

ORIGINAL ARTICLE

Evaluation of Patient's Aesthetic Satisfaction after the Cementation of the Porcelain Fused to Metal CrownLUBNA MEMON¹, ZIAULLAH CHOUDHRY¹, KASHIF ASLAM², SOFIA MALIK³, HOSHANG R SUKHIA⁴, ANWAR ALI⁵, MUHAMMAD ADEEL AHMED⁶, RIZWAN JOUHAR⁶, FAHIM VOHRA⁷, IMTIAZ AHMED⁸¹Prosthodontics Department, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, DUHS, Karachi, Pakistan.²Department of Prosthodontics, Dow Dental College, DUHS, Karachi 74200, Pakistan.³Department of Science of Dental Materials, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, Karachi, Pakistan⁴Department of Orthodontics, Sir Syed College of Medical Sciences, Karachi, Pakistan.⁵Oral and Maxillofacial Department, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, DUHS, Karachi, Pakistan.⁶Department of Restorative Dental Sciences, College of Dentistry, King Faisal University, Al Ahsa 31982, Saudi Arabia.⁷Prosthetic Dental Science Department, College of Dentistry, King Saud University, Riyadh 11451, Saudi Arabia.⁸Department of Orthodontics, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, Karachi, PakistanCorrespondence to Email: mshakeel@kfu.edu.sa; Tel: 00966581674914**ABSTRACT****Aim:** To assess the aesthetic satisfaction with the metal-ceramic dental prosthesis in relation to patient education, age and gender.**Methods:** This prospective longitudinal study was undertaken by selecting 360 adult patients from both genders indicated for single maxillary porcelain fused to metal crowns. These patients were categorized into three groups based on gender, age, and education. Patients were assessed for aesthetic satisfaction for tooth shape; color, angulation, visibility, and shade at the time of insertion and at a follow-up of 12 weeks. At the time of the prosthesis insertion, a self-evaluation questionnaire was provided to each patient to record their satisfaction levels with the prosthesis. Satisfaction levels among the participants were evaluated based on participants' age, gender, and education level (Chi-square). A p-value of 0.05 was considered statistically significant.**Results:** The study enrolled 150(41.67%) males and 210(58.33%) females with the participant age ranging from 19 to 60 years and a mean age of 30.53 (\pm 10.88 years). 84(23.3%) were uneducated participants, 210(58.3%) were high school graduates, and 66(18.3%) were university graduates. A decrease in the level of satisfaction was observed with increasing years of patient education at insertion. The overall aesthetic satisfaction among patients at PFM crown insertion (65%) and at 12 weeks follow-up (69.2%) was statistically comparable ($p > 0.05$).**Practical implication:** Aesthetic is the most important consideration for the replacement of anterior teeth. Numerous studies evaluated the aesthetic satisfaction of the patients after providing full ceramic prosthesis, however, data regarding patient satisfaction after the metal ceramic dental prosthesis scarce in the scientific literature.**Conclusion:** Satisfaction with the esthetic restoration depends on patient education and awareness. Age and education add to a person's experience and increase awareness with respect to better aesthetics.**Keywords:** Aesthetics; patient satisfaction; assessment; patient care, metal ceramic prosthesis**INTRODUCTION**

In modern era, aesthetic is identified as a contributing factor to the social life of the patients in relation to health¹. Max Eastman considered smile as symbol of welcoming gestures². Hence, creating perfect smile correlates with facial appearance and aesthetics. It has been reported that individuals with less dental disease are judged to be more socially competent, show greater intellectual achievement and have better psychological adjustment^{3,4}. Hence, people with dental problems tend to be more socially inactive. The tooth damage is related to multiple reasons such as trauma and wear due to mastication, dietary factors, habits and disease process (caries), leading to negative impacts to patients' quality of life^{5,6}. These tooth defects are addressed in form of restorations (direct or indirect) to restore tooth shape, color, size and position.

