UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
FACULDADE DE ODONTOLOGIA

PROGRAMA DE PÓS-GRADUAÇÃO EM ODONTOLOGÍA

NÍVEL MESTRADO

CLÍNICA ODONTOLÓGICA - ODONTOPEDIATRIA

LONGEVIDADE DE RESTAURAÇÕES EM DENTES DECÍDUOS SUBMETIDOS À REMOÇÃO PARCIAL DE TECIDO CARIADO E FATORES ASSOCIADOS AO INSUCESSO: ESTUDO RETROSPECTIVO

Ximena Concha Melgar

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Linha de Pesquisa:

Biomateriais e Técnicas Terapêuticas em Odontologia

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RESUMO

Objetivo: Avaliar a longevidade de restaurações adesivas diretas em dentes decíduos submetidos à remoção parcial de tecido cariado (RPTC) e os possíveis fatores associados com o insucesso, tentando aproximar os resultados à vida clínica diária. **Métodos:** Estudo observacional analítico retrospectivo que incluiu 284 restaurações adesivas diretas em dentes decíduos posteriores e anteriores confeccionadas após RPTC em 88 crianças com alta experiência de cárie. Os dentes foram acompanhados clínica e radiograficamente através da informação registrada nos prontuários clínicos dos pacientes. Adicionalmente, foram investigados os fatores potencialmente associados com o insucesso do tratamento, tais como idade, gênero, tipo de dente, número de faces restauradas, material capeador e restaurador utilizado e índice de placa visível (IPV) e de sangramento gengival (ISG). O estimador Kaplan-Meiere o teste de Log-Rank foram utilizados para analisar a longevidade das restaurações e o modelo de regressão multivariado de Cox com fragilidade compartilhada, para avaliar os fatores que poderiam estar relacionados com a falha do tratamento (p<0,05). **Resultados:** A taxa de sucesso clínico e radiográfico da amostra foi de 76% e obteve-se uma taxa de falha anual (AFR) de 20% na análise até 36 meses. O IPV (p=0,014) e o tipo de dente, anterior ou posterior (p<0,001) mostraram influência significativa no insucesso das restaurações. **Conclusão:** restaurações adesivas realizadas após RPTC na dentição decíduae em um ambiente que simula a vida clínica diária demonstrambons resultados, principalmente em dentes posteriores. Porém, o acúmulo de biofilme sobre as superfícies dentárias afeta a longevidade das mesmas.

Importância clínica: Ao longo do tempo, é muito importante manter o paciente em um programa de monitoramento da saúde bucal para controlar os fatores etiológicos da doença cárie, os quais prejudicam o desempenho das restaurações.

ABSTRACT

Objective: to assess the longevity of direct adhesive restorations undergoing partial caries removal (PCR) in primary teeth and associated factors for failure, approaching the results to a daily clinical life. **Methods:** Retrospective analytical observational study which included 284 posterior and anterior primary teeth direct adhesive restorations that had been treated with PCR of 88 children with high caries experience. The teeth had clinical and radiographic follow-up through the information registered in the clinical records of the patients.In addition, factors potentially associated with treatment failure were investigated, such as age, gender, type of tooth involved, number of surfaces restored, type of capping material and restorative material used, visible plaque (VPI) and gingival bleeding indexes (GBI). Kaplan-Meier estimate and Log-Rank test were used to analyze the longevity of restorations and multivariate Cox´s regression model with shared frailty to evaluate the factors that could be related to treatment failure ($p<0.05$). **Results:** A clinical and radiographic success rate of the sample was 76% and an annual failure rate was estimated in 20% over 36 months. Only visible plaque index ($p=0.014$) and type of teeth, anterior or posterior ($p<0.001$) had a significant influence on the restorative failure. **Conclusion:**Adhesive restorations undergoing PCR in primary teeth in an environment that simulates a daily clinical life demonstrate good results, particularly in posterior teeth. However, the biofilm accumulation on the dental surfaces affects the longevity of them.

Clinical significance: Over time, it is very important to keep the patient in maintenance oral health program to control the etiologic factors of caries disease, which impair performance of the restorations.

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LISTA DE ABREVIATURAS E SIGLAS

RPTC – Remoção Parcial de Tecido Cariado

PCR – Partial Caries Removal

RTTC – Remoção Total de Tecido Cariado

TCR – Total CariesRemoval

FO. UFRGS – Faculdade de Odontologia da Universidade Federal Rio
Grande do Sul

IPV – Índice de Placa Visível

VPI – Visual Plaque Index

ISG – Índice de sangramento gengival

GBI – GingivalBleeding Index

AFR – AnnualFailure Rate / Taxa de falha anual

DMFT – Decay, Missing, Filled teeth index

GIC – Glass Ionomer Cement

RMGIC – Resin-Modified Glass Ionomer Cement

1. ANTECEDENTES E JUSTIFICATIVA

Apesar da prevalência de cárie ter diminuído na população infantil, sobretudo a progressão da mesma, os valores ainda são altos em determinados grupos da sociedade com baixo nível socioeconômico (Ardenghiet al., 2013).

A Academia Americana de Odontopediatria -AAPD- no seu último manual de referência, 2014, suporta o uso da técnica de remoção parcial de tecido cariado (RPTC) em lesões cariosas profundas em dentina de dentes decíduos e permanentes sem sintomatologia pulpar. Ensaios clínicos randomizados e revisões sistemáticas evidenciam que a escavação incompleta de tecido cariado atinge resultados equivalentes aos da remoção total de tecido cariado (RTTC), apresentando um menor risco de exposição pulpar e menos sinais e sintomas de afecção pulpar.

