Original Research Article

INCIDENCE OF RESTORATION REPLACEMENT IN SOUTH-CANARA POPULATION - AN EPIDEMIOLOGICAL SURVEY

ABSTRACT:

Aim: Aim of the present study was to determine the incidence of restoration replacement and associated factors among South Canara population

Place of study: Department of Conservative Dentistry and Endodontics, AB Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangaluru

Duration of Study: May 15, 2018-June 15, 2018 (1 month)

Methodology: 2000 patients were examined using mouth mirror and explorer under good lighting facilities, followed by a questionnaire to determine the incidence of restoration replacement and the parameters checked for correlations were type of the restorative material, size and class of the restoration, reason for the failure, type and position of the tooth, anamnesis of the respective tooth and patient factors such as age-group, gender and oral hygiene measures followed

Statistical Analysis: Data obtained was statistically analysed by using IBM SBSS version 24. Differences between variables were analysed by Chi-square test.

Results and Conclusion: The incidence of restoration replacement was 18.2% The main cause of the failure was secondary caries followed by material fracture and discoloration.Amalgam was the most commonly replaced restorative material and lower molar teeth showed more failures.It also indicated that replacements were more prevalent in males and for individuals brushing once daily in comparison with those brushing twice daily.

KEYWORDS: Restoration replacement, Restoration failure, Filling, Resin-based composite, Amalgam, glass ionomers

1. INTRODUCTION:

Contemporary practice of restorative dentistry incorporates the diagnosis, prevention and management of carious and non-carious lesions. A substantial amount of operating time is also directed towards repair and replacement of defective and degraded restorations. [(1)] In fact, replacements make up for more than 50% of the total restorations done by clinicians and this percentage continues to grow. [(2)] This becomes time-consuming and may involve additional removal of tooth structure. Replacing a restoration may also lead to potential pulpal tissue damage.[(3)]Furthermore, a lot of such interventions all the way through a lifetime proves to be detrimental to the tooth, descending the "restorative death spiral".[(4)]

This could be attributed to an interplay of various factors associated with the restoration, patient and the clinician himself.[(5)] Several aspects like the quality of the restoration during placement, the type and size of the restoration, the restorative material involved, patient factors like oral hygiene status, age, dentition, and caries risk, practitioner's knowledge along with his expertise

in diagnosis, greatly affect the longevity of a restoration.[6-11] Majority of the failures occur as a consequence of gradual development of recurrent caries, some physical faults, like restoration or tooth fracture or discoloration of the restoration, or due to marginal degradation or 'ditching' [12]

The prime reason for the replacement of amalgam and composite restorations has been proved to be secondary caries. Apart from that, other major causes include bulk fracture, marginal fracture and discoloration. The occurrence of marginal fracture is very low, even though it has been noted as one leading cause for the replacement of restorations of amalgam in most of the studies reviewed. Due to the notion of an association between marginal defects and caries, marginal integrity is considered as one of the major standard for deciding the quality of a restoration.[13] Likewise for glass ionomers, bulk fracture, marginal fracture and poor anatomic form would be the main reasons for failure besides recurrent caries[14,15]

Largely, the replacements account for a major portion than the primary restorations in routine clinical practice. The ratio of replacements to primary restorations has been reported to be 80:20 for composite restorations and 70:30 for amalgam restorations,[16] and even greater ratios are recorded.[17] Nonetheless latest studies show that this ratio is around 50:50 for restorations in permanent teeth.[18-22] Various parameters influence this proportion, more specifically the age group of the population examined and the ratio being greater in adolescents than in adults and being lesser in the deciduous dentition.[23,24] The oral hygiene status of patient and their level of awareness, including involvement in caries prevention programs, also play a part.[25]

