



## Assessment of Influence of Polishing on The Quality of Class 1 Amalgam Restoration - A Retrospective Analysis

Jerry Jose<sup>1</sup>, Raghu Sandhya<sup>2\*</sup>, Surendar Sugumaran<sup>3</sup>

<sup>1</sup>Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, Saveetha University, Chennai 600077, India

<sup>2</sup>Reader, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, Saveetha University, Chennai 600077, India.

Email: [sandhya.sdc@saveetha.com](mailto:sandhya.sdc@saveetha.com)

<sup>3</sup>Senior Lecturer, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, Saveetha University, Chennai 600077, India

### ABSTRACT

The advent of various restorative materials in dental practice has given the operator dilemma on which material to be used for various case scenarios. Out of the different restorations materials, amalgam and composites have shown increased usage with amalgam being used almost 150 years. Polishability after restorations play a crucial role in its long-term success and shows better adaptation of the prepared tooth structure. The aim of this study was to assess the influence of polishing on the quality of Class 1 amalgam restoration by a retrospective analysis in an institutional setup. The assessment was done by a retrospective evaluation using electronic dental records from the time period June 2019 to April 2020. Grading of these restorations were carried out by using FDI criteria for direct restorations in which class 1 pre-polish amalgam restoration and post-polish amalgam restoration was assessed pictorially by 2 reviewers. The assessment showed statistically significant differences between preoperative/postoperative surface luster quality ( $p=0.000$ ), preoperative/postoperative surface marginal staining ( $p=0.000$ ), preoperative/postoperative anatomical form quality ( $p=0.002$ ), preoperative/postoperative material retention and fracture assistance ( $p=0.006$ ). The marginal adaptation quality was not altered by polishing ( $p=0.617$ ). From the overall parameters assessed, quality of the restoration post polishing was seen considerably better when compared to pre polished amalgam restoration. Polishing of amalgam restoration is deemed necessity, providing better strength and prognosis for the restoration

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### KEYWORDS

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\* **Contact:** Raghu Sandhya, Reader, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, Saveetha University, Chennai 600077, India, Ph.no: +91 9884610410 sandhya.sdc@saveetha.com

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## INTRODUCTION

Dental amalgam is one of the oldest used dental restorative materials in dental practice being around 150 year old history, which has brought many controversies during this time frame[1]. The use of dental amalgam accounts for 75% of all restorative materials used in the practice, with the combination of reliable long-term performance in load bearing areas and its economic factor is unmatched by any other dental restorative materials[2].

The usage of dental amalgam was seen to be initiated as far as 659AD by the Chinese Su Kong[3]. Following this revelation various modifications were made, later Li Shihchen in 1578 devised a dental mixture consisting of 100 parts of mercury with 45 parts of silver and 900 parts of tin[4]. The introduction of dental amalgam to the United States was in 1833 by the Crawcour brothers by the introduction of French silver coins and mercury. These amalgams also led to various disputes which led to "Amalgam wars" and finally the formation of American Society of Dental Surgeons in 1845[5] during which they considered Amalgam usage to be a malpractice. The findings of J foster flagg in 1877, led to dissolution of this belief who showed the long-standing effects and laboratory results proving no adverse effects seen on usage. It was GV blacks findings in 1895, 1896, 1908 which paved the way for the principles of cavity design and the development of alloy composition consisting of 68.5% silver, 25.5% tin, 5% gold, 1% zinc which paved the way for modern dentistry[6]. S. S white manufactured the first commercial dental amalgam consisting of alloy in which gold was replaced by copper[7].