O tratamento conservador de RPTC consiste em deixar uma camada de dentina desmineralizada e contaminada próxima à polpa, considerando que sua completa remoção poderia resultar em exposição pulpar. Além de preservar a estrutura dentária, a manutenção de tecido cariado adjacente à parede pulpar também contribui para uma menor agressão ao complexo dentino-pulpar, desencadeando um mecanismo de defesa através da esclerose dentinária e da formação de dentina reparadora (Rickettset al., 2006 e 2013). O tecido cariado das paredes circundantes é completamente removido para permitir um adequado selamento da cavidade, o que inviabiliza o metabolismo das bactérias remanescentes e impede a progressão da lesão cariosa (Bjorndal e Larsen, 2000; Maltzet al., 2002; Massara et al., 2002; Paddick et al., 2005; Santiago et al., 2005; Pinto et al., 2006; Marchi et al., 2008; Orhan et al., 2008; Lula et al., 2009 e 2011; Dalpian et al, 2012).

A RTTC não assegura a completa remoção da dentina infectada, sendo frequentemente mantidos microrganismos subjacentes à restauração de forma inadvertida. A presença dessas bactérias na dentina, por si só, não seria o fator determinante da evolução do processo da doença cárie. A paralisação da lesão cariosa pode ser efetivada através do "bloqueio" ou isolamento da mesma do meio externo com a colocação de um material restaurador, pela interrupção da

passagem de substratos e da ausência da comunicação das bactérias da lesão de cárie com o meio bucal (Bjørndal,2001; Bjørndal e Kidd, 2005; Ricketts et al., 2006).

Estudos em dentes decíduos mostram alto índice de sucesso clínico e radiográfico após a RPTC (Farooqet al., 2000; Falster et al., 2002; Al-Zayer et al., 2003; Marchi et al., 2006; Franzon et al., 2007, 2009 e 2014; Silva et al., 2009; Casagrande et al, 2009 e 2010; Gruythuysen et al., 2010; Hesse et al., 2014; Dalpian et al., 2014), deixando claro que é possível deixar parte do tecido cariado sob as restaurações atingindo resultados clinicamente satisfatórios sem necessidade de reabrir o dente e remover a dentina remanescente, o que poderia resultar em indesejáveis exposições pulpares (Orhan et al., 2010). É uma técnica segura e conservadora que permite reduzir o custo e o tempo clínico (Franzonet al., 2014).

Um dos pontos mais críticos e importantes da RPTC está relacionado ao correto diagnóstico da condição pulpar, uma vez que o sucesso está na dependênciade uma resposta favorável da polpa. Os critérios clínicos de vitalidade devem ser avaliados rigorosamente, devendo ser excluídos os dentes com história de dor espontânea (principalmente a noturna), com indícios radiográficos de envolvimento periapical ou degeneração pulpar, ou com sinais indicativos de inflamação pulpar irreversível (Ricketts, 2001; Coll, 2008; Casagrande et al., 2010). Assim, em um dente portador de uma lesão de cárie ativa profunda em dentina com viabilidade pulpar, o sucesso passa por este correto diagnóstico de saúde pulpar, estando este muito mais relacionado a um adequado vedamento marginal do que propriamente do material forrador utilizado (Falsteret al., 2002; Pinto et al., 2006; Casagrande et al., 2009).

Defeitos nas margens das restaurações, em associação com a atividade de cárie dos pacientes foram apontados como as principais causas de falhas na RPTC (Casagrandeet al., 2009; Dalpian et al., 2014). A literatura vem demonstrando que as restaurações tendem a falhar quando a atividade de cárie não é controlada no indivíduo (Trachtenberg et al., 2008). Restaurações adesivas em pacientes com este perfil apresentam uma taxa de falha duas vezes maior quando comparadas com pacientes cárie inativos (Opdam et al.,

2010). Este achado tem fundamento no descontrole dos fatores etiológicos da doença cárie (Gomes et al., 2012).

Uma boa adaptação marginal do material restaurador é necessária para limitar o fluxo de nutrientes para as bactérias, prevenindo assim sua proliferação. A manutenção da integridade marginal da interface dente/restauração está na dependência de diversos fatores, tais como o tipo do material restaurador, suas propriedades físicas e mecânicas, além da sua interação com o ambiente oral (Rossomando e Wendt, 1995).

Hevingaet al. no 2010 questionam a permanência de uma dentina cariada deixada intencionalmente na parede pulpar quanto à sobrevida de restaurações adesivas de resina composta, devido a que uma maior força de adesão é alcançada quando o material está aderido a uma dentina sadia (Xie et al., 1996; Yoshiyama et al., 2002; Diga et al., 2005), associado ao fato de que as características clínicas da dentina cariada da parede pulpar a fazem ter um menor "Módulo de Elasticidade" (Marshall et al.,2001; Zheng et al., 2003). Sugerem que ambos os fatores podem resultar em maior deformação do complexo dente-restauração, levando a tensões marginais mais elevadas e aumento da susceptibilidade à ruptura da interface dente/restauração por fadiga.

A extrapolação dos resultados do estudo de Hevingaet al. para a prática clínica deve ser feita com cautela, sendo um estudo *in vitro* que não leva em consideração a resposta biológica do complexo dentino pulpar.