Presently, composite restorations are best favoured in patients with high-quality oral hygiene, since this material shows higher adherence of plaque following placement [26]. Due to such higher probability of more plaque adhesion, more elaborate oral hygiene instructions have to be given, when these materials are selected [27]. Secondary caries and restoration fracture constitute the most prominent reasons for composite restoration failure. [28]. This material is more aesthetic, saves tooth structure and has low thermal conductivity when differentiated from amalgam [29]. Moreover, they require a more precise operative procedure to achieve a favourable long-term outcome. On the contrary, amalgam restorations have long durability, low technique sensitivity, good compressive strength, superior wear resistance and self-sealing ability. But the drawbacks include aesthetics and excessive tooth structure removal during tooth preparation [30].Most cases of amalgam failures are related to the technicality followed by the clinician, or the patient behaviour, but not associated with the material. However, amalgam being a material with low tensile strength, has to be dealt in view of this drawback. [31].

In a study conducted by Burke in 1999, he concluded that higher age of restoration at replacement is related to normal occlusal function. Likewise reduction in the restoration's age is associated with extreme occlusal function. [32].Since amalgam is more wear resistant compared to composite [33, 34] therefore in patients with parafunctional habits, excessive masticatory forces or if the occlusal contacts of restorations remain in the restorative material, amalgam should be preferred. Nonetheless, resin composites perform well as far as cases with normal occlusal loading is concerned. [35, 36, 37].

Hence, this study was done to evaluate for the reasons for the replacement of direct restorations and to correlate the replacements with factors related to the patient, tooth and the restoration in permanent teeth in general population

2. MATERIAL AND METHODS:

The study was carried out on a total population of 2000 patients over a period of three months from May 15th 2018 –June 15th 2018, out of which 1122 were examined from Out-patient section of Department of Conservative Dentistry and Endodontics A.B. Shetty Memorial Institute of

Dental Sciences, NITTE University, Deralakatte, Mangalore, India among which 430 belonged to urban strata and 692 belonged to periurban areas, and 878 were examined in Rural Health Centres of A.B. Shetty Memorial Institute of Dental Sciences, NITTE University, Deralakatte, Mangalore. Permission to conduct the study was sought from the relevant authorities. Informed verbal consents were obtained. Failure to consent did not affect the patients' treatment and confidentiality of the information given was assured. After the tooth isolation, patients were examined for restoration replacement and a questionnaire was set to record the history linked to the failure of restoration. Direct examination consisted of visual examination with the use of basic diagnostic instruments -a standard mouth mirror, a sharp-ended explorer, and optimal illumination from a dental operatory lamp. Bite-wing radiographs were taken for examination of approximal surfaces. Patients were recorded under different age groups, sex, existing, oral hygiene habits, type of restorative material used, and class of restoration and reason of restoration replacement. Patients were selected on basis of inclusion and exclusion criteria. Data was recorded on the prepared survey form based on the WHO Oral Health Assessment Form 2013[Annexure 1] [(45)] and this data was analysed using IBM SPSS Version 24 and statistical evaluation was done by chi-squared test

2.1 <u>INCLUSION CRITERIA:</u>

-Defective restorations

-Age groups:

15-30 years

30-45 years

45-60 years

60 and above

2.2 <u>EXCLUSION CRITERIA:</u>

-Patients with no restorations

2.3 QUESTIONNAIRE

Name:

Gender: 1. Male 2. Female

Age group: 1. 15-30y 2. 30-45y 3. 45-60y 4. >60y

Location: 1. Urban 2. Periurban 3. Rural

Frequency of brushing/day: 1. Occasionally 2. Once daily 3. Twice daily

REQUIREMENT FOR RESTORATION REPLACEMENT

Reason for restoration replacement

1. Fractured 2. Discoloured 3. Recurrent Caries

Type of restorative material used

1. Amalgam 2. Composite 3. GIC

Class of restoration?