Currently, full mouth rehabilitation using metal-ceramic restorations is prevalent as they have excellent physical and optical characteristics derived from metallic and ceramic infrastructure^{7,8}. The metal alloy provides mechanical resistance, while ceramic contributes to aesthetics with fluorescence, opalescence and translucency⁸. Contemporary metal ceramics display excellent ceramic mechanical and esthetic properties with proven long-term durability. Metal ceramic restorations are effective in long span fixed partial dentures and full mouth rehabilitations as tooth and implant supported restorations⁹. Moreover, metal ceramic restorations resist pathologic occlusal forces including, parafunction and bruxism in tooth wear patients with tooth defects of size, shape and shade⁹.

Perception is subjective and varies from person to person. Studies have shown that people have greater opinion than a

dentist assessment, which gives them insight on the different perception^{10,11}. However, social factors play an important role influencing, the results of the assessment which includes age, gender, education and socio-demographic¹¹. Studies have shown that age does not directly correlate with changing perception; however, young adults especially females, present with greater dissatisfaction due to greater sense of psychological elements^{12,13}.

Patients seeking cosmetic dental treatment are often those who consider their appearance satisfactory and believe in enhancing the esthetics for better social impression^{14,15}. Difference in opinion between the dentist and patient is based on the level of knowledge, differences of skills, and understanding between the two¹⁴. Authors have identified a difference in perception of individuals, which is greatly influenced by social factors such as age, gender and education¹⁵. Studies point out that individuals who are more socially competent, show greater intellectual achievement and have better psychological adjustment, whereas adults with visible dental problems are reluctant and hesitate in adjusting to achieve a satisfactory esthetics^{15,16}. Hence, the knowledge and understanding of a patient's perception of dental appearance is an important aspect of patient management in order to plan treatment that is acceptable to the patient and achieving the highest level of patient satisfaction. It is hypothesized patient education plays an important role in smile designing for best aesthetic appeal.

Thus the present study aimed to assess aesthetic satisfaction of metal-ceramic dental prosthesis in relation to patient education.

METHODOLOGY

The study was performed with respect to the ethical consideration under the Declaration of Helenski (2013). Prior to the treatment,

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selected patients were informed regarding the nature and purpose of the study and informed consent was obtained from patients in their language. After acquiring the written consent of the participants, the 360 patients were categorized into three groups based on a set inclusion and exclusion criteria. All patients were clinically and radiographically evaluated. Following the evaluation, treatment plan was designed and prosthesis was fabricated for each one.

Study population: Sample size was calculated using a software (GraphPad, InStat), employing a P (prevalence)=42%, d (precision of estimate)=9% and 95% confidence level. The calculated sample size was 300 participants, however an additional, 60 participants were enrolled to avoid any dropouts or lost patients during follow ups. Therefore, 360 participants were enrolled in the study.

The patient selection was based on patient aesthetic requirement which included individual requiring maxillary anterior teeth replacement due to discoloration, break down, mal-positioning, trauma, diastema, missing or endodontic treatment. However, patients with mental or psychological disorder, previously restored teeth, periodontal problems, pregnant women and children were excluded.

The study was undertaken by selecting 360 adult patients being treated by the operator for a single maxillary crown (porcelain fused to metal). These patients were categorized into three groups based on gender, age and education. The patient was assessed for their aesthetic satisfaction for tooth shape, color, angulation, visibility and shade at two points; at time of insertion and in follow up after 8 weeks.

Study procedure: Prior to preparing the tooth for indirect restoration, an impression was taken with elastomeric impression material (addition silicone, New Dentplus, dental line LTD-G. Deverikos). Impressions were poured with dental stone (ad material details) to prepare cast. Cast were prepared for shell provisionals and provisional crowns were prepared (tempron -GC corporation).