Além disso, uma falha restauradora não necessariamente significa insucesso da técnica da RPTC. Os pacientes devem ser mantidos sob acompanhamento periódico profissional, permitindo que quando da ocorrência destas falhas, haja a identificação e de acordo com a sequela e o tempo decorrido entre a falha e o exame, o reparo ou asubstituição.

Os materiais restauradores adesivos têm sido amplamente utilizados na clínica odontopediatrica, apresentando um desempenho compatível com o tempo de permanência do dente decíduo na cavidade bucal nos quesitos desgaste do material, controle da infiltração marginal e estética (Yengopalet al., 2009).

Embora na dentição permanente o desempenho dos cimentos de ionômero de vidro seja inferior à resina (Manhartet al., 2004), na dentição decídua a literatura é controversa, e o ionômero de vidro modificado com resina apresenta um bom desempenho comparável ao da resina composta (Qvist et al., 2010).

Um recente estudoretrospectivo avaliou a longevidade das restaurações adesivas realizadas em dentes decíduos por alunos do Curso de Graduação. Os resultados mostraram um risco relativo de falha de 1,86 e 1.16 para os cimentos de ionômero de vidro convencional e o modificado, respectivamente, quando comparados com a resina composta (Pinto et al., 2014).

Há insuficiente informação na literatura sobre a longevidade das restaurações adesivas confeccionadas após RPTC em dentes decíduos, havendo assim também anecessidade de se verificar se os bons resultados encontrados nos trabalhos de pesquisa possuem validade externa na prática clínica.

2. OBJETIVO

Avaliar a longevidade de restaurações adesivas diretas em dentes decíduos portadores de lesões cariosas profundas em dentina confeccionadas após remoção parcial de tecido cariado e os possíveis fatores associados ao insucesso.

ARTIGO CIENTÍFICO

LONGEVITY OF PRIMARY TEETH RESTORATIONS UNDERGOING PARTIAL CARIES REMOVAL AND FACTORS ASSOCIATED WITH FAILURE: RETROSPECTIVE STUDY APPROACHING DAILY CLINICAL LIFE

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Short Title: Primary teeth restorations longevity undergoingpartial caries removal.

Key Words: Dental caries, composite resin, primary tooth, incomplete excavation.

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SUMMARY

Objective: to assess the longevity of direct adhesive restorations undergoing partial caries removal (PCR) in primary teeth and associated factors for failure, approaching the results to a daily clinical life. **Methods:** Retrospective analytical observational study which included 284 posterior and anterior primary teeth direct adhesive restorations that had been treated with PCR of 88 children with high caries experience. The teeth had clinical and radiographic follow-up through the information registered in the clinical records of the patients. In addition, factors potentially associated with treatment failure were investigated, such as age, gender, type of tooth involved, number of surfaces restored, type of capping material and restorative material used, visible plaque (VPI) and gingival bleeding indexes (GBI). Kaplan-Meier estimate and Log-Rank test were used to analyze the longevity of restorations and multivariate Cox´s regression model with shared frailty to evaluate the factors that could be related to treatment failure ($p<0.05$). **Results:** A clinical and radiographic success rate of the sample was 76% and an annual failure rate was estimated in 20% over 36 months. Only visible plaque index ($p=0.014$) and type of teeth, anterior or posterior ($p<0.001$) had a significant influence on the restorative failure. **Conclusion:** Adhesive restorations undergoing PCR in primary teeth in an environment that simulates a daily clinical life demonstrate good results, particularly in posterior teeth. However, the biofilm accumulation on the dental surfaces affects the longevity of them.

Clinical significance: Over time, it is very important to keep the patient in maintenance oral health program to control the etiologic factors of caries disease, which impair performance of the restorations.

INTRODUCTION

The total caries removal (TCR) before a tooth restoration does not ensure the complete elimination of the infected dentin, often being kept microorganisms underlying inadvertently. However, the presence of those bacteria in dentin, by themselves, would not be the determining factor for the evolution of the caries process if the cavity has an adequate sealing, that interrupts the passage of substrates and the communication with the oral environment (Bjørndal, 2001; Bjørndal and Kidd, 2005; Ricketts et al., 2006).

Within this context and based on current scientific evidence, the last American Academy of Pediatric Dentistry reference manual (AAPD, 2014-2015) recommends the partial caries removal (PCR) for the treatment of deep caries lesions in primary and permanent teeth. This technique involves the complete remove of the carious tissue from the lateral walls of the cavity and only the superficial carious dentin that is highly infected at the pulpar surface, whereas dentin near to the pulp able to be remineralized is maintained to avoid accidental pulp exposures (Bjørndal e Kidd, 2005).

Two aspects should be considered together when PCR is performed: the correct diagnosis of pulp condition (Ricketts, 2001; Coll, 2008; Casagrande et al., 2010) and the maintenance of adequate cavity sealing (Falster et al., 2002; Franzon et al., 2007). Pulp vitality should be rigorously evaluated and the teeth with history of spontaneous pain, radiographic evidence of periapical involvement or pulp degeneration and signals that indicate irreversible pulp inflammation should be excluded. With a correct diagnosis and treatment, PCR technique permits the formation of reparative dentin and dentinal esclerosis (Bjørndal, 2001). Furthermore, maintenance of the cavity sealing interrupts the communication of bacteria present in dentin with the biofilm surface, therefore, reduction of nutrients and bacterial viability (Kidd, 2004).

