Association of Age and Gender of Patients Who Underwent Class I Amalgam Restoration in Maxillary First Molars - A Retrospective Analysis

Research Article

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Abstract

Amalgam is an alloy of silver, copper, tin and zinc combined with mercury. It has been used as restorative material for more than 150 years. It can be used in individuals of all ages in stress bearing areas where esthetics is not a concern. This aim of the study was to derive an association between age, gender of patients who underwent class I amalgam restorations in maxillary first molars in the South Indian population. A total of 83 case sheets of patients who had undergone class I amalgam restoration in maxillary first molar were reviewed and analyzed statistically for association with age and gender. The patients selected for the study were in the age group of 18-65 years of age. Data was tabulated using excel sheets. The association of age and gender in patients choosing class I amalgam restoration as treatment option, was evaluated statistically using SPSS software. The people included in the study were in the age group of 18- 65 years. 56 out of 83 patients (67.4%) were in 18-30 years of age. But there was no significant association between age and the treatment procedure (p value= 0.805). Out of 83 teeth, 48 (57.8%) were male and 35 (42.1%) were female patients. There was no significant association between gender and class I amalgam restoration, p value= 0.532 (p>0.05). Within the limitations of the study, there was no significant association between age, gender with class I amalgam restoration.

Keywords: Amalgam; Amalgam Restoration; Class I Cavity; Dental Amalgam; Maxillary First Molar.

Introduction

Amalgam is an alloy of silver, copper, tin and zinc combined with mercury. Unreacted alloy particles of silver-tin are considered as gamma phase [1]. These particles combine with mercury and form a matrix consisting of gamma $1(Ag_2Hg_3)$ and gamma 2 (Sn7-8Hg). The gamma-2 phase is the weakest phase of amalgam and gives rise to a porous and weak amalgam matrix. Copper added to gamma 2 phase, replaces tin mercury phase with ($Cu_5 Sn_5$) copper tin phase.

Louis Regnart is known as Father of Amalgam. In 1959, Dr. Wilmer Eames [2] developed a low mercury technique to alloy mixing ratio that dropped from 8:5 to 1:1 . Modern amalgams use proportioned alloy consisting of 42% to 45% mercury by weight as well as calcium fluoride compositions [3].

In 1943, the American Society of Dental Surgeon (ASDA) declared amalgam to be malpractice due to mercury poisoning which was the beginning of amalgam war [4]. In 1958, American Dental Association (ADA) did not forbid amalgam usage [5]. In 1991, National Institute of Health-National Institute for Dental Research (NIH-NIDR) and FDA concluded that amalgam did not cause any significant health hazard [6].

Due to its metallic color, most clinicians and patients preferred tooth colored filling materials. Nevertheless, amalgam has numerous advantages over composites such as low cost, ease of application, strength, durability and bacteriostatic effects [7].

Tooth colored restorations with superior properties have greatly reduced the usage of amalgam as posterior restorative material.

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Nevertheless, the strength, longevity, ease of application in difficult isolation areas, still supports the usage of amalgam in dentistry. This aim of this study was to derive an association between Age, Gender of patients who underwent Class I Amalgam restorations in Maxillary first molars in the South Indian population.

Materials And Methods

This comparative Retrospective analytical study was conducted at Saveetha Dental College in 2020. Case sheets from 1st June 2018 to 31st March 2019 were reviewed and analyzed. A total of 86,000 patient case sheets were screened and 83 case sheets of patients undergoing class I amalgam restoration for maxillary first molars were reviewed, evaluated and analyzed. The case sheets were cross-verified by another examiner to avoid missing any data. The age, gender, tooth number were checked by data evaluation and photographs. The patients included in the study were in the age group of 18-65 years. Both right and left maxillary molars with class I amalgam restorations were included in the study.

Sampling bias was minimized by verifying photographs of patients and restoration. Incomplete data was verified from concerned patient case sheets/department. Gross incomplete date case sheets were excluded as it affects the study. The data were tabulated in Excel sheets.