Though dental amalgam is a suitable direct filling material for various cavities, it is in its demise and composite restorations is expected to replace it gradually due to its various advancements [8]. It is seen by various studies and clinical trials that amalgam has shown to be superior to composite resin restorations [9,10] and one of the basic training provided in many institutions other than the various other dental procedures done in an institutional setup [11-13]. As much as performing the amalgam restoration it is equally important to polish these surfaces which many operators fail to do this, the major reason being it is time consuming and excessive heat generation is seen. [14]

One of the major advantage seen post amalgam polishing is the fact that it removes all surface irregularities of the restoration inturn preventing any tarnish to take place in the long run as well as removal of excessive removal of restorative material from all the cavosurface margins. This provides the restoration a self cleansable area preventing plaque accumulation to occur [15]. This

should be emphasized very clearly in educational institutions. The aim of the current study was to assess the influence of polishing on the quality of class 1 amalgam restorations by a retrospective analysis in an institutional setup.

## MATERIAL AND METHODS

A retrospective observational study was carried out from the time frame June 2019 to April 2020 using electronic dental records of an Institution at Chennai, India. Ethical clearance was obtained from "Saveetha Institute Human Ethical Committee" with an ethical clearance number of SDC/SIHEC/2020/DIASDATA/0619-0320. The preoperative/postoperative amalgam polishing quality was assessed using pictorial data which was manually evaluated. The study samples were selected based on the following criteria:-

### Inclusion criteria

- Patient aged 17 to 80 years
- Permanent posterior teeth having completed Class 1 Amalgam restoration only

### Exclusion criteria

- Data which was missing in either variable (pre-polishing/post polishing picture of the same tooth)
- Anterior class 1 Amalgam restoration

Initially, 98 teeth samples were taken into consideration based on the Inclusion/Exclusion criteria assessment the sample size was finalised to 55.

The criteria used for assessment of amalgam restoration was using Fédération Dentaire Internationale (FDI) Criteria for Dental Restorations [16]. The criteria was used based on the preoperative and postoperative polishing quality. The parameters used for assessment were as follows :-

- Surface lustre quality
- Surface marginal staining quality
- Anatomical form quality
- Fracture of material and retention
- Marginal adaptation quality

Each parameter was assessed by the 2 calibrated examiners and scoring was done based on the criteria. The scoring consists of (1-5). In case of disagreement by the examiners the third reviewers was asked to grade the criteria.

The statistical analysis was carried out using SPSS Version 21.0 (IBM Corp, USA). Demographic data such as patient age, gender, tooth number was tabulated based on descriptive analysis. Mean, median and standard deviation was assessed with 25,50, 75 percentiles. Normality test was done using Skewness and Kurtosis test; (z value-2.15, z > 1.96). Correlation analysis was done for the nonparametric data using Wilcoxon Signed Rank Test between pre polishing amalgam and post

polishing assessment. A p-value of  $<0.05$  was considered to be statistically significant

## RESULTS

The study population consisted of 55% of female (n=30) and 45% of male (n=25). The teeth assessed were maxillary premolars (15%), maxillary molars (24%), mandibular premolars (3%), mandibular molars (58%) (Figure 1, Figure 2). Considering the surface luster and marginal staining, in the present study it was seen that the quality of restoration overall increased significantly based on the parameters assessed. It was observed that there was a significant difference in the quality of the restoration post polishing (p=0.000) (Figure 3, Figure 4).

The anatomical form was seen to be significantly improved by assessing pre polishing/post polishing amalgam (p=0.002) (Figure 5). Fracture of material and restorations as well was significantly improved (p=0.006) (Figure 6) but the marginal adaptation quality was not improved which showed (p=0.617) statistical insignificance (Figure 7).

## DISCUSSION

Retrospective studies have the ability to show intervention data and baseline state which is paramount for providing crucial information for identifying outcomes[17]. From the studies done in the institutional practice, it was observed that most studies emphasis on endodontic treatment procedures Previously we have focused our research on various invitro and invivo studies. [18-37] We have currently shifted our focus to this retrospective analysis. Assessment of the quality of restorations was aimed in this study.

Surface luster of dental restorations plays a significant role in increasing the long term success. Inadequate burnishing as well as use of improper alloy mixture have shown a negative effect on the restoration in the long run. Elderton et al[38] in their study showed the dental amalgam lasted significantly longer if polishing was carried out judiciously. In the present study the quality of restoration improved post polishing.