There are clinical, ultra-structural, chemical, microbiological (Bjørndal, 2000; Massara et al., 2002; Pinto et al., 2006; Orhan et al., 2008 and 2010; Lula et al., 2011; Marchi et al., 2006 and 2008; Casagrande et al., 2009; Franzon et al., 2007 and 2009; Al-Zayer et al., 2003; Falster et al., 2002; Ribeiro et al., 1999; Maltz et al., 2011 and 2012; Bjørndal et al., 1997 and 2010; Lula et al.,

2009; Santiago et al., 2005) and radiological (Franzon et al., 2014; Maltz et al., 2002; Ribeiro et al., 1999; Oliveira et al., 2006; Alves et al., 2010; casagrande et al., 2010; Hesse et al., 2014) evidences that that support the use of this technique.

Nevertheless, there is a need to verify if the reported success about restorations over PCR technique in very controlled studies can be reproduced in everyday clinical attention. Therefore, the objective of this research is to assess the longevity of direct adhesive restorations undergoing PCR in primary teeth and associated factors for failure in patients treated in conditions closer to daily clinical life.

METHODS

Study design and Ethics

This retrospective analytical observational study was developed at the Children and Youth Dental Clinic, School of Dentistry, FederalUniversity of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. This research protocol had the approval from the Research (26759) and Ethical Committee (no. 36799714.1.0000.5347) of the University. All the clinical records included in the present study had informed consent forms properly completed and signed by the legal guardian of the patient authorizing dental treatment and use of data registered for future researches.

Study population

The sample consisted of children with adhesive restorations undergoing PCR in primary teeth. They were selected from the dental records of patients who were treatedby trained dentists in PCR and use of restorative materials from the postgraduate program in Pediatric Dentistry at the School of Dentistry, Federal University of Rio Grande do Sul – Brazil (UFRGS). One trained individual collected the clinical and radiographic data registered in clinical records and factors potentially associated with treatment failure were investigated. Data collected included the following information: (1) patient age (months); (2) gender (male/female); (3) Caries experience (OMS criteria, DMFT + dmft); (4) Aimano& Bay gingival bleeding and visible plaque index (GBI –

initial/final; VPI – initial/final); (5) tooth location (anterior or posterior); (6) type of cavity (one surface or multiple surfaces); (7) Isolation (rubber dam or relative); (8) pulp capping material (calcium hydroxide cement, GIC or adhesive system); (9) restorative material (GIC or resin composite - RC); (10) monitoring period (measured in months until the last clinical and/or radiographic evaluation); (11) Clinical and radiographic Outcomes (success or failure details).

Inclusion criteria

- Children from 3 to 10 years old who were treated between 2005 and 2013
- No medically compromised children
- Reported PCR restorations in anterior or posterior primary teeth with clinical and radiographic follow-up of at least 6 months

Interventions

All the procedures were performed under the supervision of professors of the UFRGS Post graduate Program inPediatric Dentistry.

Patients were anesthetized and rubber dam or relative isolation with cotton rolls was performed. A high-speed bur was used, if necessary, to gain access to the caries lesion. Caries excavation was undertaken using a low-speed stainless steel bur or by hand excavation. Lateral walls were only accepted for filling if they were caries-free. Caries removal near the pulp was considered to be sufficient if the remaining dentin was discolored but hard (Massara et al., 2013). In addition, in cases with deep caries near the pulp, a calcium hydroxide liner (Dycal, Dentsply Caulk, Milford, DE, USA) was placed prior to restoring. For approximal lesions, a matrix and wedge were placed.

Then, a 37% phosphoric acid etching was performed followed by the application of adhesive system (Single Bond, 3M ESPE, St. Paul, MN, USA) and composite restoration (Filtek^{TM} Z 350$^{®}$, 3M ESPE, St. Paul, MN, USA) or glass-ionomer cement (Vitremer, GIC, 3M ESPE, St. Paul, MN, USA) as instructed by the manufacturer. Finally, the rubber dam or relative isolation was removed and the occlusion checked.

The outcomes of the PCR restorations were determined by clinical data and radiographic images found in the clinical records.

Clinical success: absence of information related to pain, fistula, edema, abnormal mobility, alteration of the filling and/or re-interventions, either replacement or repair of the restoration.

Radiographic success: absence of radiolucencies at interradicular and/or periapical regions and internal or external root resorption that was not compatible with biological resorption due to the exfoliation process in the patient radiographies.

The examiner was trained for radiographic diagnostic reproducibility, assessing 10% of the all the radiographies in two different occasions. The Kappa coefficient obtained was 0.85.

Data analysis

The descriptive distribution provides summary statistics of success rates according to the independent variables and demographic and clinical characteristics.

Data collected from patient records were included in a database and analyzed using software Stata 11.2. Survival analysis included the Kaplan–Meier curves. The time between the placement of the restoration and the failure event, if occurred, or the last dental visit was considered, taking into account a maximum period of 36 months of follow-up.

The log-rank test was used to compare survival curves. The factors associated with failure were analyzed using multivariate analysis utilizing Cox regression models with shared frailty, which considers that observations within the same patient are correlated, sharing the same frailty. Only variables presenting a $p<0.20$ were included in the final adjusted model. Hazard ratios (HR) and their 95% confidence intervals were estimated. A level of significance of 5% was considered.