1. Class I 2. Class II 3. Class III 4. Class IV 5. Class V

Quadrant affected 1. First 2. Second 3. Third 4. Fourth

Tooth affected 1. Incisor 2. Canine 3. Premolars 4.Molars

3. RESULTS:

In the present study, out of a total of 2000 patients, 430 subjects belonged to urban strata, 692 subjects belonged to periurban whereas 878 subjects belonged to rural location. (Table 1) Males constituted 55.2% and females formed 44.8%.of the study population. (Table 2)

Location:	**Subjects**
Urban	430 (21.5%)
Rural	878 (43.9%)
Periurban	692 (34.6%)

TABLE 1

GENDER	Subjects
MALES:	1104 (55.2%)
FEMALES:	896 (44.8%)

TABLE 2

The incidence of restoration replacement came out to be 18.2% as 364 patients out of 2000 patients showed the need for replacements.

Incidence was found more in males with a percentage of 59.3% whereas females consisted of 40.6%.When the different age groups were analysed with the replacements, 15.6% replacements were seen in in 15-30 years, 33.5% in 30-45 years, 39.8% in 45-60 years and 10.9% in > 60 years. The most significant age groups came out to be 30-45(33.5%) and 45-60 (39.8%).When the brushing frequency was cross tabulated with replacements, out of 364 cases, 215 (59.06%) had habit of brushing once daily, 77(21.15%) subjects who brushed occasionally and 72(19.7%) who brushed twice daily. (Table 3)

TABLE 3:-

		Requirement of Restoration Replacement		**Total**	**Chi Square test**	
		Required	**Not Required**		**Chi Square value**	**p-value**
Gender	**Males**	216	888	1104	3.09	0.08(NS)

		19.6%	80.4%	100.0%		
	Females	148	748	896		
		16.5%	83.5%	100.0%		
Age group (in years)	**15-30**	57	217	274	139.23	<0.001*
		20.8%	79.2%	100.0%		
	30-45	122	490	612		
		19.9%	80.1%	100.0%		
	45-60	145	289	434		
		33.4%	66.6%	100.0%		
	Above 60	40	640	680		
		5.9%	94.1%	100.0%		
Frequency of brushing	**Occasionally**	77	192	269	26.25	<0.001*
		28.6%	71.4%	100.0%		
	Once Daily	215	998	1213		
		17.7%	82.3%	100.0%		
	Twice Daily	72	446	518		
		13.9%	86.1%	100.0%		

*p<0.05 Statistically Significant, p>0.05 Non Significant, NS

In the present study, the most significant reason was found to be secondary caries in 45.1% subjects, whereas marginal or bulk fracture in 33.5% subjects and discoloration in 21.4 % subjects. (Table 4, Figure 1)When the type of restorative material was analysed, most replacements were seen in amalgam followed by composite and then glass ionomer cements. (Table 4) The cause of replacement was separately cross-tabulated with the type of restorative material. Secondary caries was found out to be 49.39% in amalgam, 26.21% in composite and 24.39% in Glass Ionomer Cements. Whereas 50.8% amalgam, 18.03 % composite and 31.14% in GIC showed fracture. Discoloration was found out to be present in 56.4% in composite and 43.59% in Glass ionomers. (Table 5,Figure 2)Therefore, secondary caries and bulk or marginal fracture were seen to be the most frequent reasons for amalgam replacements whereas discoloration was commonly seen for composites and glass ionomers.

Incidence of replacements was found to be more in Class II (50.8%) whereas Class I showed 18.95%, Class II showed 50.8 %, Class III showed 6.04% ,Class IV showed 10.43% ,Class V showed 13.73 %.(Table 4) and these were separately analysed for amalgam, composite and Glass ionomers. Among Class I, 42.02% had been restored with amalgam, 36.23% with composite and 21.7% with Glass ionomers.(Table 5**)**

When the replacements were analysed with the quadrants most affected, third (34.06%) and fourth (35.16%) quadrants showed more replacements. Whereas first quadrant showed only 6.04 % and Second quadrant 24.7 %.(Table 4**) Moreover,** most replacements were seen in molars (51.09%) where as incisors showed 12.08%,canines 10.43% and premolars 26.4 % failures.(Table 4)