Statistical Analysis

Statistical analysis was done using SPSS software. The independent variables assigned as age and gender and dependent variable were maxillary right and left first molars treated with class I amalgam restoration. The statistical test that was used to check significance of association was the Chi square test. The type of analysis performed was associative and descriptive using SPSS software (SPSS) version 21.0, SPSS, Chicago, IL, USA). p value less than 0.05 would be considered as a significant value statistically.

Results and Discussion

The people included in the study were in the age group of 18- 65 years. 56 out of 83 patients (67.4%) were in 18-30 years of age, 14 patients (16.8%) were in the age group of 31-40 years, 10 patients (12%) were in the age group of 41-50 years. (Table 1)(Fig 1). But there was no significant association between age and the treatment procedure, p value= .805 (p>0.05) (Table 2). Out of 83 teeth, 48 (57.8%) were male and 35 (42.1%) were female patients (Table 3)(Fig 2). There was no statistically significant difference between gender and class I amalgam restoration (Table 4). The frequency of maxillary right and left maxillary first molars treated with class I amalgam restoration was analyzed (Fig 3)

The low copper amalgams (before 1963) had a limited life span

Table 1. Distribution of Class I amalgam restoration in maxillary first molar among the different age groups. Out of 83 patients, 56 patients(67.4%) were in the age group of 18-30 years, 14 patients(16.8%) were in the age group of 31-40 years, 10 patients(12%) were in the age group of 41-50 years and 3 patients(3.6%) were above 50 years of age.

Age	Maxillary right first molar	Maxillary left first molar	Frequency	Percentage
18-30 years	29	27	56	67.40%
31- 40 years	9	5	14	16.80%
41- 50 years	6	4	10	12%
>50 years	2	1	3	3.60%
Total	46	37	83	100%

Table 2. Shows association between age and class I Amalgam restoration. Shows the results of Chi square test indicating association between Age and Class I Amalgam restoration. According to Chi square test, p value = 0.805. (p>0.05) - statistically not significant.

	Value	df	Asymptomatic Significance (2- sided)
Pearson Chi- square	0.983	3	0.805
Likelihood ratio	0.995	3	0.802
Linear- by- linear Association	0.684	1	0.408
No of valid cases	83		

Table 3. Distribution of Class I Amalgam restoration in Maxillary first molar amongst Gender. Out of 83 patients, 48 patients (57.8%) with class I Amalgam restoration in maxillary first molars were male and 35 patients(42.1%) were female.

Gender	Maxillary right first molar	Maxillary left first molar	Frequency	percentage
Male	28	20	48	57.80%
Female	18	17	35	42.10%
Total	46	37	83	100%

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Table 4. Association between Gender and Class I amalgam restoration in maxillary first molar. Table 4 shows the results of Chi square test indicating the association between Gender and Class I Amalgam restoration. According to Chi square test, p value= 0.532 (p>0.05) - statistically not significant.

	Value	df	Asymptomatic Significance (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi- square	0.391	1	0.532		
Continuity correction	0.161	1	0.688		
Likelihood ratio	0.39	1	0.532		
Fisher's exact test				0.655	0.344
Linear- by- linear Association	0.386	1	0.534		
N of Valid cases	83				

Figure 1. Association between age and class I amalgam restoration. Shows the Bar chart indicating the association between age of patient and class I amalgam restoration. X axis represents the age of patient and Y axis represents the number of class I amalgam restoration done in maxillary first molar. Maxillary right 1st molar (Blue) and Maxillary left 1st molar (Red).The patients in the age group of 18-30 years frequently underwent class I Amalgam restoration in maxillary first molar. According to Chi square test, p value= .805, showed no statistically significant difference (p >0.05). There was no association between age and class I Amalgam restoration in maxillary first molar.
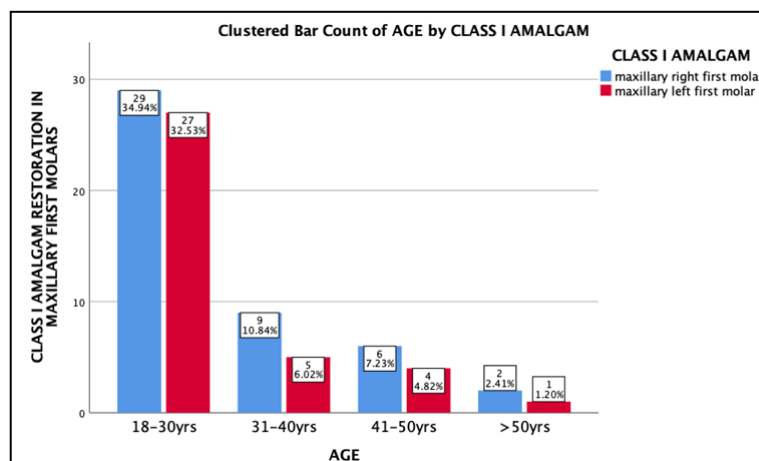