Surface marginal staining and quality is an important parameter which can assess the involvement of secondary caries. Rudolphy et al [39] had described discolouration around amalgam restoration could be an important indication for secondary caries formation. These staining also can be an important indicator for insufficient caries removal. Another study by Magalheaus et al [40] in their study stated that staining and ditching could be indicators for caries formation. Our analysis revealed that the surface marginal stains were lesser in amalgam restorations post polishing.

Anatomical form of dental restorations plays a crucial role in dissipating occlusal forces as well prevention of fracture of restorative material[41]. They have improved significantly by burnishing these areas. Martin et al [42] in their prospective study showed that teeth which were overcontoured were not prone to fracture of material but also suggested repair of these amalgam restorations is a better treatment choice than complete replacement. The adjuvant use of polishing has shown to correct these problems to a certain extent [43].

Emphasis should be given for polishing dental amalgam restorations in dental institutions which in our study has shown that an overall significant quality improvement was seen. Different methods can be advocated for finishing and polishing such as [44] pumice with rubber cup, polishing with green stone, amalgam finishing bur, pumice and zinc oxide in sequence in rubber cups, polishing with brownie cup and brownie minipoint (Shofu), polishing with prophy jet polishing agent and use of rubber cup with polishing paste.

From the analysis in our study it was seen that most of the students tend to use rubber cups and polishing paste which has shown good results and lesser time for better mastery of their technique by the operator [45]. From the analysis done it was seen that a high copper amalgam was used. Creaven et al [46] in their surface topographic analysis saw that high copper amalgam initially (pre polishing) had shown to be significantly rougher but after polishing of these restorations better surface topography was witnessed with surfaces being equally smooth even if polished after 24 hours. This could have an influence on the results obtained in our study.

This retrospective study was done based on the documentations in the patient record. Clinical chair side assessment would alter the outcome of the analysis. The procedure was performed by different operators, which could influence the standardization. However this institutional based assessment focused on the outcome of polishing. This study would create awareness on the procedure performed and would pave a platform for future prospective studies.

## CONCLUSION

From the present study based on FDI assessment criteria, it can be concluded that the quality of restoration for Class 1 amalgam restorations improved with polishing. Polishing of amalgam is a deemed necessity since it has shown to correct many defects as well as remove fracture of material to a certain extent. It also provides better strength to the restoration giving it better prognosis in the long run.

## AUTHOR CONTRIBUTIONS

Jerry Jose (first author) in this study has contributed to data collection, data analysis and in the preparation of the manuscript. Raghu Sandhya (second author) in this study has contributed to the data analysis and preparation of the manuscript and editing. Surendar Sugumaran (third author) in this study has contributed to the supervision and preparation of the manuscript.

## CONFLICT OF INTEREST

None

## SOURCE OF FUNDING

Self

## ETHICAL CLEARANCE

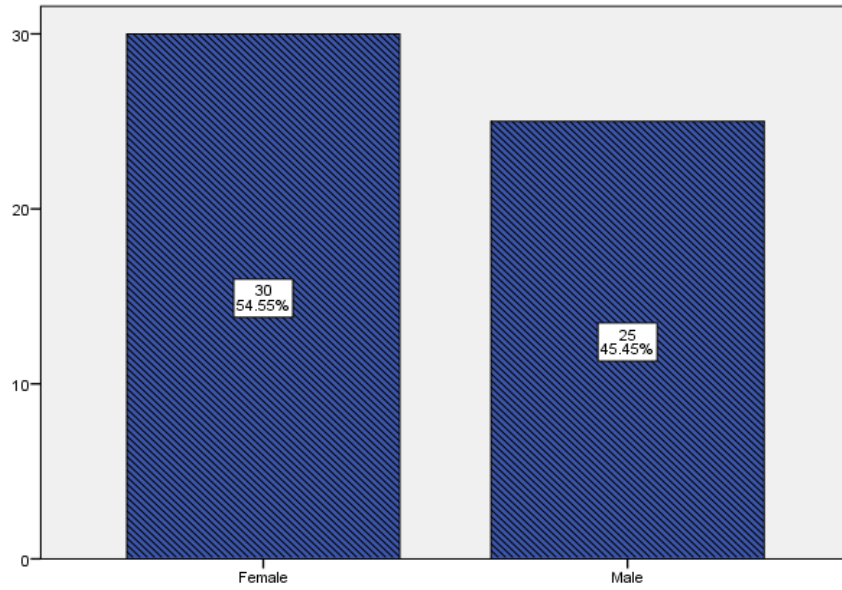
Ethical clearance was obtained from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number-SDC/SIHEC/2020/DIASDATA/0619-0320)

