	3			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	4			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	5			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		
	6			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!		

Análise dos resíduos em cortes horizontais

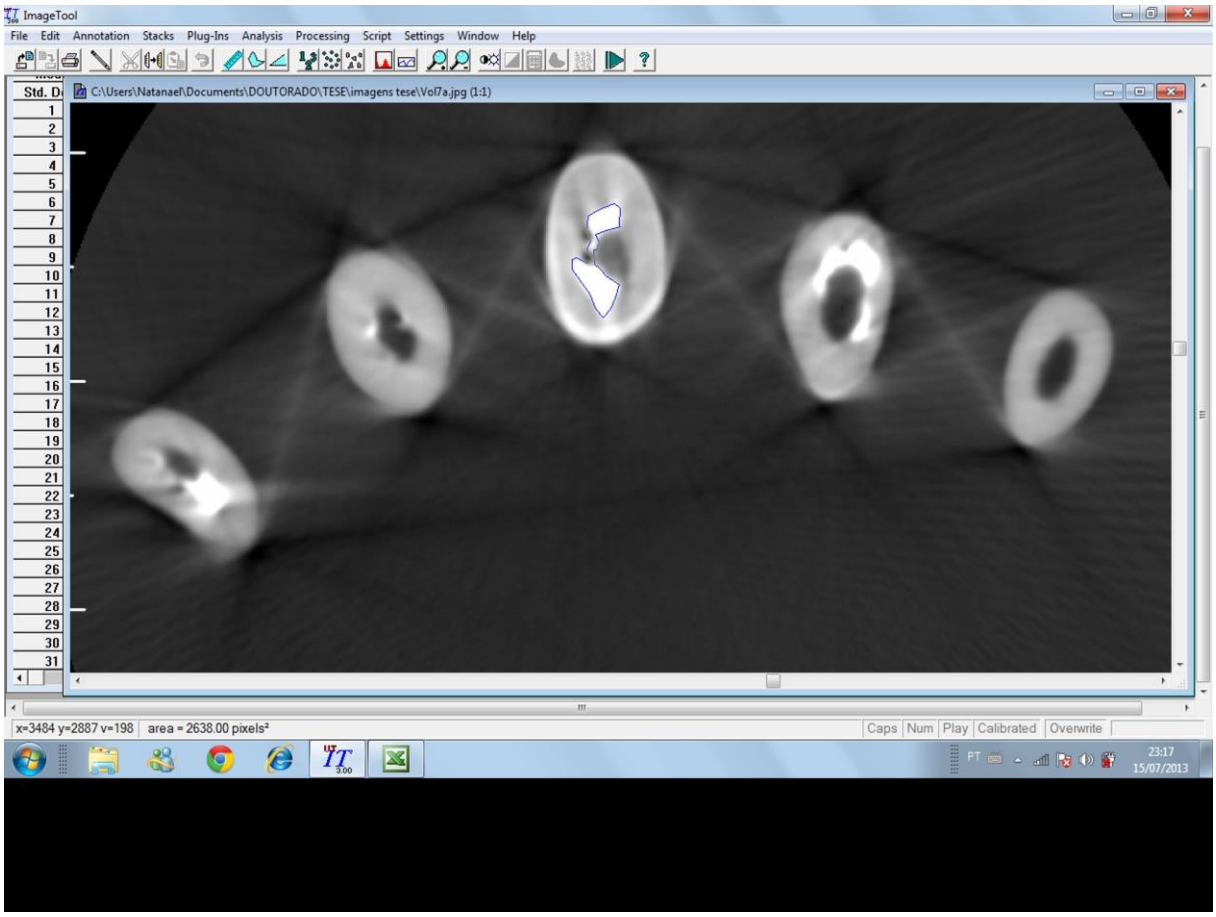


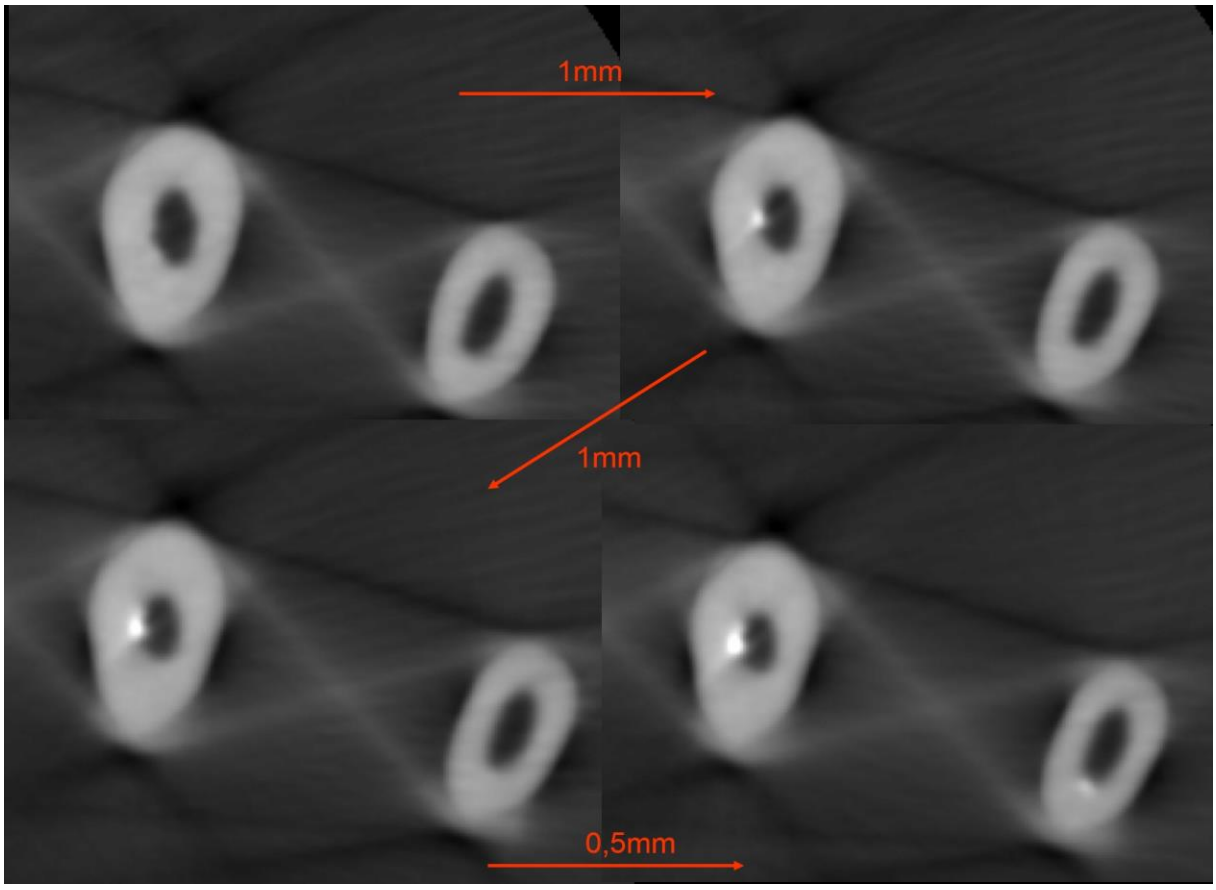
Análise dos resíduos em cortes horizontais