Figure 2. Bar chart indicating the association between Gender of patient and class I amalgam restoration. X axis represents the gender of the patient, Y axis represents the number of class I amalgam restoration done in the maxillary first molar.Maxillary right 1st molar (Blue) were more common in male patients when compared to Maxillary left 1st molar (Red).According to Chi square test, p value = 0.532, showed no statistically significant difference (p >0.05). There was no association between Gender and class I Amalgam restoration in maxillary molar.
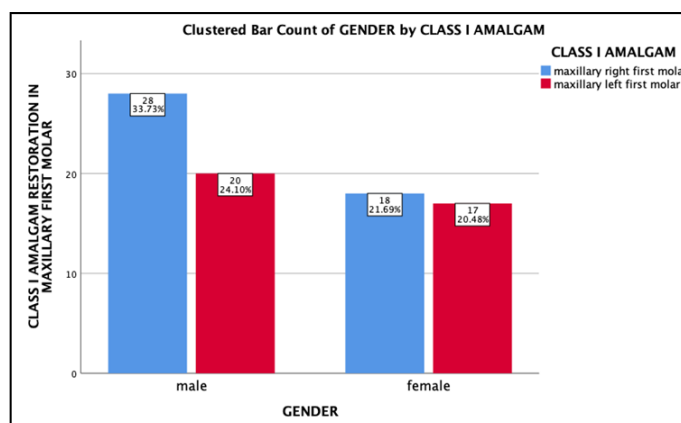

due to gamma-2 phase, which resulted in corrosion thus weakening the restoration. But the high copper amalgam has studies proving satisfactory performance for over 12 years [8, 9] Letzel et al investigated survival and modes of failure of amalgam restorations in class I and class II lesions during follow up periods of 30 to 84 months [10]. The fracture pattern most commonly observed in amalgam restorations was bulk fracture (4.6%) followed by tooth fracture (1.9%) and marginal ridge fracture (1.3%). But only 0.8% of amalgam restorations failed [11].

Manhart et al, stated that the principal reason for failure of amalgam were secondary caries, fracture, marginal deficiencies, wear and post-operative sensitivity [12]. Various studies have been done to determine association between amalgam restoration and

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Figure 3. Frequency graph representing the tooth number and class I amalgam restoration in maxillary first molars. X axis represents the tooth number and Y axis represents the number of class I amalgam restorations done in the maxillary first molar. Out of 83 patients, 46 teeth(55.4%) were maxillary right first molar and 37 teeth(44.5%) were maxillary left first molar. The maximum restorative treatment was done for maxillary right first molar followed by left maxillary first molar.
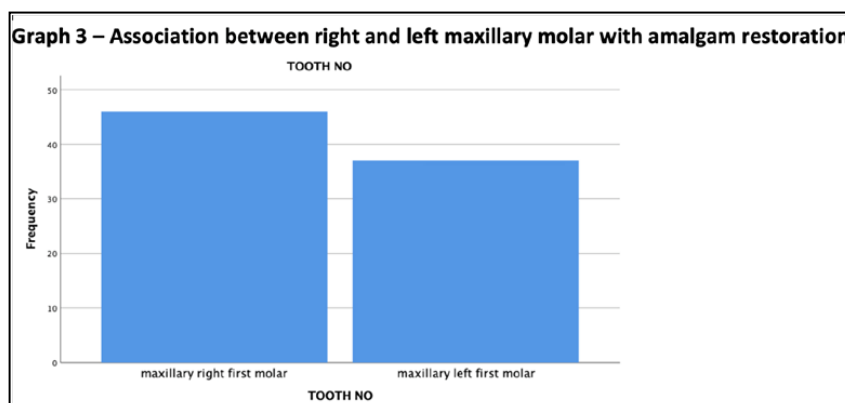
diseases such as Alzheimer's disease [13], Essential tremors [14] and Parkinson's disease [15]. This was the first kind of study to analyze the association between age and gender in patients undergoing class I amalgam restorations in the South Indian population.