RESULTS

In total, 637 restorative procedures involving PCR were found. Only 284 restorations met the inclusion criteria and were included for this retrospective study (Figure 1). These corresponded to 88 patients (45 boys and 43 girls) with a mean age of 62.5 months (±SD 22.98) and a mean caries experience of 11.1 (±SD 5.04).

The clinical and radiographic success of the total of restorations evaluated was 76%. The restorative failures (any alteration or re-intervention, either replacement or repair, in the restoration), pulp complications (diagnosis of irreversible pulpitis or necrosis) and the combination of both corresponded to 20%, 3% and 1% respectively.

Taking into account only anterior restorations, the overall success rate was 55% because they showed 42% of restorative failures and 3% of pulp complications.

For posterior restorations, the success rate was 81% and they presented 14% of restorative failures, 4% of pulp complications and 1% of both.
The annual failure rate (AFR) over 36 months of follow-up was 20%.

Table 1 shows the distribution of restorations in primary teeth according individual and tooth-level variables. Regarding the restorations, composite resin was the restorative material most frequently used (88%) and adhesive system was the capping material more chosen (62%).

Table 2 shows the crude and adjusted Cox regression analyses for independent variables and failure of restorations. The adjusted model showed that patients with plaque index above 20% had a risk of failure about 2.49 times (1.24; 4.99) higher than in children with plaque index up to 20%. Regarding type of teeth, anterior teeth had 3.34 times (1.84; 6.04) higher risk of failure in comparison with posterior teeth.

Figures 2 and 3 shows the Kaplan–Meier survival curves of the restorations undergoing PCR up to 36 months follow-up considering visible plaque index and type of teeth as criteria for failure, respectively. Higher survival rates were observed in patients with a VPI up to 20% and in posterior teeth.

DISCUSSION

This retrospective analytical observational study in primary teeth restorations submitted to PCR obtained satisfactory overall success rate. Gender, gingival bleeding index, number of surfaces, capping and restorative materials did not affect the success of the restorations. Only plaque index and type of teeth showed statistical significance for the failure of restorations.

Patients with plaque index higher than 20% showed more probability of failure compared to those with an index up to 20% (p=0.014). While anterior teeth had more chance to failure comparing to posterior teeth (p<0,001).

The overall clinical and radiographic success observed in this study was 76% (55% and 81% for anterior and posterior restorations respectively). Dalpian et al., 2014, in a retrospective study which analyzed restorations over PCR in posterior primary teeth performed by undergraduate students, obtained 80,3% of success rate and the same associated factor to the failure of restoration (plaque index more than 20%). It was expected that clinicians with more experience would have more success; however, the restorations in the present study were made by trained dentists of a pediatric dentistry post graduate program and the resultswere similar to Dalpian et al. In Al Zaier et al study, 2001, posterior restorations in deciduous teeth were performed by post graduate and undergraduate dentistry students, and it was showed that operator's skill and experience had no significant effect on the success of the technique.

Additionally, the results of this study are similar with those observed in clinical trials that have a rigorous methodological design, with trained and calibrated operators (Franzon et al., 2015). This is a relevant date that have encourages all clinicians to use this conservative technique with security independently of formation grade.

At the UFRGS Children and Young Dental Clinic, the treatment of choice for deep caries is the PCR. The teeth are restored in the same session, preferably with composite resin. This is a definitive treatment in a single session. It's well documented that leaving a contaminated dentin under the restoration did not impair the lesion arrestment and the maintenance of pulp vitality (Casagrande 2010, Franzon 2014). Besides, good marginal isolation provided by adhesive systems ensures substrate absence for the remaining bacteria (Orhan 2008). According to Ricketts et al., 2013, in a recent systematic review, one-step complete excavation, step- wise excavation, or two-step incomplete caries removal increases the risk of pulp exposure when compared to one- appointment incomplete caries removal. It is beneficial for restorations longevity to avoid pulp treatments; Pinto et al., 2014, found that patients with

high risk of caries or with at least one pulp intervention had a risk of failure higher than in children without pulp intervention.

PCR technique has demonstrated good results about pulp vitality. It is a safe and conservative technique requiring a reduced time in the chair and also reduces the number of pulp exposures (Franzon et al, 2014). In the present study, we found that the majority of failures were of restorative type (57/284) contrasting with pulp complications (10/284) or both (2/284).

Although in permanent teeth, the performance of glass ionomer cements is inferior to composite (Manhart et al., 2004), this is controversial in primary dentition. Composites and resin modified glass ionomer cements have shown to provide adequate marginal sealing in deciduous teeth (Qvist et al., 2010). A retrospective study of Da Silva et al., 2009, in deciduous molars over PCR, state that there was no statistically significant difference between composite resin and resin modified glass ionomer cement like our results.

Concerns have been raised that incompletely excavated teeth might show higher risk of fracture or microleakage compared with completely excavated teeth, possibly associated with reduced bond strengths to carious dentine depending on the used adhesive system. Such higher risk of non-pulpal complications may compensate for the possibly lower risk of pulpal complications (Ricketts et al., 2013). A recent randomized clinical trial found that PCR yielded lower longevity for composite restoration compared to TCR, suggesting that PCR restorations need to be followed rigorously over time (Franzon et al., 2015).