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180 **TABLE 4:-**

		Frequency	Percent
Material Used	Amalgam	143	39.3
	Composite	109	29.9
	Glass Ionomer Cement	112	30.8
Reason	Secondary Caries	164	45.1
	Fractured	122	33.5
	Discolored	78	21.4
Class	I	69	19.0
	II	185	50.8
	III	22	6.0
	IV	38	10.4
	V	50	13.7
Quadrant	First	22	6.0
	Second	90	24.7
	Third	124	34.1
	Fourth	128	35.2
Teeth	Incisor	44	12.1
	Canine	38	10.4
	Premolar	96	26.4
	Molar	186	51.1

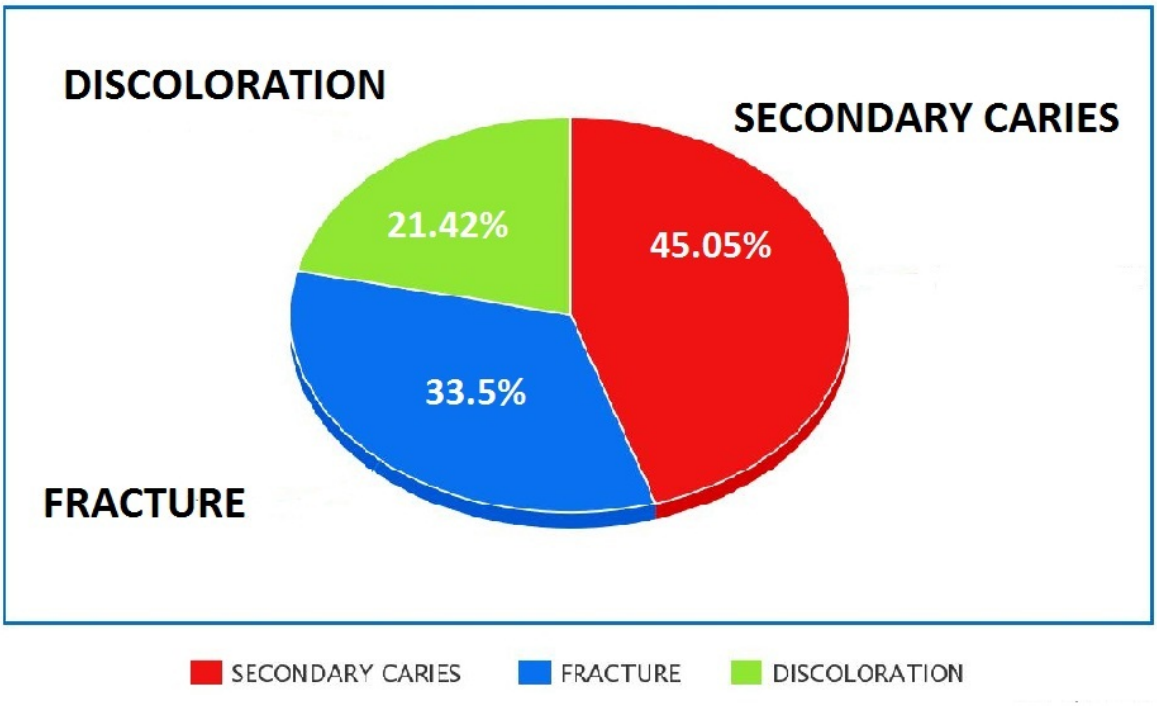

FIGURE 1- Reasons of restoration replacement

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182 **TABLE 5:-**

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		Material Used			Total	Chi Square test	
		Amalgam	**Composite**	**Glass Ionomer**		**Chi Square value**	**p-value**
Reason	Secondary Caries	81	43	40	164	70.16	<0.001*
		56.6%	39.4%	35.7%	45.1%		
	Fractured	62	22	38	122		
		43.4%	20.2%	33.9%	33.5%		
	Discolored	0	44	34	78		
		0.0%	40.4%	30.4%	21.4		
					%		
Class	I	29	25	15	69	184.45	<0.001*
		20.3%	22.9%	13.4%	19.0%		
	II	112	60	13	185		
		78.3%	55.0%	11.6%	50.8%		
	III	0	0	22	22		