First step was shade selection, which was accurately selected and noted using a porcelain shade guide (vitapan classical). Teeth were prepared for porcelain fused to metal crowns (PFM) with standardized simulated crown preparations using high-speed hand piece (Henry Schein, Melville, NY, USA) and diamond burs (Henry Schein, Melville, NY, USA) with the precise reduction at two gingival and incisal planes. The reduction included, axial surface 1.2-1.5mm and finish margins 0.8-1 mm labial, mesial, distal, whereas 0.5-0.8 mm palatal, with reduction at an angle of approximately 5° with no beveling. In addition, continuous circumferential chamfer with a reduction of at least 0.5 mm at the gingival margin was performed. After overall preparation, the incisal edge was reduced up to 2mm, with a palatal slope.

All preparations were performed by two operators (L.B, ZC). Teeth preparations were guided and standardized using a sectioned putty index (Aquasil Putty, Dentsply-Sirona, York, PA, USA). Prepared teeth were washed and dried, followed by application of retraction cord (size 00, Ultrapak, Ultradent, South Jordan, Utah, USA) retraction cord was inserted for 5 minutes and removed when still moist. Impressions of the prepared teeth were made using a putty/ light single stage impression technique (Aquasil Ultra, Regular, Dentsply-Sirona, York, PA, USA Light-body impression material was placed around the tooth and spread using light air. Subsequently, a tray with putty-body impression material in a custom tray was placed intra-oral. Provisional shell crowns were relined with tempron, adjusted, finished and polished prior to fitting using zinc oxide eugenol temporary cement (Temp Bond, KERR, Orange County, CA, USA).

The model fabricated using the putty impression was sent to the laboratory for fabrication of the PFM crown using the lost wax technique. Initially, a uniform layer of stone was applied to the waxed frameworks up to 1mm from the finish line. The lingual shoulder position 1mm wide and 2mm high with overall with 0.5-

millimeter uniform wax (Renfert). Subsequently, the framework is embedded in an investment material (the Z4 universal investment; Neiryneck & Vogt N.V., Schelle, Belgium), casted with a cobalt-chromium alloy (Wirobond® 280; Bego, Bremen, Germany), polished, and finished. Following the process, the crown is degassed and coated with opaque porcelain to cover up the metal. Different layer of porcelain were added to achieve the desired color outcome. Final finishing was performed with a diamond bur for optimum size, shape and appearance followed by occlusal adjustments and finishing and polishing.

Each patient was recalled once the prosthesis was ready for fitting and adjustment. The final crown was then placed in the oral cavity and checked for any occlusal adjustments. The tooth cementation was processed using a GIC cement. The powder of GIC was missed at ratio of 2:1 followed by completely isolating the tooth and keeping it dried to avoid moisture contamination. The cement was mixed and painted in the crown, crowns were seated with occlusal force and excess cement was removed.

Data collection: At the time of the prosthesis insertion, a self-evaluation questionnaire was provided to each patient to record their satisfaction levels for the prosthesis and at 12 weeks follow-up. The questionnaire consisted of simple, clear questions without any direct or indirect overlap, chosen by a panel of restorative specialist. The questionnaire enquired about satisfaction of patients related to the prosthesis shade, shape, angulation, arrangements and visibility of teeth. Satisfied patients were defined as those, if all 5 factors fulfilled patient need. If even one of the factors were not fulfilling patient's need, the response was considered unsatisfied.

Statistical Analysis: The response from the participants was tabulated and analysed using statistical program for social sciences (SPSS version 23, IBM, NY, USA). Descriptive statistics was performed for demographic and frequency of responses for satisfaction. Satisfaction levels among the participants were evaluated based on participants' age, gender and Education level using Chi square test. A p value of 0.05 was considered statistically significant.

RESULTS

The study performed evaluated the frequency of dental aesthetic satisfaction after providing PFM prosthesis.