PCR showed superior results in posterior teeth compared to anterior one. Bücher et al. in 2013, find that, regarding to tooth type, molar fillings showed a significantly lower failure rate (56/607; 9.2 %) than incisor (35/216; 16.2 %) and canine restorations (34/194; 17.5 %) (log rank test; p=0.011).

This superiority probably stems from the radiographic diagnostic of carious lesion, because the overlap of carious lesions in buccal or palatal surfaces in anterior teeth complicates the delimitation of the depth of it and consequently there is a difficulty to assess the amount of carious tissue to remove. Furthermore, after PCR, the substrate for adhesion on the side walls is lower in anterior teeth compared to posteriors. But the most important factor in

characterizing a failure of restorations in anterior teeth is the aesthetic requirements of the patient and of the professional. Small pigmentation in restoration margin that would be tolerated in posteriors teeth are totally unwanted in anteriors and often require repair or replacement.

Visible plaque presence is usually associated with the presence of bleeding on probing due to the inflammatory process triggered by their presence. In the present study, only plaque index was associated with failure of restoration (p = 0.014). Gingival bleeding index was not significant in restoration longevity maybe because gingivitis in children shown to be less severe compared to adults when similar amounts of plaque deposition are found (Jenkins et al., 2002). Another point is that the Oragranulocyte Migration rate (OMR) is low in children when compared with the rate in adults. The tendency to gingival bleeding, the production of crevicular fluid and leukocytes are less than in the adults (Oh et al., 2002).

In regards of capping material, no difference in restoration longevity was observed among the materials used. Adhesive system was used in 62% of the cases.The selection of the adhesive system as a liner material simplifies the technique, since the insertion of the calcium hydroxide cement only in the pulp wall requires professional skill and immobility of the patient and represents a step forward in the techinique. Studies in deciduous teeth have demonstrated that even with the use of inert materials on the pulp, there is the arrestment of the carious lesion (Marchi et al., 2006; Franzon etal., 2007).

Number of surfaces involved did not affected the restoration longevity (p=0.442) according our results. Retrospective study of Pinto et al., 2014, concluded the same. Nevertheless, this matter remains unclear in the literature. Asistematic review, Schwendicke et al., 2013, found significantly lower risk of failure for teeth with single- compared with multi-surface cavities and Franzon et al., 2015, confirmed that through a randomized clinical trial.

The fact of could not classified the severity of the "restorative failures" and consider all as failure was a limitation of the study. Is demonstrated that repairing restorations is an alternative treatment that works well and increase their longevity, it is proved to be a safe and effective in the long term, with the original restoration behaving as would a replacement (Fernandez et al., 2015).

The present study showed good results of restorations longevity undergoing PCR in deciduous dentition, particularly in posterior teeth. The factor associated with the failure seems to be related to the patient's self-care for their oral health. Perhaps these patients should be entered into an oral health promotion program to maintain the longevity of restorations.

Table 1. Distribution of restorations in primary teeth according individual and tooth-level variables (88 children, 284 restorations)

Variables	n (%) ofrestorations	Success (%)	Failure (%)
Gender			
Male	158 (55.63)	125 (79.12)	33 (20.88)
Female	126 (44.37)	90 (71,43)	36 (28.57)
Plaque Index (follow-up)			
<20%	170 (59.85)	136 (80.00)	34 (20.00)
>20%	114 (40.15)	79 (69.29)	35 (30.71)
Gingival Bleeding Index (follow-up)			
<20%	179 (63.02)	142 (79.32)	37 (20.68)
>20%	105 (36.98)	73 (69.52)	32 (30.48)
Typeofteeth			
Posterior	224 (78.87)	182 (81.25)	42 (18.75)
Anterior	60 (21,13)	33 (55.00)	27 (45.00)
NumberofSurfaces			
1	115 (40.49)	88 (76.52)	27 (23.48)
2	89 (31.33)	67 (75.28)	22 (24.72)
3or more	80 (28.18)	60 (75.00)	20 (25.00)
Capping Material			
Adhesive System	176 (61.97)	132 (75.00)	44 (25.00)
GIC/CalciumHydroxide	108 (38.03)	83 (76.85)	25 (23.15)
Restorative Material			
CompositeResin	249 (87.67)	191 (76.70)	58 (23.30)
RMGIC/GIC	35 (12.33)	24 (68.57)	11 (31.43)

Table 2. Crude (^{c}) and adjusted (^{a}) Hazard Ratios (HR) for independent variables and failure of restorations in primary teeth (Cox regression with shared frailty models).

Independentvariables	HR^c(95% CI)	p-value	HR^a(95% CI)	p-value
Gender		0.804		-
Male	1.00		-	
Female	1.10 (0.52;2.30)			
Plaque index		0.010		0.014
Up 20%	1.00		1.00	
More than 20%	2.49(1.24;4.99)		2.47 (1.20;5.08)	
Gingival Bleeding Index		0.182		-
Up 20%	1.00		-	
More than 20%	1.67 (0.79;3.53)			
Type of teeth		<0.001		<0.001
Posterior	1.00		1.00	
Anterior	3.34(1.84;6.04)		3.75 (2.03;6.61)	
Number of Surfaces		0.442		-
1	1.00		-	
2	0.88 (0.45;1.73)			
3 or more	1.42 (0.68;2.98)			
Capping Material		0.372		-
Adhesive System	1.00		-	
GIC/Calcium Hydroxide	0.76 (0.42;1.39)			
Restorative Material		0.341		0.186
CompositeResin	1.00		1.00	
RMGIC/GIC	1.47 (0.67;3.24)		1.80 (0.75;4.28)	