		0.0%	0.0%	19.6%	6.0%		
	IV	0	12	26	38		
		0.0%	11.0%	23.2%	10.4%		
	V	2	12	36	50		
		1.4%	11.0%	32.1%	13.7%		

*p<0.05 Statistically Significant, p>0.05 Non Significant, NS

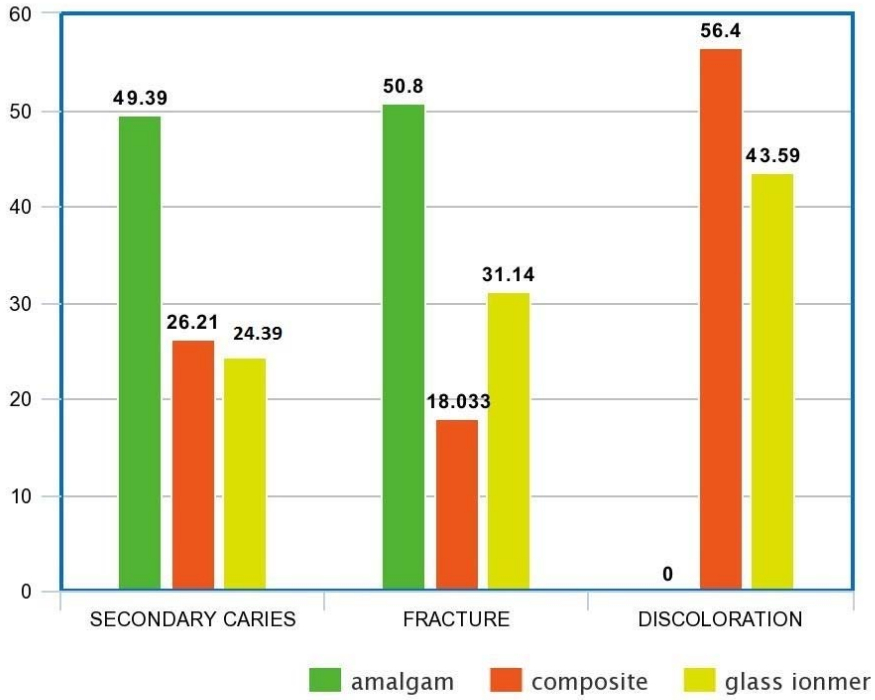

FIGURE 2- Reason with the type of restorative material used

4. DISCUSSION:

There are numerous factors which determine the success of dental restorations which include size and design of restoration, type and orientation of the tooth in the dental arch, the form of restorative material used, the level of experience the clinician has and the age and gender of the patient. Most of the studies have been published on the failure of direct restorations but their comparison becomes very complex as they diverge on several aspects like patient number, follow-up years, number of dentists involved in the same case and their degree of expertise, type and size of restorations and the type of statistical methods used.[39]

The aim of our study was to evaluate for the incidence of replacements of amalgam, composite and glass ionomer cements in the general population. The incidence of restoration replacement among 2000 patients accounted up to 18.2%. Further, it was confirmed that secondary caries was the most typical reason for restoration replacement. This is supported by some studies conducted by Dahl and Erikson in 1978, Rytomaa in 1984, Erikson in 1986, Mjor IA in 2000 and 2002,

MJ Tyas 2005, Hegde M N, Brijesh .A.J in 2013. In our study, of the total number, 39.28% were restored with amalgam, 29.94% with composite and 30.76% with glass ionomer cements .This shows that among all other materials, amalgam is still being commonly used over the last years. This was quite similar with the results of the study conducted by Hegde M N, Brijesh .A.J in the year 2013. [40]