General characteristics: The present study enrolled 360 participants, which were categorised based on patients' age, gender and educational level. Considering gender division, the study enrolled 150(41.67%) males and 210(58.33%) female. Furthermore, the participant age ranged from 19 to 60 years with mean age of 30.530 (\pm 10.88 years). The participants were divided into 4 age groups; young adults (19 to 30 years), adult age (31 to 40 years), middle age (41 to 50 years) and old age (above 50 years). The highest patients were identified among young adults (198), followed by middle age (72) patients, adult age (63) and old age (27). Among these age groups high number of female was recorded in young adults (63%) and adult age group (80%), where as higher number of male were recorded among, middle age (54%) and old age group (100%) groups. The gender and age distribution is shown in table 1.

With respect to education, the enrolled 360 patients were distributed into 3 groups, uneducated participants were 84(23.3%), high school graduates were 210(58.3%) and university graduates were 66(18.3%) respectively.

Assessment of Aesthetic Satisfaction: The level of satisfaction was assessed based on five factors: shape, angulation, size, visibility and tooth colour. Outcomes displayed that 65.83% patients were satisfied with the prosthesis at the time of insertion, whereas 34.17% patients felt there was a need of improvement. With respect to gender, the study reported no significant difference among patient's groups ($p > 0.05$). Out of total 360 patients, 210(58.3%) females and 150(41.7%) male patients participated in the study. Among these groups, 144(68%) females and 93(62%)

males were satisfied with outcome of the treatment provided; however, 66(32%) females and 57(38%) males felt the need for further improvement at time of insertion (Table 1).

A decrease was observed in the level of satisfaction with increasing years of patient education. The study showed that, 66(78%) uneducated patients, 45(64%) middle school and 12(54%) graduates were satisfied with aesthetic outcome at the time of insertion. With regards to education, uneducated patients showed significantly higher satisfaction levels compared to graduate patients ($p < 0.05$) (Table 2).

With respect to age, adult age patients showed highest level of satisfaction (85%), which was higher than the young adult satisfaction levels of 57% ($p < 0.05$). Middle age and old age participants showed 70% and 66% satisfaction levels respectively (Table 3).

Table 1: Satisfaction assessment at insertion with respect to gender categorisation

Gender	Aesthetic		Total
	Satisfied	Unsatisfied	
Male	93(62%) ^a	57(38%)	150(41.7%)
Female	144(68%) ^a	66(32%)	210(58.3%)
Total	237 (65%)	123(34.1%)	360(100%)

P value 0.454

Values with similar superscript alphabets show comparable outcomes ($p > 0.05$).

Table 2: Satisfaction assessment at insertion with respect to education

Groups Level of education	Assessment		Total
	Satisfied	Unsatisfied	
Uneducated	198(78%) ^a	9(21%)	84(23.3%)
Primary to Secondary	135(64%) ^{ab}	75(35%)	210(58.3%)
Graduate to Onwards	36(54%) ^b	30(45.4%)	66(18.3%)
Total	237(65%)	123(34.1%)	360(100%)

Groups with dissimilar superscript alphabets showed significantly different outcomes ($p < 0.05$)

Table 3: Satisfaction assessment at insertion with respect to age categorization

Group Age (years)	Assessment		Total
	Satisfied	Unsatisfied	
19-30	114(57%) ^a	84(42%)	198(55%)
31-40	54(85%) ^b	9(14%)	63(17%)
41-50	51(70%) ^{ab}	21(29%)	72(21%)
51-60	18(66%) ^a	9(33%)	27(7%)
Total	237(65%)	123(34%)	360(100%)

Groups with dissimilar superscript alphabets showed significantly different outcomes ($p < 0.05$)

For aesthetic satisfaction levels at 12 weeks follow-up, with respect to gender, no significant difference was observed ($p > 0.05$). Comparing the genders, 147(70%) female and 102(68%) male patients were found to be completely satisfied whereas 63(30%) females and 48(32%) males male patients felt need for improvement (Table 4)

Table 4: Satisfaction assessment at 12-week follow up with respect to gender

Gender	Aesthetic		Total
	Satisfied	Unsatisfied	
Male	102(68%) ^a	48(32%)	150(41.6%)
Female	147(70%) ^a	63(30%)	210(58.3%)
Total	249(69.2 %)	111(30.8%)	(100%)360

P value 0.815

Values with similar superscript alphabets show comparable outcomes ($p > 0.05$).