Most of the cases in our study were in the age group of 18-30 years. But both gender and age did not have any statistically significant association with class I amalgam restorations. With rising concerns in mercury release from amalgam fillings, there has been confusion among clinicians, whether to still use amalgam as a restorative material. But the strength, durability and survival rates of amalgam restoration are far better than composite or any other tooth coloured filling material, which compels us to still use this restorative material [16, 17].

Plasmans et al evaluated long term survival of large multi-surface restorations and found that extension of extensive amalgam restorations (i.e.) number of cases involved in restoration, had no influence on the survival rate, which is in accordance with retrospective study results of Robbins and Summit, who found a 50% survival rate of 11.5 years [18]. Rathore et al, did an extensive review of the effect of mercury in dental restorations and concluded that there is no evidence of any adverse health effect due to dental amalgam restorations [1].

Composite restorations are highly esthetic but they fail to still totally replace amalgam restorations due to many facts. Hodge et al stated that the overall failure rate of composite restorations in posterior teeth at 8 years was 13.7% and the failure rate was 2 to 3 times that of control high copper amalgam restorations (5.8%). Main modes of failure of composites were bulk fracture and secondary caries which contributed to 72% of failure rate [19]. Arvind Shenoy has done a critical review comparing amalgam and composite restorations [20]. He concluded that high copper amalgams are superior to composites in large restorations and cusp capping. The composite restorations are more technique sensitive but offer a better seal and meet patient's demands for aesthetics [21]. The limitations of the study include a very small sample size and population which cannot be correlated to a larger population.

Incaseof deep amalgam restorations with secondary caries, root canal treatment has to be done. Various irrigants with antimicro-bial and substantivity have been studied for their interactions and effectiveness [22-24]. Irrigant activation is needed for effective disinfection of the root canal system [25]. The infected and inflamed pulp should be completely removed to achieve success in root canal treatment [26, 27]. The root canal treatment for amalgam restored teeth should be taken extra care during cleaning and shaping procedures. Care should be taken to maintain remaining dentin thickness as much as possible [28, 29], . Also incase of deep amalgam restorations, the base or the restoration itself, might act as a mild irritant, thus causing the canals to calcify eventually, thereby further making the root canal treatment difficult [30].

Due to traumatic injuries, the tooth may be fractured [31], luxated or avulsed [32]. The prognosis of teeth depends on nature, time and impact of the injury. The traumatized tooth is never a good candidate for amalgam restoration which has a high compressive strength. The treatment plan should always follow reliable pulp vitality tests taken at regular recall appointments [33]. With advancing caries detection methods and minimal intervention techniques [34] the caries can be diagnosed and treated at the earliest. White spot lesions can be treated by remineralizing agents and bioactive agents that restore the calcium phosphate balance, thus favoring the remineralization phase [35, 36].

The limitations of the study is the small sample size which cannot be generalized to a large population. Further studies can be done with large retrospective data collection and analysis to understand the extent of usage of amalgam in dentistry and its significant association with age and gender.

Conclusion

Within the limitations of the study, there was no significant association between age, gender and tooth number in relation to class I amalgam restorations in maxillary first molars. Although the amalgam restorations are unaesthetic and have concerns regarding mercury toxicity, it is still being used as a restorative material due to its strength, longevity and simplicity of procedure.

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