GRUPO PROTAPER F4


ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
C:\Users\Natanael\Documents\DOUTORADO\TESE\imagens tese\Vol7a.jpg (1:1)
x=3484 y=2887 v=198
area = 2638.00 pixels²
Caps Num Play Calibrated Overwrite
23:17
15/07/2013


1mm
1mm
0,5mm


ImageTool
File Edit Annotation Stacks Plug-Ins Analysis Processing Script Settings Window Help
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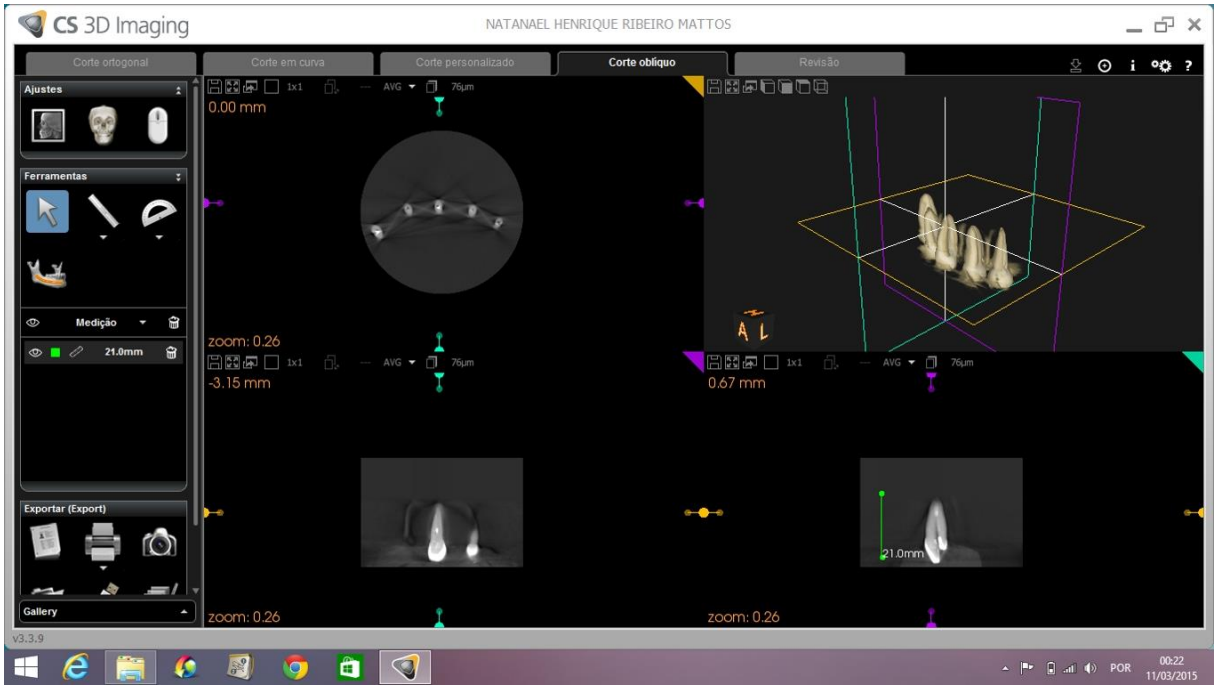
Análise dos resíduos em cortes horizontais


CS 3D Imaging
NATANAEL HENRIQUE RIBEIRO MATTOS
Corte ortogonal
Corte em curva
Corte personalizado
Corte oblíquo
Revisão
Ajustes
Ferramentas
Medição
21.0mm
Exportar (Export)
Gallery
0.00 mm
zoom: 0.26
-3.15 mm
0.67 mm
zoom: 0.26
zoom: 0.26
21.0mm
v3.3.9

ANEXO E – ANÁLISE ESTATÍSTICA

Tests of Normality

Grupo		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Valor p	Statistic	df	Valor p
Variação do pH	PROTAPER F1	,121	20	0,2000	,971	20	0,7845
	PROTAPER F4	,120	20	0,2000	,968	20	0,7217
	M TWO 20.06	,149	20	0,2000	,961	20	0,5585
	M TWO 40.04	,137	20	0,2000	,973	20	0,8074
	CONTROLE NEGATIVO	,121	20	0,2000	,943	20	0,2719
	CONTROLE POSITIVO	,137	20	0,2000	,946	20	0,3122

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Valor p > 0,05 indica distribuição normal