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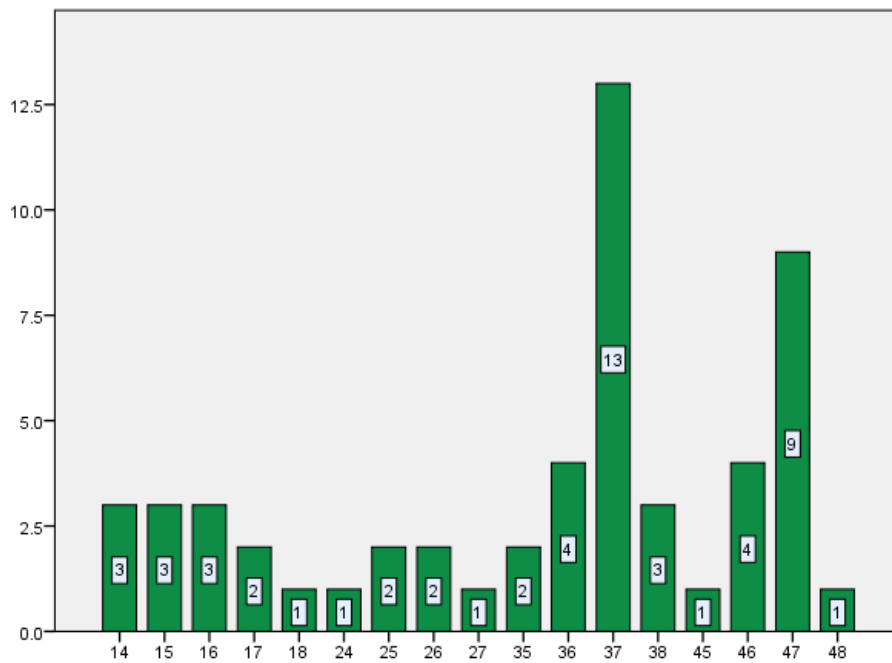
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**Figure 1:** Bar chart denoting the gender distribution of patients included for the assessment of class 1 amalgam restoration. X axis represents the gender; Y axis represents the number of patients. The study population consisted of 54.55% of female (n=30) and 45.45% of male (n=25)



**Figure 2:** Bar chart denoting the distribution of teeth included for the assessment of class 1 amalgam restoration. X axis represents the distribution of teeth; Y axis represents the number of teeth. Among the teeth included, the mandibular second molar had the highest frequency (22).