Fig. 1 – Flowchart of the study

Assessed for eligibility:
637 PCR Restorations

Excluded (n=353)
Medically compromised children (n=19)
Lack of data (n=200)
Absence of follow-up (n=134)

Analyzed 284 PCR Restorations
in 88 patients = 45 boys, 43 girls
(mean age: 62.5 months)

Clinical and radiographic success: 76% (n=215/284)
Restorative failures: 20% (n=57/284)
Pulp complications: 3% (n=10/284)
Both: 1% (n=2/284)

PCR Anterior Restorations (n=60)

PCR Posterior Restorations (n=224)

Clinical and radiographic success: 55% (n=33/60)
Restorative failures: 41.67% (n=25/60)
Pulp complications: 3.33% (n=2/60)

Clinical and radiographic success: 81% (n=182/224)
Restorative failures: 14% (n=32/224)
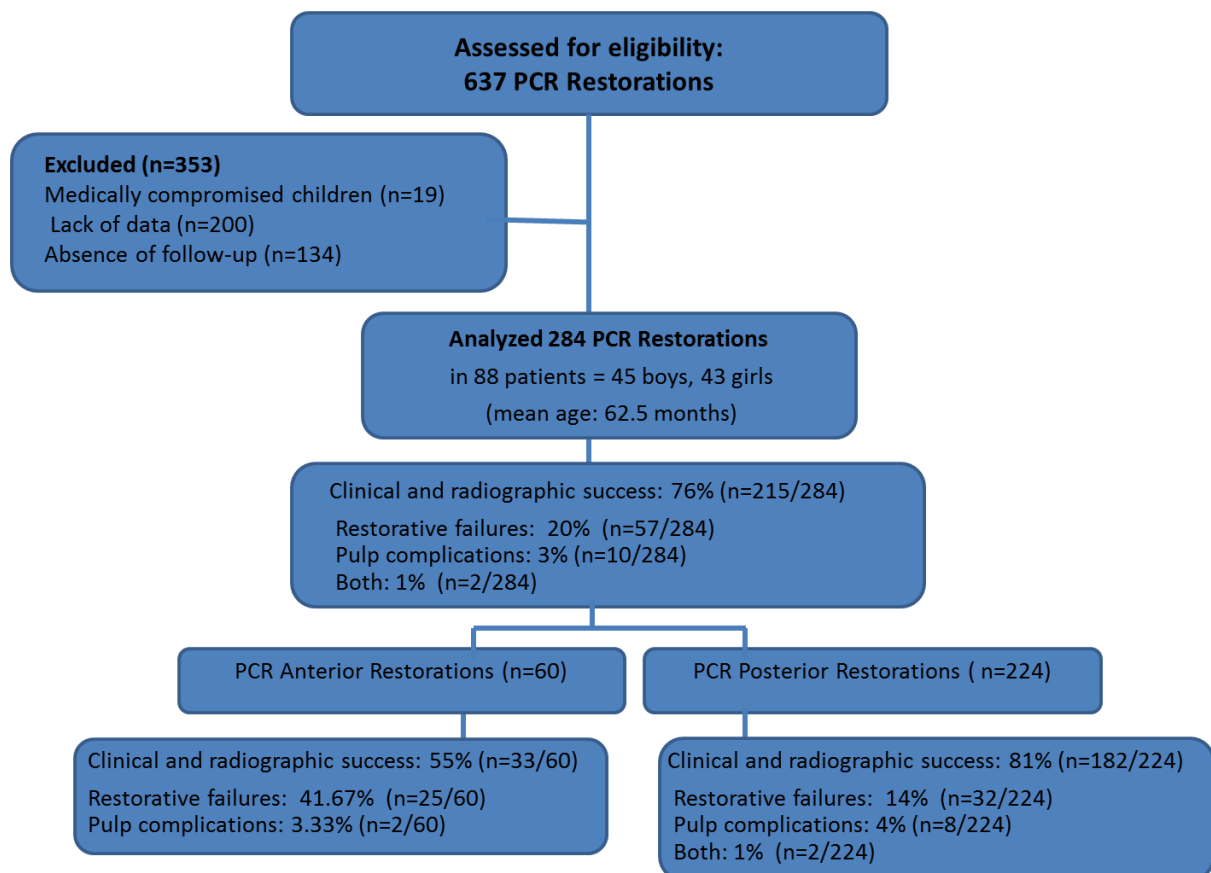Pulp complications: 4% (n=8/224)
Both: 1% (n=2/224)

Fig. 2 - Kaplan–Meier Survival curves of restorations considering plaque index criteria for failure. Log Rank p =0,121