Descriptives

Variação do pH

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
PROTAPER F1	20	2,07	0,41	0,09	1,88	2,26	1,35	2,86
PROTAPER F4	20	2,39	0,40	0,09	2,20	2,57	1,63	3,19
M TWO 20.06	20	2,24	0,35	0,08	2,08	2,41	1,55	2,82
M TWO 40.04	20	2,55	0,43	0,10	2,34	2,75	1,55	3,30
CONTROLE NEGATIVO	20	0,94	0,21	0,05	0,84	1,04	0,62	1,30
CONTROLE POSITIVO	20	2,49	0,33	0,07	2,34	2,65	1,97	3,18
Total	120	2,11	0,65	0,06	1,99	2,23	0,62	3,30

Test of Homogeneity of Variances

Variação do pH

Levene Statistic	df1	df2	Valor p
1,542	5	114	0,1824

Valor p > 0,05 indica homogeneidade de variâncias entre os grupos

Tests of Between-Subjects Effects

Dependent Variable: Variação do pH

Source	Type III Sum of Squares	df	Mean Square	F	Valor p	Observed Power[b]
Grupo	35,793	5	7,159	54,578	0,00000	0,999999980
Error	14,953	114	,131			
Corrected Total	50,746	119				

b. Computed using alpha = ,05

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

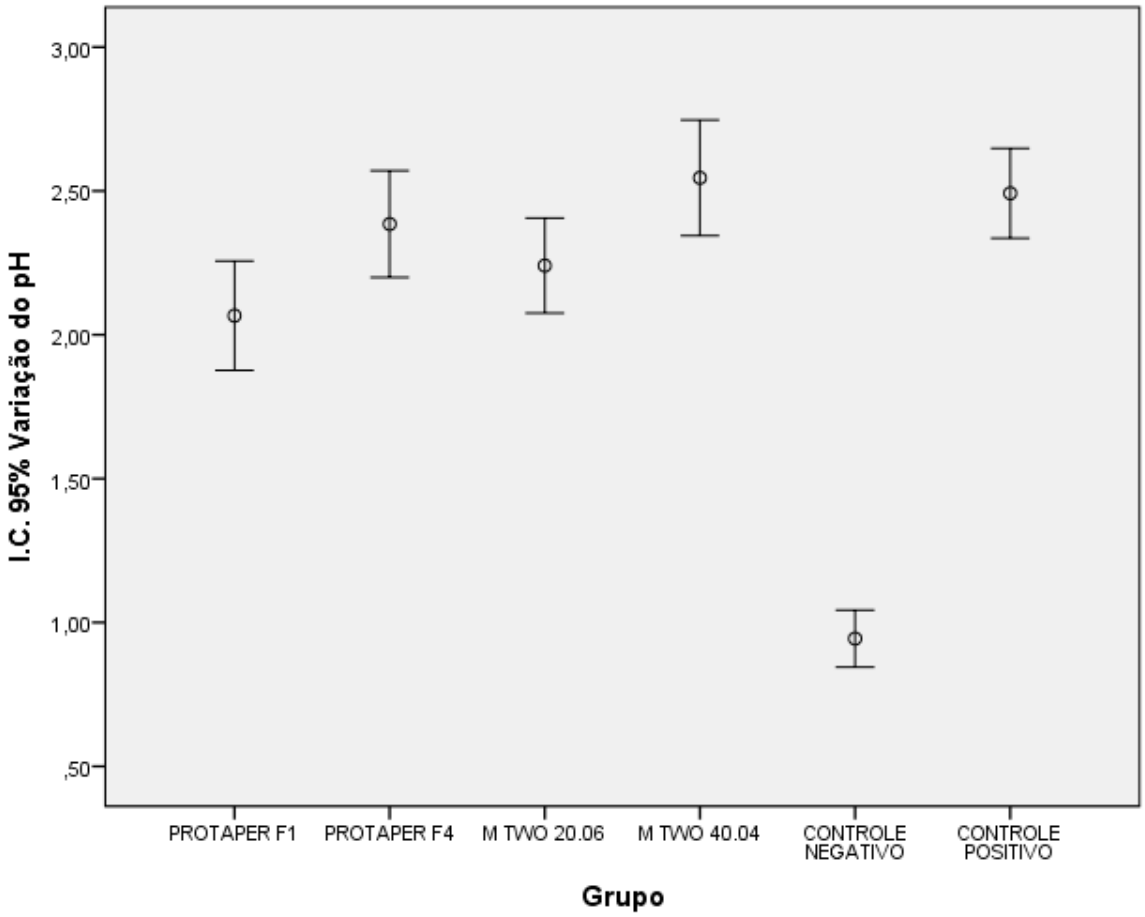
Multiple Comparisons

Dependent Variable: Variação do pH Tukey HSD

(I) Grupo		Mean Difference (I-J)	Std. Error	Valor p	95% Confidence Interval	
					Lower Bound	Upper Bound
PROTAPER F1	PROTAPER F4	-,3185	,11453	0,0679	-,6505	,0135
	M TWO 20.06	-,1740	,11453	0,6526	-,5060	,1580
	M TWO 40.04	-,4790*	,11453	0,0008	-,8110	-,1470
	CONTROLE NEGATIVO	1,1225*	,11453	0,0000	,7905	1,4545
	CONTROLE POSITIVO	-,4255*	,11453	0,0042	-,7575	-,0935
PROTAPER F4	PROTAPER F1	,3185	,11453	0,0679	-,0135	,6505
	M TWO 20.06	,1445	,11453	0,8050	-,1875	,4765
	M TWO 40.04	-,1605	,11453	0,7261	-,4925	,1715
	CONTROLE NEGATIVO	1,4410*	,11453	0,0000	1,1090	1,7730
	CONTROLE POSITIVO	-,1070	,11453	0,9368	-,4390	,2250
M TWO 20.06	PROTAPER F1	,1740	,11453	0,6526	-,1580	,5060
	PROTAPER F4	-,1445	,11453	0,8050	-,4765	,1875
	M TWO 40.04	-,3050	,11453	0,0909	-,6370	,0270
	CONTROLE NEGATIVO	1,2965*	,11453	0,0000	,9645	1,6285
	CONTROLE POSITIVO	-,2515	,11453	0,2478	-,5835	,0805
M TWO 40.04	PROTAPER F1	,4790*	,11453	0,0008	,1470	,8110
	PROTAPER F4	,1605	,11453	0,7261	-,1715	,4925
	M TWO 20.06	,3050	,11453	0,0909	-,0270	,6370
	CONTROLE NEGATIVO	1,6015*	,11453	0,0000	1,2695	1,9335
	CONTROLE POSITIVO	,0535	,11453	0,9972	-,2785	,3855
CONTROLE NEGATIVO	PROTAPER F1	-1,1225*	,11453	0,0000	-1,4545	-,7905
	PROTAPER F4	-1,4410*	,11453	0,0000	-1,7730	-1,1090
	M TWO 20.06	-1,2965*	,11453	0,0000	-1,6285	-,9645
	M TWO 40.04	-1,6015*	,11453	0,0000	-1,9335	-1,2695
	CONTROLE POSITIVO	-1,5480*	,11453	0,0000	-1,8800	-1,2160
CONTROLE POSITIVO	PROTAPER F1	,4255*	,11453	0,0042	,0935	,7575
	PROTAPER F4	,1070	,11453	0,9368	-,2250	,4390
	M TWO 20.06	,2515	,11453	0,2478	-,0805	,5835
	M TWO 40.04	-,0535	,11453	0,9972	-,3855	,2785
	CONTROLE NEGATIVO	1,5480*	,11453	0,0000	1,2160	1,8800

*. The mean difference is significant at the ,05 level.

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos


3,00
2,50
2,00
1,50
1,00
,50
I.C. 95% Variação do pH
PROTAPER F1
