Survival time of direct dental restorations in adults

Sobrevida de restaurações dentárias diretas em adultos

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Resumo

Introdução: A cárie dentária é o principal motivo para a instalação e troca de restaurações. A preservação **destas** em condição clínica satisfatória é um desafio, apesar da evolução dos materiais e técnicas cirúrgico-operatórias. **Objetivo:** Investigar o tempo de sobrevida e características técnico-operatórias das restaurações dentárias diretas de adultos em Teresina, Piauí. **Material e método:** A coleta de dados ocorreu de setembro de 2009 a janeiro de 2010, em clínicas de tratamento odontológico sem fins lucrativos. Os dados técnicos e operatórios do preparo cavitário e da restauração foram coletados no momento da substituição. A sobrevida foi calculada a partir da data de instalação que constava no prontuário. Os dados foram registrados em um formulário criado com esse fim. Kruskal-Wallis e Mann-Whitney foram empregados para comparar a sobrevida dos diferentes tipos de restaurações e o teste qui-quadrado para associações entre variáveis qualitativas, ambos com nível de significância de 5%. **Resultado:** As 262 substituições de restaurações deficientes estavam em 139 pacientes. A mediana de sobrevida das restaurações foi 2 anos. As restaurações de amálgama tiveram sobrevivência maior que as de resina composta (p=0,004). O material restaurador mais substituído foi resina composta (66,4%). A maioria das restaurações localizava-se em dentes anteriores e em preparos proximais. **Conclusão:** As restaurações de amálgama teve sobrevida maior que as de resina composta. As variáveis técnico-operacionais não influenciaram na taxa de substituições. As restaurações diretas possuem reduzido tempo de sobrevida o que pode estar associada à filosofia adotada pelo serviço para o tratamento fornecido.

Descritores: Falha de restauração dentária; restauração dentária permanente; pesquisa baseada na prática.

Abstract

Introduction: The presence of dental caries is the main reason for the placement and replacement of restorations. Maintaining restorations to a satisfactory clinical condition is a challenge, despite the evolution of materials and surgical operative techniques. **Objective:** To investigate the survival time and technical-operatory characteristics of dental restorations among adults in Teresina-PI. **Material and method:** Data collection was carried out from September 2009 to January 2010 at a non-profit dental service. Data were collected at the moment of restoration replacement. The sample consisted of 262 defective restorations in 139 individuals. Survival time was calculated using the placement date that was registered on the individual's dental form. Kruskal-Wallis and Mann-Whitney tests were used to compare the survival time of the different types of restorations and the chi-square test was used to assess the association between qualitative variables, at a 5% significance level. **Result:** The median survival time of the restorations was 2 years. The survival time for amalgam was higher than for composite and glass ionomer cement (p=0.004). The most replaced dental material was the composite (66.4%). The majority of the replaced restorations had been placed in anterior teeth, in proximal surfaces. **Conclusion:** Amalgam restorations have a longer survival time than composite resin. Technical and operatory variables had no influence on the survival time of restorations. Dental restorations have a low survival time and this fact might be associated with the decion-making process that is adopted by the professionals.

Descriptors: Dental restoration failure; permanent dental restoration; practice-based research.

INTRODUCTION

Despite recent advances in the prevention of dental caries, the disease continues to be a global public health problem and is the main reason for the placement and replacement of dental restorations[1-6]. Once placed, the restorations should be followed-up, which places a lot of demand on oral health services and their professionals.

Invasive operatory practices of dental tissues are costly, require a large amount of clinical time and result in the loss of sound tissue, thus expanding the tooth-restoration interface and reducing the resistance of the remaining dental tissues[7,8]. In many countries, the replacement of dental restorations is responsible for much

of the clinical time spent treating adults[1-9]. However, preserving restorations in a satisfactory clinical condition for long periods is a challenge, despite the evolution of restorative materials and operative techniques.

A considerable number of restorative procedures are replaced in a short space of time[4-6,8-10]. The survival time of direct restorations has ranged from 03 to 08 years depending on the type of study and associated variables, such as the extent of the preparation and location of the restoration in the dental arch[3,11-14]. A careful diagnosis of the etiology of failure is crucial in order to adopt a precautionary approach and to minimally invade dental tissues[4-6,15-17]. However, diagnosing the reason for failures and the choice of treatment is a subjective process[1-9].

The most common reasons for the replacement of restorations are secondary caries, marginal degradation, restoration fracture, tooth fracture, cosmetic changes and loss of restoration. Any such defects may relate to factors inherent to the material, the operator and the individual[3,11,13].

Thus, the objective of this study was to measure the survival time of direct dental restorations of composite resin, glass ionomer cement (GIC) and silver amalgam, at the time of replacement.

MATERIAL AND METHOD

This was an observational, cross-sectional study that followed the principles of Dental Practice Based Research, which aims to portray the reality of everyday dental. The dentists were not calibrated, although the data collection was standardized. Thus, the dentists did not alter their routine and the results are applicable to daily practice[18]. The sample consisted of 262 restorations in 139 individuals.