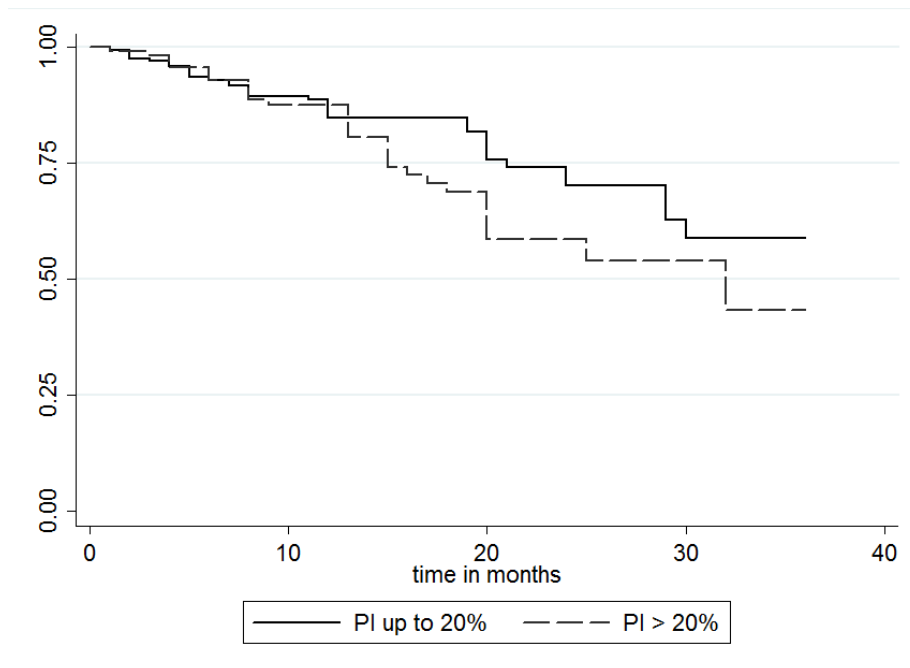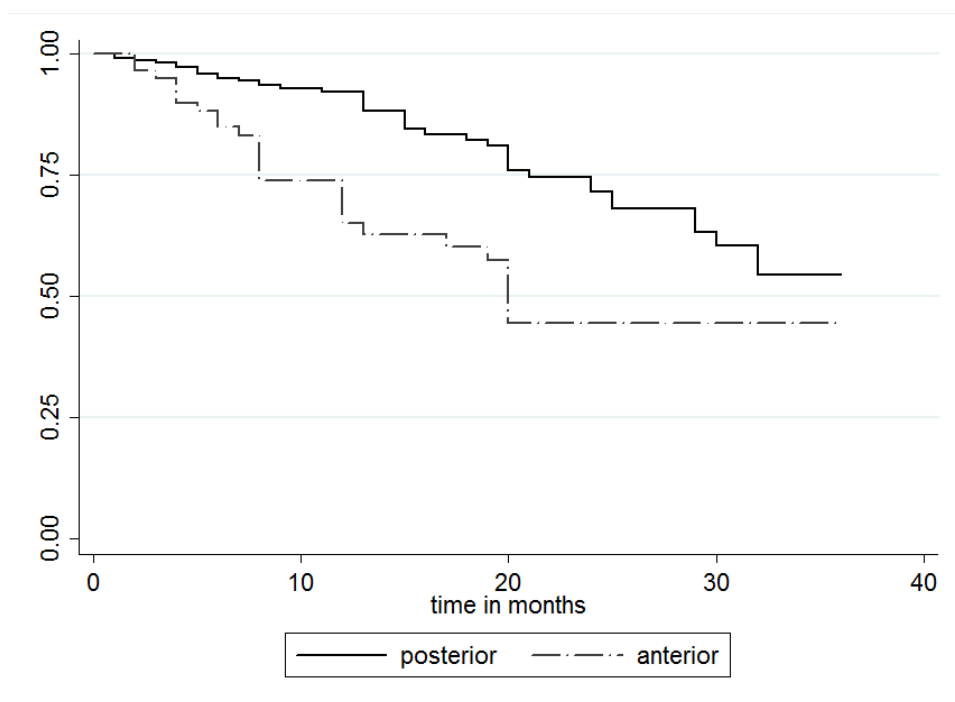**Fig. 3- Kaplan–Meier Survival curves of restorations considering type of teeth (anterior or posterior) as criteria for failure. Log Rank p <0,001**

3. CONSIDERAÇÕES FINAIS

Há uma crescente busca para a implantação da proposta da terapia de "mínima-intervenção" para o tratamento da cárie, tanto na população infantil como na de adultos. O presente estudo demostrou que as restaurações adesivas diretas confeccionadas após RPTC em dentes decíduos apresentam um alto índice de longevidade, principalmente em dentes posteriores. Porém, uma atenção continua deve ser dada aos fatores etiológicos da doença, principalmente em crianças com alta experiência de cárie, com o intuito desta terapia também interferir na longevidade das restaurações.

O desenho experimental escolhido neste estudo tentou refletir a "vida clínica real" e permitiu avaliar a longevidade das restaurações adesivas envolvendo RPTC, embora tenha sido utilizada uma amostra de conveniência com características específicas.

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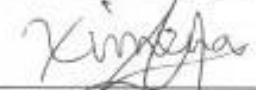
ANEXOS

Termo de Compromisso para Utilização de Dados

Título do Projeto

Remoção Parcial de Tecido Cariado em Dentes Decíduos – Estudo retrospectivo em pacientes do curso de especialização em odontopediatria da FO-UFRGS

Os pesquisadores do presente projeto se comprometem a preservar as informações que serão coletadas em bases de dados do Ambulatório da Clínica Infanto-Juvenil da Faculdade de Odontologia da UFRGS. Concordam, igualmente, que estas informações serão utilizadas única e exclusivamente para execução do presente projeto. As informações somente poderão ser divulgadas em atividades acadêmicas e científicas, no contexto do projeto de pesquisa aprovado.

Porto Alegre, 25 de Setembro de 2014

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