PROTAPER F4
M TWO 20.06
M TWO 40.04
CONTROLE NEGATIVO
CONTROLE POSITIVO
Grupo

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Grupo		Statistic	df	Valor p	Statistic	df	Valor p
Percentual de resíduos nas paredes dos canais em cortes verticais	PROTAPER F1	,144	20	0,2000	,941	20	0,2483
	PROTAPER F4	,125	20	0,2000	,939	20	0,2248
	M TWO 20.06	,120	20	0,2000	,967	20	0,6974
	M TWO 40.04	,184	20	0,0738	,927	20	0,1377
Percentual de resíduos nas paredes dos canais em cortes horizontais	PROTAPER F1	,126	20	0,2000	,957	20	0,4944
	PROTAPER F4	,112	20	0,2000	,954	20	0,4275
	M TWO 20.06	,116	20	0,2000	,951	20	0,3891
	M TWO 40.04	,179	20	0,0925	,911	20	0,0652
Tempo de desobturação e repreparo dos canais (s)	PROTAPER F1	,112	20	0,2000	,955	20	0,4415
	PROTAPER F4	,122	20	0,2000	,957	20	0,4919
	M TWO 20.06	,098	20	0,2000	,940	20	0,2385
	M TWO 40.04	,108	20	0,2000	,940	20	0,2359

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Valor p > 0,05 indica distribuição normal

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Percentual de resíduos nas paredes dos canais em cortes verticais	PROTAPER F1	20	59,08	17,67	3,95	50,81	67,35	22,67	82,04
	PROTAPER F4	20	29,91	17,06	3,81	21,93	37,90	-	54,62
	M TWO 20.06	20	57,75	15,50	3,47	50,49	65,00	25,99	86,77
	M TWO 40.04	20	22,51	13,33	2,98	16,27	28,75	3,62	48,35
	Total	80	42,31	22,70	2,54	37,26	47,36	-	86,77
Percentual de resíduos nas paredes dos canais em cortes horizontais	PROTAPER F1	20	60,26	16,63	3,72	52,48	68,04	32,21	91,68
	PROTAPER F4	20	29,45	17,25	3,86	21,37	37,52	5,16	63,95
	M TWO 20.06	20	58,15	13,08	2,93	52,02	64,27	30,99	92,07
	M TWO 40.04	20	23,52	17,12	3,83	15,50	31,53	1,61	64,92
	Total	80	42,84	22,93	2,56	37,74	47,94	1,61	92,07
Tempo de desobturação e repreparo dos canais (s)	PROTAPER F1	20	407,65	87,73	19,62	366,59	448,71	270,00	583,00
	PROTAPER F4	20	668,30	89,61	20,04	626,36	710,24	480,00	826,00
	M TWO 20.06	20	436,20	90,01	20,13	394,07	478,33	305,00	685,00
	M TWO 40.04	20	820,15	120,27	26,89	763,86	876,44	570,00	990,00
	Total	80	583,08	196,29	21,95	539,39	626,76	270,00	990,00

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Valor p
Percentual de resíduos nas paredes dos canais em cortes verticais	,947	3	76	0,4224
Percentual de resíduos nas paredes dos canais em cortes horizontais	,863	3	76	0,4641
Tempo de desobturação e repreparo dos canais (s)	1,324	3	76	0,2727

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Tests of Between-Subjects Effects

Dependent Variable: Percentual de resíduos nas paredes dos canais em cortes verticais

Source	Type III Sum of Squares	df	Mean Square	F	Valor p	Observed Power[b]
Grupo	21308,341	3	7102,780	27,825	0,000000	1,000000
Error	19399,879	76	255,262			
Corrected Total	40708,221	79				

b. Computed using alpha = ,05

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Multiple Comparisons

Dependent Variable: Percentual de resíduos nas paredes dos canais em cortes verticais