With respect to education, no significant difference was observed among the study groups ($p > 0.05$). At 12-week follow-up, a greater level of satisfaction was observed among uneducated people compared to secondary and graduate educated patients. 66(78%) of uneducated participants were satisfied with the outcome of PFM

crowns compared to 135(64%) high school graduates and 48(72.7%) degree graduates (Table 5).

Table 5: Satisfaction assessment at 12-week follow up with respect to education

Education	Assessment		Total
	Satisfied	Unsatisfied	
Uneducated	66 (78%) ^a	9(21%)	84(23%)
Primary to Secondary	135 (64%) ^a	75(35%)	210(83%)
Graduate to Onwards	48 (72.7%) ^a	9(27%)	66(18%)
Total	249(69.2 %)	111(30.8%)	360(100%)

Values with similar superscript alphabets show comparable outcomes ($p > 0.05$).

With respect to age, adult age patients showed highest satisfaction levels of 80%, which was significantly higher compared to old age patients (55%) ($p < 0.05$). Young adults, middle aged and adult patients showed comparable aesthetic satisfaction levels ($p > 0.05$).

Table 6: Satisfaction assessment at 12-week follow up with respect to age

Age (years)	Aesthetic		Total
	Satisfied	Unsatisfied	
19-30	132(66%)	66(33%)	198(55%)
31-40	48(80%) [§]	12(20%)	60(16.6%)
41-50	54(72%)	21(28%)	75(20%)
51-60	15(55%) [§]	12(44%)	27(75%)
Total	249(69.2 %)	111(30.8%)	360(100%)

§, satisfaction levels are significantly different ($p < 0.05$).

The overall aesthetic satisfaction among patients at PFM crown insertion (65%) and at 12 weeks follow-up (69.2%) was statistically comparable ($p > 0.05$).

DISCUSSION

The present study assessed aesthetic satisfaction of metal-ceramic dental prosthesis in relation to patient education, age and gender. The concept of dental appearance and aesthetics is a subjective perception whose importance has rapidly changed over past few decades. In modern era, for aesthetic treatments, restorative procedures, and prosthetic therapy, patient's subjective evaluation and satisfaction with respect to dental appearance and aesthetics is critical. The outcome revealed no significant difference in aesthetic satisfaction at insertion and at 12 week follow-up. However, the data indicated that increase in age and education level (at insertion) increased the aesthetic dissatisfaction of the patient. Hence, this indicates higher education creates greater aesthetic awareness and improves aesthetic choice. A plethora of explanations can be reasoned for the outcomes observed in patient satisfaction for metal-ceramic dental prosthesis.

Multiple factors play an important role in subjective evaluation of dental appearance as it is associated with varying degrees of sensitivity to certain esthetic issues. The study outcome supported the ideology that perception is subjective and varies person to person; however, the age did not show a great influence on the outcome. Nevertheless, a pattern was observed among the study participants, which showed aging increases satisfaction level to a certain point. Furthermore, it was observed after age 40, aesthetic satisfaction decreased. Studies have shown cognitive aging is a possible explanation for change in level of satisfaction^{17,18}. Hence, with age mental functions become less nimble and flexible along with memory, which influences the aesthetic choices and satisfaction. According to Ahlholm et al, Young people show greater interest in whiter teeth and beautiful smile compared to old age¹⁹. Similar findings were presented by Alkhatib et al, they showed age had an impact on dissatisfaction with dental aesthetics; however, the level of acceptability of aesthetic changes in elderly is significantly higher than in younger patients for tooth colored restoration¹⁸. The reason being, the clear perception of choice which influences the satisfaction level of the person¹⁸. However, the present study outcomes did not coincide with the other study findings because of the difference in restoration type.