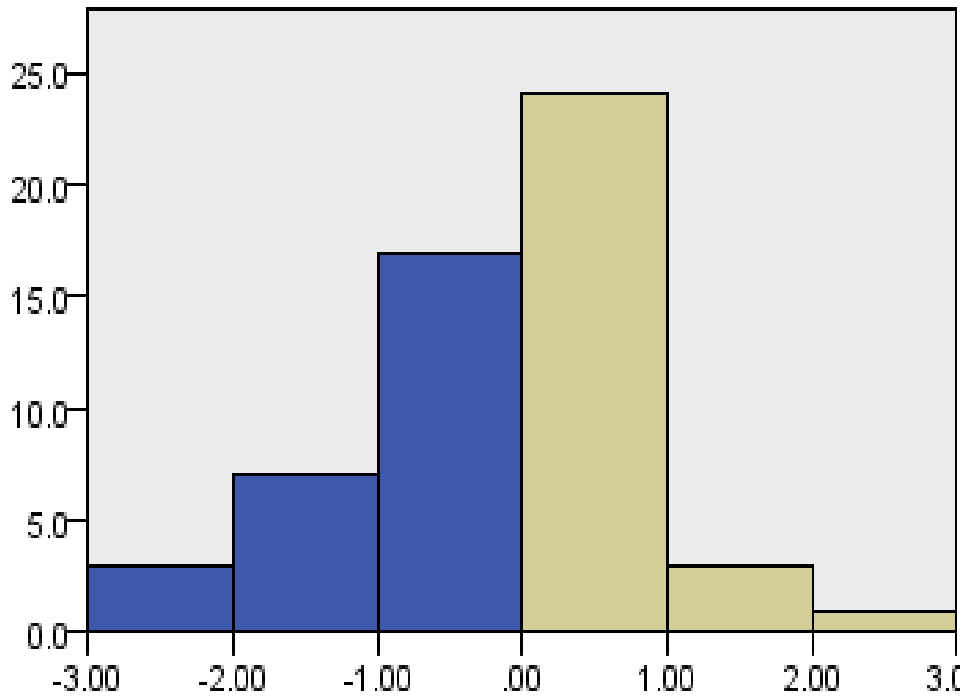


Figure 3: Bar graph showing surface luster of class 1 amalgam restoration pre-polishing (blue) and post polishing (cream) of class 1 amalgam restoration scoring based on FDI criteria for assessment of dental restoration. X axis represents the scores based on FDI criteria; Y axis represents the number of teeth. Wilcoxon Signed Rank Test, P value- 0.00,  $P < 0.05$ , statistically significant. The analysis shows that the quality of surface luster of class 1 amalgam restoration was significantly improved with polishing.

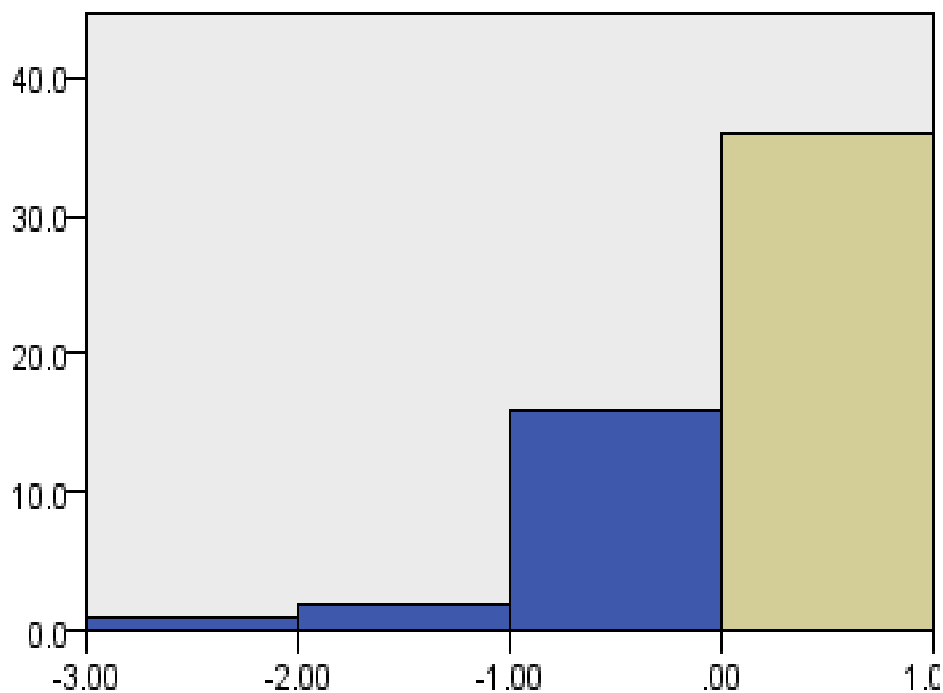


Figure 4: Bar graph showing surface marginal staining of class 1 amalgam restoration pre-polishing (blue) and post polishing (cream) of class 1 amalgam restoration scoring based on FDI criteria for assessment of dental restoration. X axis represents the scores based on FDI criteria; Y axis represents the number of teeth. Wilcoxon Signed Rank Test, P value- 0.00,  $P < 0.05$ , statistically significant. The analysis shows that the quality of surface marginal staining of class 1 amalgam restoration was significantly improved with polishing.