This study followed the recommendations of the Declaration of Helsinki (2000) and Resolution No. 466/2012 of the Brazilian National Health Council. The research project was authorized by the institution where the study was carried out and by the Ethics Committee of the Federal University of Piauí (Protocol number 0145.0.045.000-09).

All individuals aged over 18 years and who received a professional diagnosis of the need for repair and/or replacement of direct restorations (composite resin, silver amalgam or GIC) were included in the study. Indirect restorations such as crowns, inlays and onlays, and restorations where the patient's opinion interfered with the final decision of the procedure, were not included in the study. The data collection period was from September 2009 to January 2010, which included the annual period of highest demand for dental treatments.

The dentist who carried out the procedure answered questions regarding the study variables and the data were recorded on a form that had been previously tested in a pilot study. The survival time of the restorations was calculated using the date of the last available record on the individual's dental form.

The data collection location (SESC - Serviço Social do Comércio) is an institution that operates throughout Brazil and assists professionals in the trade and service businesses, their relatives and dependents. Other individuals of society also have access to the services. The dental team consists of 15 general dentists, who perform around 120 clinical procedures per day, including consultations, health promotion procedures, basic periodontal procedures, exodontias and restorations.

The date of replacement of the restorations, the restorative material, the tooth surface involved in the cavity preparation and the restored tooth were recorded. The Kolmogorov-Smirnov test was used to verify the normal distribution of variables. The Kruskal-Wallis test followed by the Mann-Whitney test were used to analyze the difference between the median survival time of restorations; and for an analysis of association, Pearson's chi-square test (χ2) or Fisher's exact test, at a level of significance of 5% ($p < 0.05$) was used.

RESULT

The survival time of restorations ranged from one month to 18 years, with a median of 2 years; 25% of the restorations had a survival time of 0.83 years; 50% survived up to 2 years, and 75% up to 3.83 years. Each individual had a mean of 1.9 restorations replaced during the data collection period of 5 months.

The replaced restorations were restored with: composite resin (174 - 66.4%), silver amalgam (84 - 32.1%) or GIC (04 - 1.5%). The majority of the replaced restorations were strictly on proximal surfaces (all composite resin restorations) or on the proximal and occlusal surfaces (composite resin or amalgam restorations) (Table 1).

The median survival times of amalgam, resin and GIC restorations were 3.04 years 1.56 years and 2.12 years, respectively. There was a

Table 1. The type of cavity preparation for direct restorations replaced in adults (SESC/Teresina-PI), according to the restorative material

| Cavity preparation surface | Restorative Material | | | | | | Total | |
| | Amalgam | | composite | | GIC | | | |
	N	%	N	%	N	%	N	%
Strictly proximal	-	-	95	54.6	-	-	95	36.2
Occlusal and proximal	58	69.0	17	9.8	-	-	75	28.6
Cervical	04	4.8	58	33.3	-	-	62	23.7
Occlusal	22	26.2	04	2.3	04	100.0	30	11.5
Total	84	100.0	174	100.0	04	100.0	262	100.0

statistically significant difference for the material factor (p = 0.009). The survival time of amalgam restorations was significantly higher than that of the resin restorations (p = 0.002).

There was no association between the replaced restorative material and the surface of the cavity (p = 0.421). For this analysis, the restorative materials were considered as aesthetic (resin and GIC) and non-aesthetic (amalgam) materials (Table 2).

Replacements were most frequent in anterior teeth (104 cases or 39.7%), followed by premolars (85 cases or 32.4%) and molars (73 cases or 27.9%). The median survival time of the restorations did not vary according to the group of teeth: 2.7 (SD = 2.8) years for anterior teeth, 2.7 (SD = 2.5) years for premolars and 2.7 (sd = 2.5) years for molars (Kruskal-Wallis, p = 0.779). The survival time did not vary according to the type of cavity preparation (Kruskal-Wallis, p = 0.616 - Table 3).

DISCUSSION

The survival times of amalgam, resin and GIC were found to be low, and lower than in other studies of the same nature[1,15-18]. The silver amalgam restorations had a higher survival time than the composite resin and GIC. Factors such as the material used, the professional operative technique and the individual's characteristics may be associated with the survival time of dental restorations[1,9,19].

The dental service establishes a daily quantitative target of clinical procedures to be met by dentists during their working hours, on average 30 minutes per individual treated. Thus, the mean number of replacements per clinical session was considered high. During the clinical time, other types of procedures could also be carried out, which compromised even further the quality of the restorative technique. This factor may have influenced the outcome of this study. The restorative procedure with composite resin, for example, may require 2.5 times longer than a similar amalgam due to the greater complexity of the operatory technique[12].