In the present study, the outcomes showed that with higher education the aesthetic satisfaction levels decline. This indicates that the higher education increases awareness for a person and desire for better esthetic restorations. Studies have shown greater acceptability for anterior zirconia crown among the higher educated people¹⁹⁻²¹. Hence, these findings indicate that higher self-satisfaction for dental aesthetics are observed in participants with higher academic titles. On the other hand, the study of Tin-Oo et al²⁰ revealed that satisfaction with tooth shade or general dental aesthetic was not related with educational level of the participants instead quality of tooth restoration. As all ceramic crowns are esthetically superior to PFM crowns, it has been identified that people with higher education may have better understanding of esthetics and restorations.

Furthermore, gender plays an important role in aesthetic perception among dental patients²². The present study showed higher number of females with satisfaction level compared to the males. These two genders are distinct biologically and socially, hence, differ in their ability to extract ensemble aesthetic characteristics. Studies have shown woman have shown greater interest in esthetic appearance compared to the males^{22, 23}. Hence, this agrees well that unaesthetic appeal affects women's self-esteem more than men's. In addition, the desire for better teeth restoration is also higher among women (57.3%) compared to men (42.7%)²⁴. However, the outcome signifies that esthetic sense of the women is greater, and therefore they showed greater dissatisfaction for PFM restoration. This can be explained by the fact that male and female use different hemisphere of parietal region, which allows them to develop beauty sense²⁵. For women they use both hemispheres, whereas men use only right, which instills greater sense of precision within them. Hence, spatial relations appear to be a key feature of beauty appreciation²⁵.

Shade selection is a critical aspect in aesthetic process for patient satisfaction. It is based on three characteristics, value, chroma, and hue. Shade selection has to be done in a systematic protocol which follows as, Operating site lighting (shade selection day light), environment (no bright surrounding environment), tooth condition (no stains and deposits) and using a Vita Classical Shade Guide based on the hue²⁶. Studies have shown that incorrect technique used in matching the shade greatly impacts the final restoration outcome^{27,28}. Great emphasis has been placed on the environment of the shade selection, which leads to alteration of shade if not taken properly in daylight. Hence, leading to greater dissatisfaction for public appearance^{29,30}. The present study showed no significant difference among the study groups and aesthetic satisfaction levels were high, as satisfactory shade matching standard technique was employed. However, the impact on the outcome perceived can be affected by the high value of the restoration.

Within the experimental limitations, the study showed nearly 70% aesthetic satisfaction of PFM crowns, with comparable outcomes at insertion and follow-up. It has been observed that Oral conditions and oral hygiene maintenance influences color stability of restoration, which was not assessed at 12 week follow-up. Maintenance of good oral hygiene is an important factor to avoid periodontal problems along with esthetic maintenance. In addition, all ceramic crowns are considered the gold standard for anterior esthetics. Therefore, future studies to assess comparative aesthetic satisfaction of PFM and all ceramic crowns with periodontal health are warranted.

CONCLUSION

Porcelain fused to metal crown patients showed up to 69% aesthetic satisfaction, with comparable aesthetic satisfaction at insertion and 12 weeks follow-up. Less years of education showed increased aesthetic satisfaction at PFM crown insertion. Adult age patients showed higher aesthetic satisfaction levels at insertion and follow up. Satisfaction of the esthetic restoration depends on patient education, and awareness. Age and education adds to a

person experience and increase the awareness with respect to better aesthetic.

Ethical Consideration: The study was performed in the Sir Syed College of Medical Sciences for Girls after taking approval from the ethical review board with reference number (SSCMS/college/principal (dental)/2021/080).

Conflicts of Interest: The author declares no conflict of interest.

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