Tukey HSD

(I) Grupo		Mean Difference (I-J)	Std. Error	Valor p	95% Confidence Interval	
					Lower Bound	Upper Bound
PROTAPER F1	PROTAPER F4	29,1672*	5,05234	0,0000	15,8957	42,4387
	M TWO 20.06	1,3342	5,05234	0,9935	-11,9373	14,6056
	M TWO 40.04	36,5747*	5,05234	0,0000	23,3033	49,8462
PROTAPER F4	PROTAPER F1	-29,1672*	5,05234	0,0000	-42,4387	-15,8957
	M TWO 20.06	-27,8331*	5,05234	0,0000	-41,1045	-14,5616
	M TWO 40.04	7,4075	5,05234	0,4628	-5,8639	20,6790
M TWO 20.06	PROTAPER F1	-1,3342	5,05234	0,9935	-14,6056	11,9373
	PROTAPER F4	27,8331*	5,05234	0,0000	14,5616	41,1045
	M TWO 40.04	35,2406*	5,05234	0,0000	21,9691	48,5121
M TWO 40.04	PROTAPER F1	-36,5747*	5,05234	0,0000	-49,8462	-23,3033
	PROTAPER F4	-7,4075	5,05234	0,4628	-20,6790	5,8639
	M TWO 20.06	-35,2406*	5,05234	0,0000	-48,5121	-21,9691

*. The mean difference is significant at the ,05 level.

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Tests of Between-Subjects Effects

Dependent Variable: Percentual de resíduos nas paredes dos canais em cortes horizontais

Source	Type III Sum of Squares	df	Mean Square	F	Valor p	Observed Power[b]
Grupo	21807,279	3	7269,093	27,998	0,000000	1,000000
Error	19731,541	76	259,626			
Corrected Total	41538,820	79				

b. Computed using alpha = ,05

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Multiple Comparisons

Dependent Variable: Percentual de resíduos nas paredes dos canais em cortes horizontais

Tukey HSD

(I) Grupo		Mean Difference (I-J)	Std. Error	Valor p	95% Confidence Interval	
					Lower Bound	Upper Bound
PROTAPER F1	PROTAPER F4	30,8100*	5,09535	0,0000	17,4255	44,1944
	M TWO 20.06	2,1103	5,09535	0,9759	-11,2742	15,4947
	M TWO 40.04	36,7391*	5,09535	0,0000	23,3547	50,1236
PROTAPER F4	PROTAPER F1	-30,8100*	5,09535	0,0000	-44,1944	-17,4255
	M TWO 20.06	-28,6997*	5,09535	0,0000	-42,0841	-15,3153
	M TWO 40.04	5,9292	5,09535	0,6514	-7,4553	19,3136
M TWO 20.06	PROTAPER F1	-2,1103	5,09535	0,9759	-15,4947	11,2742
	PROTAPER F4	28,6997*	5,09535	0,0000	15,3153	42,0841
	M TWO 40.04	34,6289*	5,09535	0,0000	21,2444	48,0133
M TWO 40.04	PROTAPER F1	-36,7391*	5,09535	0,0000	-50,1236	-23,3547
	PROTAPER F4	-5,9292	5,09535	0,6514	-19,3136	7,4553
	M TWO 20.06	-34,6289*	5,09535	0,0000	-48,0133	-21,2444

*. The mean difference is significant at the ,05 level.

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Tests of Between-Subjects Effects

Dependent Variable: Tempo de desobturação e repreparo dos canais (s)

Source	Type III Sum of Squares	df	Mean Square	F	Valor p	Observed Power[b]
Grupo	2316281,050	3	772093,683	80,651	0,000000	1,000000
Error	727570,500	76	9573,296			
Corrected Total	3043851,550	79				

b. Computed using alpha = ,05

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos

Multiple Comparisons

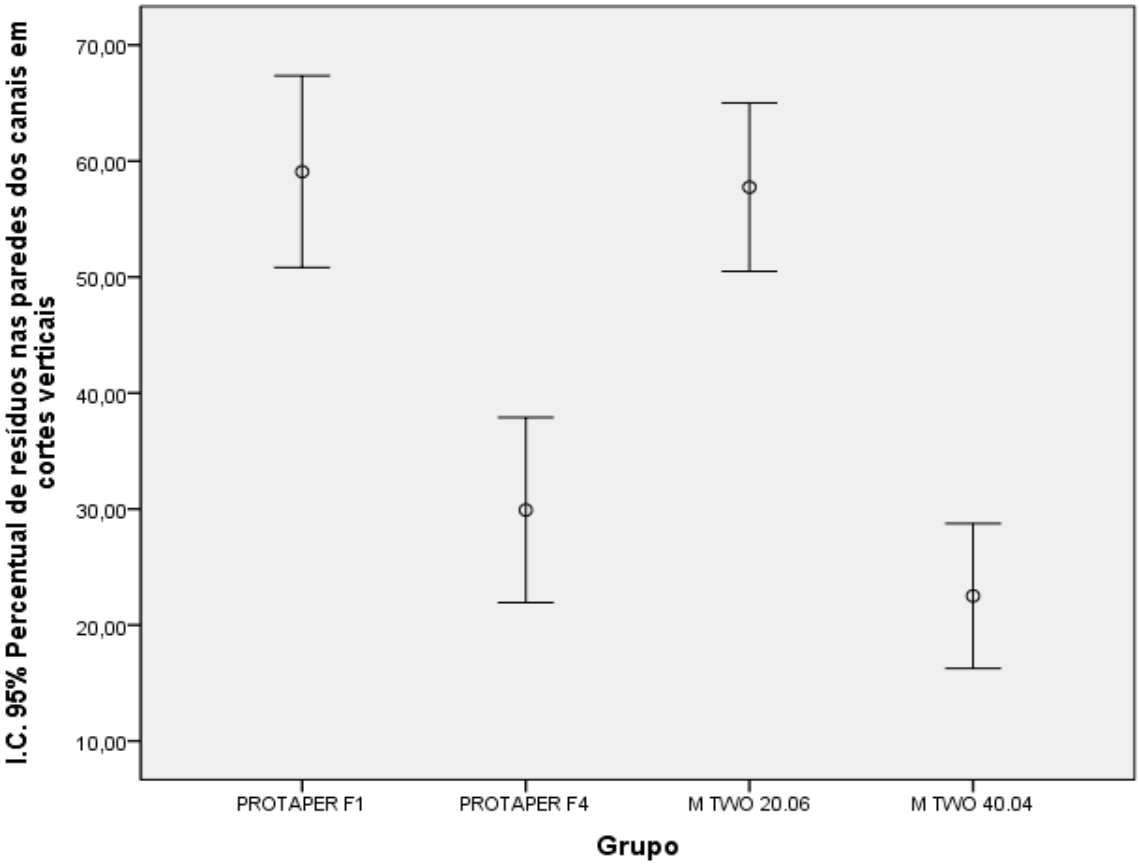
Dependent Variable: Tempo de desobturação e repreparo dos canais (s)