The prognosis of a restorative treatment is closely associated with the conditions under which it is carried out. Inaccurate diagnoses, failure to comply with the technical requirements of the procedure, overtreatment in case of failures, the wrong indication of the materials for specific clinical situations and the underestimation or ignorance of the causes may culminate in premature failure of the restoration[5,15,16,20].

Most restorations indicated for replacement due to secondary caries are free of caries when the radiographic examination is carried out[21]. Because most dentists in this study did not use radiographs (2.7% of the replacement procedures were carried out after radiograph exam - data not shown), there may have been overtreatment.

Dental amalgam and composite resin were the most frequently used materials in this study [22, 23] and the fact that most of the restorations were placed with composite resin confirms the worldwide trend of using composites as a universal restorative material (for anterior and posterior teeth). The growing desire of individuals for aesthetic materials also contributes to the increase in the use of composites[7,24-27].

Because composite resins are more frequently used than amalgam, they tend to fail more often, especially because of their higher sensitivity to operative technique[3,11,13,14]. According to Tyas[3], amalgam restorations survive for longer than composite resin, as found in this study. However, this statement is not a consensus[2,3,9,11,12,15]. The survival time of amalgam and composite resin restorations varies according to the nature of the study and other factors. Amalgam survival time varies between 8 and 16 years[3,11,12,26,27].

Table 2. Tooth surfaces involved in the cavity preparation of direct restorations replaced in adults at SESC/Teresina, PI, according to the type of restorative material

| Cavity preparation surface | Restorative Material | | Total | p* |
	Non-aesthetic	aesthetic		
Occlusal	22	08	30	
Occluso-proximal	58	17	75	0.421
Total	80	25	105	

*Fisher's exact test.

Table 3. Survival time (years) of direct restorations replaced in adults treated at SESC (Teresina-PI) according to the tooth surface involved in the cavity preparation

| Cavity preparation surface | Survival time (years) | | | p* |
	Median	minimum	maximum	
Proximal	2.9	0.08	18.0	
Occluso- proximal	2.0	0.08	10.9	0.616
Cervical	1.75	0.08	10.9	
Occlusal	2.1	0.17	9.0	

*Kruskal-Wallis.

Clinical controlled studies have reported longer survival times because the restorative technique used was carried out under ideal technical conditions[27].

Most of the replacements (36.2%) were carried out in proximal cavity preparations, which had been restored with composite resin (Table 1), and in anterior teeth. Composite resins are technique-sensitive materials and their aesthetic failure is easily visible to the patient. This might be responsible for the high number of replacements.

Some clinical situations, such as large cavity preparations, limit the survival time of the resins in proximal cavities of anterior teeth[7]. Because the institution in this study does not provide indirect restorations as a restorative option, the professionals often opt to restore certain teeth with composite resin when a crown would be the ideal indication.

The frequency of replacement of non-aesthetic material was the same as aesthetic material for the occlusal and occluso-proximal surfaces (Table 2). This result may reveal an invasive mentality for the treatment of failed restorations. Often, failures are restricted to certain areas of the restorations or are superficial. These failures could be resolved with repairs or resurfacing of the restoration. The incorrect indication of replacing restorations is responsible for about two-thirds of unnecessary direct restorations placement. This may result in overtreatment and the loss of sound dental tissue[20,21]. The repair, sealing of margins, recontouring and resurfacing of existing restorations should be part of the proposed treatment for dental restorations. These procedures improve the clinical longevity of these restorations, avoid unnecessary loss of dental tissue and have reduced cost[5,15,16].

Class II cavity preparations are the most frequently placed and replaced restorations[13,17], unlike in this study. In occluso-proximal preparations, important anatomical structures which are located the masticatory stress region and that reinforce the dental crown (such as cusps and marginal ridges) are lost. However, regardless of the material that was used, the various types of preparation had the same survival time (Table 3), which indicates that the restorations failed after a similar period (p = 0.840).

The reduced survival time of restorations in different groups of teeth supported the hypothesis that the clinical performance was not associated with the type of material or the location of the tooth, but with technical failures, overtreatment and/or the patient's characteristics. Possibly, investment in the continuing education of professionals, a paradigm shift to a more conservative approach to dental tissue and technical rigor in restorative procedures could improve this situation.

Despite the great advances in dentistry, especially regarding oral health promotion, the prevention of caries and the technological evolution of materials and restorative techniques, it is important that professionals are aware of the maintenance of functional restorations, avoiding premature or unnecessary replacements.

Systematic research on the longevity and the replacement of direct restorations in Brazilian dental clinical practice is necessary. Studies like this are critical for the assessment of the professional's performance and for the management of the dental service (proposing protocols, reducing costs and increasing efficiency).

CONCLUSION

The direct restorations that were placed in the studied dental service had a reduced survival time. The amalgam restorations had a higher survival time than the other materials studied. The technical and operational variables did not influence the rate of replacement of restorations of the studied materials. The reduced survival time of restorations may be associated with the philosophy adopted by the treatment providers.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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