In our study the number of glass ionomer replacements due to secondary caries was found to be 24.39% which is opposed to a study conducted by Burke and Wilson in 2001 where it came out to be higher(48%)[41] Secondary caries is seemingly not associated to crevices at the tooth/restoration interface but it is typically present in the gingival portion which is governed by numerous factors since the material placement and the accessibility with oral hygiene aids is quite tough specifically in this region.[40] The second prominent reason was found to be material fracture, which is similar to a study conducted by MJ Tyas in 2005 [42]. The proportion of amalgam 50.8%, composite 18.03%, GIC 31.14 % being replaced due to this reason is different to that in a prior study conducted by Mojor in 2000 which revealed amalgam 25% composite 24% and GIC 25%. [43]The results indicate since composite and glass ionomer exhibit a property of brittleness which in turn leads to chipping and marginal failure even in non- stress bearing areas.[44].Conversely, fracture in amalgam restorations is owed mostly to defective cavity preparation and incorrect handling of the material.[45]Discolouration accounted as the third characteristic cause for failure of composite (56.4%) and glass ionomer materials (43.59%) in this study, which is in parallel to a study done by Mojor in 2000. [43]

When the class of restoration was analysed in the present study, the fail rate was found to be more in Class II (50.8%) than on Class I (18.95%) restorations, and the small sized restorations exhibit longer durability than the larger restorations. [39].Moreover, when class II was tabulated with the material type, amalgam comprised of 60.5% of all Class II and composite 32.43 %. These findings are similar to a study conducted by MJ Tyas in 2005 where 51 per cent of total Class II restorations had been restored with amalgam and 41 per cent restored with composite.Also, by our study, amalgam had been used for 42.02% Class I failures and 60.5 % Class II failures whereas 36.23% of Class I and 32.43% of Class II were restored with composite. Moreover glass ionomer alone comprised of 72% of Class V restoration failures.When gender was evaluated with the occurrence of replacements, males were found to have more replaced restorations as compared to females. This may be attributed to the para functional habits more prevalent in males, This is contradictory to a study by Burke in 2001,where no such association was found in between gender and the frequency of replacements. [41]The results of the current study revealed that the incidence of replacements was most common in the middle-aged i.e, 45-60 years. (39.8%)Moreover, we concluded that subjects who brushed once every day showed higher incidence of restoration replacement than those who brushed twice This is supported by a study conducted by Burke and Wilson in 2001[41]. This is because maintenance of good oral hygiene practices plays a substantial role in preventing recurrent caries and hence is able to counter the most common reason for replacements, since secondary caries formed the prime reason for more than half of the replacements [40]

In the present study, most replacements were found to be in the third and the fourth quadrant. Type of tooth was a significant variable. Molar teeth were the most commonly replaced compared to any other teeth .This was similar to a study which was done by G. V Valeria in 2015.[5] A probable justification could be that molar teeth need to take the maximum occlusal forces.Also, according to a study conducted by Rodolpho in 2016, as far as direct composite restorations are concerned, the survival rate on mandibular premolars and maxillary molars is 43% and 37% at 17 years, and for maxillary premolars and mandibular molars is 24% and 13%

at 17 years, respectively. He concluded that the difference between the tooth types is only marked between mandibular premolars and mandibular molars. According to him, this can be justified by the location of mandibular molars where high occlusal forces prevail and the difficulty to achieve optimum isolation in this region leading to lesser durability of resin-based composites in lower molars. [(39)]

CONCLUSION

It may be established that studies analysing the causes for the replacement of restorations showed factual life figures which signifies the requirement to promote further research and impart a more preservative outlook for the routine clinical practice. In the present study, it is concluded that replacements were more common in males especially in the middle aged and subjects with poor oral hygiene practices. Recurrent caries was the principal cause for replacement. And amalgam was more commonly replaced than composite and Glass ionomers. The information obtained from this study can be used for planning of oral treatment and also in the planning of oral health education programmes to counter the highest cause of replacement of restorations.

CONSENT

Informed conents were obtained

ETHICAL APPROVAL:

Permission to conduct the study was sought from the relevant authorities

CONFLICTING INTEREST:

Authors have declared that no competing interests exist

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