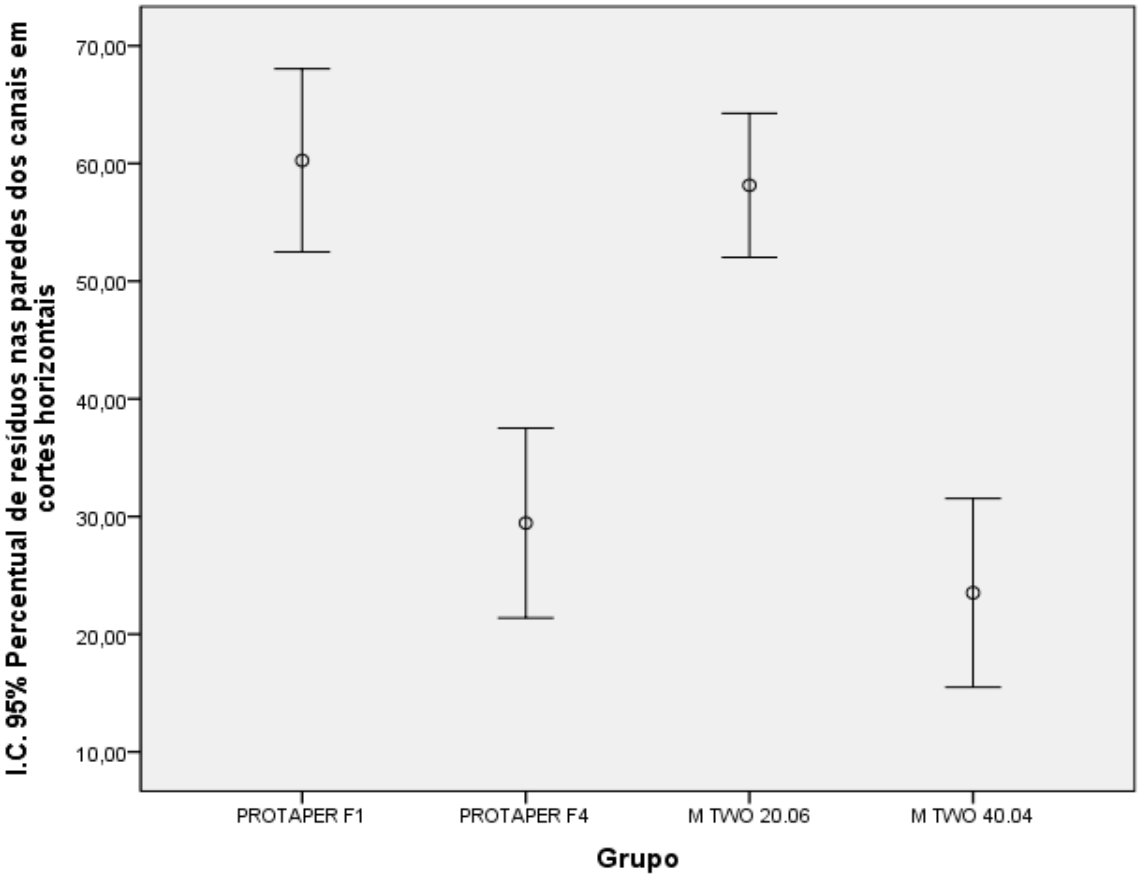
Tukey HSD

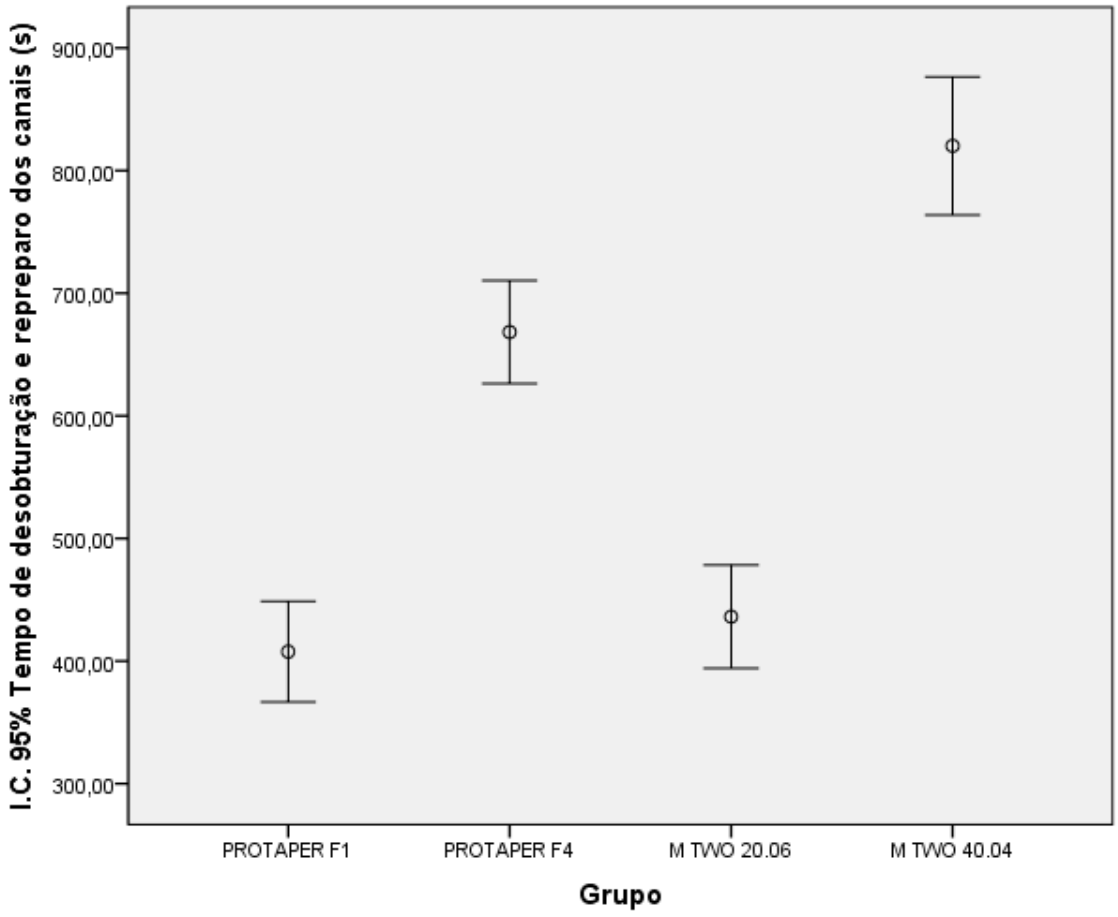
(I) Grupo		Mean Difference (I-J)	Std. Error	Valor p	95% Confidence Interval	
					Lower Bound	Upper Bound
PROTAPER F1	PROTAPER F4	-260,6500*	30,94074	0,0000	-341,9250	-179,3750
	M TWO 20.06	-28,5500	30,94074	0,7928	-109,8250	52,7250
	M TWO 40.04	-412,5000*	30,94074	0,0000	-493,7750	-331,2250
PROTAPER F4	PROTAPER F1	260,6500*	30,94074	0,0000	179,3750	341,9250
	M TWO 20.06	232,1000*	30,94074	0,0000	150,8250	313,3750
	M TWO 40.04	-151,8500*	30,94074	0,0000	-233,1250	-70,5750
M TWO 20.06	PROTAPER F1	28,5500	30,94074	0,7928	-52,7250	109,8250
	PROTAPER F4	-232,1000*	30,94074	0,0000	-313,3750	-150,8250
	M TWO 40.04	-383,9500*	30,94074	0,0000	-465,2250	-302,6750
M TWO 40.04	PROTAPER F1	412,5000*	30,94074	0,0000	331,2250	493,7750
	PROTAPER F4	151,8500*	30,94074	0,0000	70,5750	233,1250
	M TWO 20.06	383,9500*	30,94074	0,0000	302,6750	465,2250

*. The mean difference is significant at the ,05 level.

Valor p < 0,05 indica diferença estatisticamente significante entre os grupos


I.C. 95% Percentual de resíduos nas paredes dos canais em cortes verticais
70,00
60,00
50,00
40,00
30,00
20,00
10,00
PROTAPER F1
PROTAPER F4