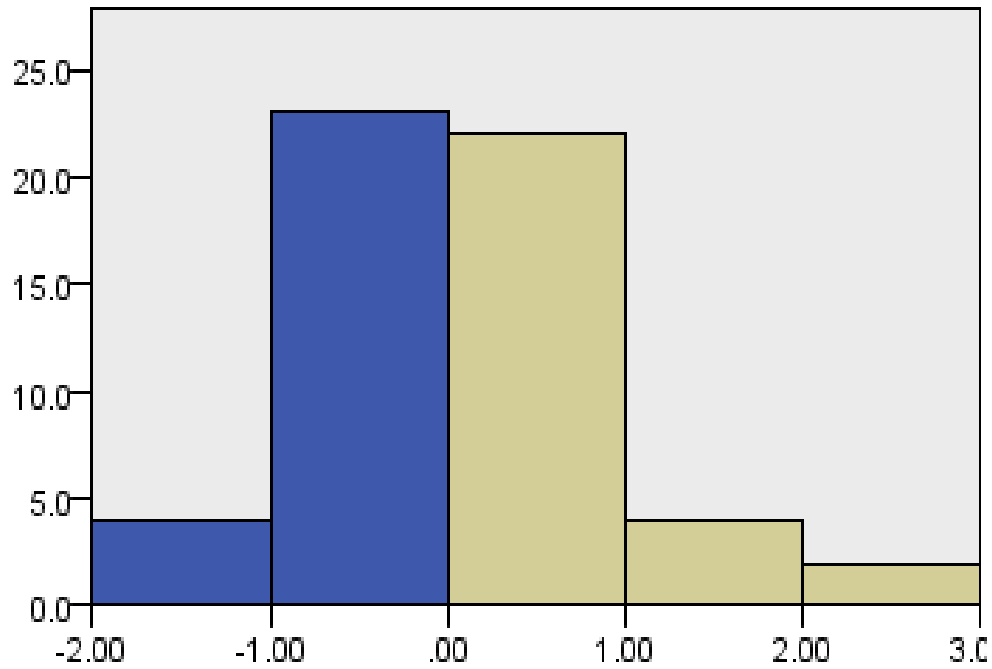


Figure 5: Bar graph showing esthetical anatomical form of class 1 amalgam restoration pre-polishing (blue) and post polishing (cream) of class 1 amalgam restoration scoring based on FDI criteria for assessment of dental restoration. X axis represents the scores based on FDI criteria; Y axis represents the number of teeth. Wilcoxon Signed Rank Test, P value- 0.002,  $P < 0.05$ , statistically significant difference. The analysis shows that the quality of esthetic anatomical form of class 1 amalgam restoration was significantly improved with polishing.