M TWO 20.06
M TWO 40.04
Grupo


I.C. 95% Percentual de resíduos nas paredes dos canais em cortes horizontais
70,00
60,00
50,00
40,00
30,00
20,00
10,00
PROTAPER F1
PROTAPER F4
M TWO 20.06
M TWO 40.04
Grupo


I.C. 95% Tempo de desobturação e repreparo dos canais (s)
900,00
800,00
700,00
600,00
500,00
400,00
300,00
PROTAPER F1
PROTAPER F4
M TWO 20.06
M TWO 40.04
Grupo

COMPARAÇÃO GERAL PERCENTUAL VERTICAL X HORIZONTAL

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais	42,3129	80	22,70009	2,53795
	Percentual de resíduos nas paredes dos canais em cortes horizontais	42,8417	80	22,93050	2,56371

Paired Samples Correlations

		N	Correlation	Valor p
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais & Percentual de resíduos nas paredes dos canais em cortes horizontais	80	,807	0,0000

Valor p < 0,05 indica que existe correlação estatisticamente diferente de zero entre o percentual vertical e horizontal

O coeficiente de correlação de Pearson mede o grau de associação entre as duas variáveis:
0,00 |------- 0,30 - Fraca

0,30 |------- 0,60 - Regular

0,60 |------- 0,90 - Forte

0,90 |------- 1,00 - Muito Forte

Bioestatística: Princípios e aplicações - Sídia Callegari-Jacques. Artmed. 2003. 256 p.

Paired Samples Test

		Paired Differences					t	df	Valor p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais - Percentual de resíduos nas paredes dos canais em cortes horizontais	-,52884	14,18552	1,58599	-3,68567	2,62800	-,333	79	0,7397

Valor p > 0,05 indica que não existe diferença entre o Percentual vertical e horizontal

COMPARAÇÃO PROTAPER F1 PERCENTUAL VERTICAL X HORIZONTAL

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais	59,0819	20	17,66894	3,95090
	Percentual de resíduos nas paredes dos canais em cortes horizontais	60,2565	20	16,62619	3,71773

Paired Samples Correlations

		N	Correlation	Valor p
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais & Percentual de resíduos nas paredes dos canais em cortes horizontais	20	,604	0,0048

Valor p < 0,05 indica que existe correlação estatisticamente diferente de zero entre o percentual vertical e horizontal

Paired Samples Test

		Paired Differences					t	df	Valor p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais - Percentual de resíduos nas paredes dos canais em cortes horizontais	-1,17464	15,29267	3,41955	-8,33184	5,98255	-,344	19	0,7350

Valor p > 0,05 indica que não existe diferença entre o Percentual vertical e horizontal

COMPARAÇÃO PROTAPER F4 PERCENTUAL VERTICAL X HORIZONTAL

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais	29,9147	20	17,05644	3,81394
	Percentual de resíduos nas paredes dos canais em cortes horizontais	29,4466	20	17,25182	3,85762

Paired Samples Correlations

		N	Correlation	Valor p
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais & Percentual de resíduos nas paredes dos canais em cortes horizontais	20	,450	0,0464

Valor p < 0,05 indica que existe correlação estatisticamente diferente de zero entre o percentual vertical e horizontal

Paired Samples Test

		Paired Differences					t	df	Valor p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais - Percentual de resíduos nas paredes dos canais em cortes horizontais	,46811	17,98874	4,02240	-7,95088	8,88710	,116	19	0,9086

Valor p > 0,05 indica que não existe diferença entre o Percentual vertical e horizontal

COMPARAÇÃO M TWO 20.06 PERCENTUAL VERTICAL X HORIZONTAL

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais	57,7477	20	15,50003	3,46591
	Percentual de resíduos nas paredes dos canais em cortes horizontais	58,1463	20	13,08450	2,92578

Paired Samples Correlations

		N	Correlation	Valor p
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais & Percentual de resíduos nas paredes dos canais em cortes horizontais	20	,759	0,0001

Valor p < 0,05 indica que existe correlação estatisticamente diferente de zero entre o percentual vertical e horizontal

Paired Samples Test

	Paired Differences	t	df	Valor p

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	U p p e r			
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais - Percentual de resíduos nas paredes dos canais em cortes horizontais	-,39854	10,16813	2,27366	-5,15737	4,36029	-,175	19	0,8627

Valor p > 0,05 indica que não existe diferença entre o Percentual vertical e horizontal

COMPARAÇÃO M TWO 40.04 PERCENTUAL VERTICAL X HORIZONTAL

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais	22,5071	20	13,32974	2,98062
	Percentual de resíduos nas paredes dos canais em cortes horizontais	23,5174	20	17,12432	3,82912

Paired Samples Correlations

		N	Correlation	Valor p
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais & Percentual de resíduos nas paredes dos canais em cortes horizontais	20	,650	0,0019

Valor p < 0,05 indica que existe correlação estatisticamente diferente de zero entre o percentual vertical e horizontal

Paired Samples Test

		Paired Differences					t	df	Valor p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Percentual de resíduos nas paredes dos canais em cortes verticais - Percentual de resíduos nas paredes dos canais em cortes horizontais	-1,01027	13,19433	2,95034	-7,18541	5,16487	-,342	19	0,7358

Valor p > 0,05 indica que não existe diferença entre o Percentual vertical e horizontal

ANEXO F – NORMAS PARA PUBLICAÇÃO

Introduction

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Preparation

General Points on Composition

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a. The paragraph is the ideal unit of organization. Paragraphs typically start with an introductory sentence that is followed by sentences that describe additional detail or examples. The last sentence of the paragraph provides conclusions and forms a transition to the next paragraph. Common problems include one-sentence paragraphs, sentences that do not develop the theme of the paragraph (see also section “c,” below), or sentences with little to no transition within a paragraph.

b. Keep to the point. The subject of the sentence should support the subject of the paragraph For example, the introduction of authors’ names in a sentence changes the subject and lengthens the text. In a paragraph on sodium hypochlorite, the sentence, “In 1983, Langeland et al, reported that sodium hypochlorite acts as a lubricating factor during instrumentation and helps to flush debris from the root canals” can be edited to: “Sodium hypochlorite acts as a lubricant during instrumentation and as a vehicle for flushing the generated debris (Langeland et al, 1983).” In this example, the paragraph’s subject is sodium hypochlorite and sentences should focus on this subject.

c. Sentences are stronger when written in the active voice, that is, the subject performs the action. Passive sentences are identified by the use of passive verbs such as “was,” “were,” “could,” etc. For example: “Dexamethasone was found in this study to be a factor that was associated with reduced inflammation,” can be edited to: “Our results demonstrated that dexamethasone reduced inflammation.” Sentences written in a direct and active voice are generally more powerful and shorter than sentences written in the passive voice.

d. Reduce verbiage. Short sentences are easier to understand. The inclusion of unnecessary words is often associated with the use of a passive voice, a lack of focus, or run-on sentences. This is not to imply that all sentences need be short or even the same length. Indeed, variation in sentence structure and length often helps to maintain reader interest. However, make all words count. A more formal way of stating this point is that the use of subordinate clauses adds variety and information when constructing a paragraph. (This section was written deliberately with sentences of varying length to illustrate this point.)

e. Use parallel construction to express related ideas. For example, the sentence, “Formerly, endodontics was taught by hand instrumentation, while now rotary instrumentation is the common method,” can be edited to “Formerly, endodontics was taught using hand instrumentation; now it is commonly taught using rotary instrumentation.” The use of parallel construction in sentences simply means that similar ideas are expressed in similar ways, and this helps the reader recognize that the ideas are related.

f. Keep modifying phrases close to the word that they modify. This is a common problem in complex sentences that may confuse the reader. For example, the statement, “Accordingly, when conclusions are drawn from the results of this study, caution must be used,” can be edited to “Caution must be used when conclusions are drawn from the results of this study.”

g. To summarize these points, effective sentences are clear and precise, and often are short, simple and focused on one key point that supports the paragraph’s theme.

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