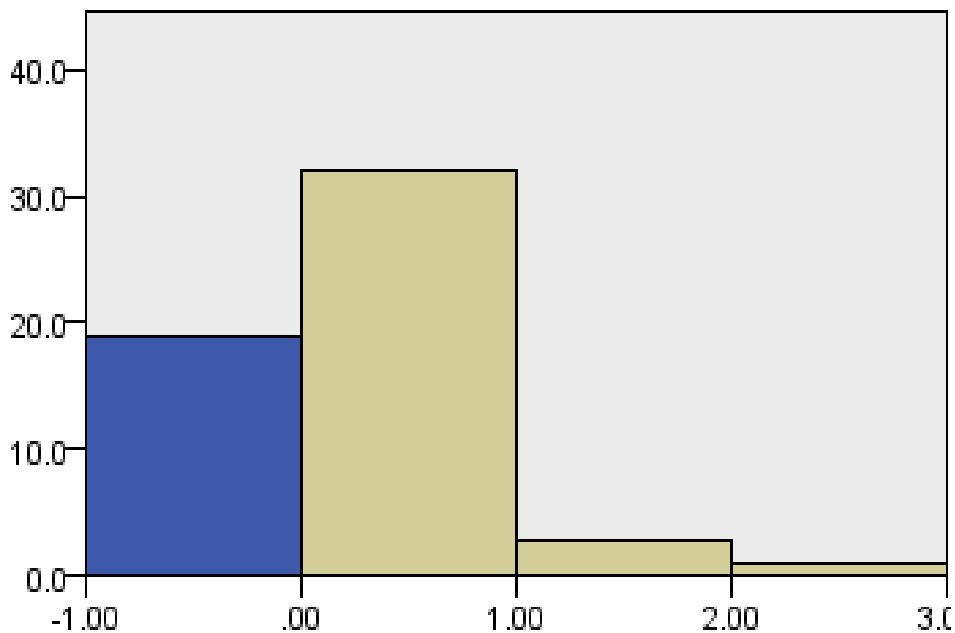
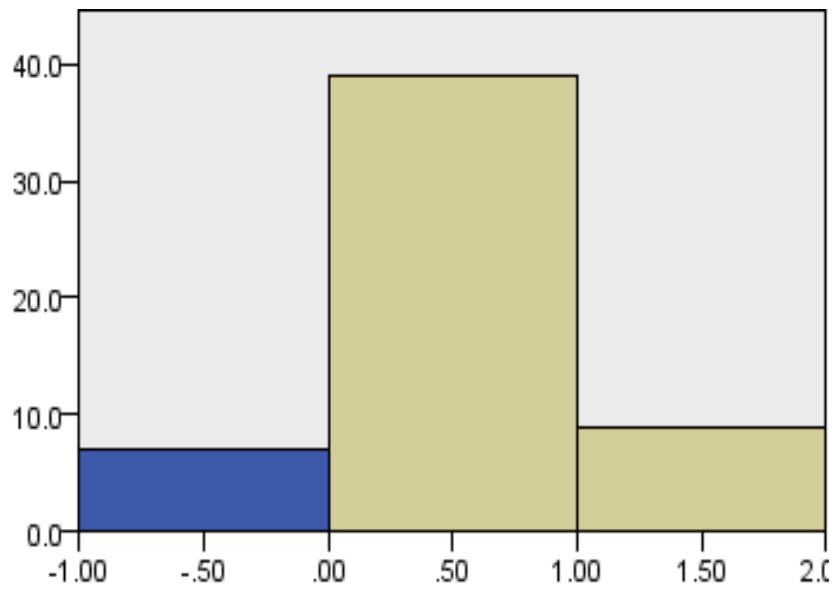


Figure 6: Bar graph showing fracture of material and retention of class 1 amalgam restoration pre-polishing (blue) and post polishing (cream) of class 1 amalgam restoration scoring based on FDI criteria for assessment of dental restoration. X axis represents the scores based on FDI criteria; Y axis represents the number of teeth. Wilcoxon Signed Rank Test, P value- 0.006,  $P < 0.05$ , statistically significant. The analysis shows that the quality of fracture of material and retention of class 1 amalgam restoration was significantly improved with polishing.



**Figure 7: Bar graph showing marginal adaptation of class 1 amalgam restoration pre-polishing (blue) and post polishing (cream) of class 1 amalgam restoration scoring based on FDI criteria for assessment of dental restoration. X axis represents the scores based on FDI criteria; Y axis represents the number of teeth. Wilcoxon Signed Rank Test, P value- 0.617,  $P > 0.05$ , statistically insignificant. The analysis shows that the quality of marginal adaptation of class 1 amalgam restoration did not show difference with polishing.**