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Patient satisfaction of vita enamic versus lithium disilicate hybrid abutment crowns in implants placed in the anterior zone

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Abstract---Aim: This study was performed to evaluate the use of vita enamic versus lithium disilicate hybrid abutment crowns on the patient satisfaction. emax was found to be a stiff material when used with implants. This causes a remarkable stress concentration in the crestal bone that is a primary factor in bone loss resulting in failed esthetic restoration in the anterior esthetic zone. with subsequent patient dissatisfaction. Methodology: forty two patients who needed a single implant restoration in the esthetic zone were included in this study. 42 patients completed screening, twelve-month follow-up visits. At the screening visit, the patients were randomly allocated into two groups: vita enamic hybrid abutments (A) Group, and lithium disilicate hybrid abutments (B) Group. Patients Satisfaction was assessed by visual analogue scale (VAS). Results: All implants were successfully osseointegrated with a 100% survival rate over one year. Patient satisfaction for vita enamic is comparable to lithium disilicate. Conclusions: Both Lithium Disilicate and Vita Enamic hybrid abutment crowns reported high scores of patient satisfaction throughout the follow up period.

Keywords---patient satisfaction, hybrid abutment crowns, implants.

Introduction

Implant placement might be the ideal choice to replace a single missing tooth, due to its high survival rate. Success of this treatment modality is not only related to successful osseointegration, but also to the respective supra-structure. The main focus in prosthodontic research is the development of materials with improved biomechanical and esthetic properties. Computer-aided design/computer-aided manufacturing (CAD/CAM) technology simplified the construction of implant-supported restorations and reduced the challenging laboratory steps (1). When using metal abutment in patients with thin gingival biotype a gray color may be transmitted through the peri implant tissues. While ceramic abutment with ceramic crowns can enhance the esthetic results. (2)

Once introduced, high strength zirconia came to be used for fabrication of all ceramic implant abutment. It has good biocompatibility similar to titanium. Its ceramic nature gives better esthetic outcome. Yet, the stress concentration at the implant abutment interface may lead to fracture of abutment at this area. It might be possible to solve this problem by use of a hybrid design in which the zirconia element is bonded to titanium connector. (2) High translucency of lithium disilicate ceramic and good mechanical properties introduced the possibility of using lithium disilicate with titanium bases as abutments. Few studies have investigated the use of lithium disilicate as an abutment material.(3)

In spite that lithium disilicate have been well established in the market for years and years however their high modulus of elasticity is a major drawback. Especially in the anterior zone where the remaining bone is limited and the amount of stresses transmitted to the bone should be reduced to the minimum by the use of material like with low modulus of elasticity.(4) Recently Vita Enamic was introduced, which is formed of two interlocking phases of a porous sintered feldspathic ceramic and an infiltrating polymer. This was produced with the intention to achieve better stress distribution. To combine the advantages of both ceramics with its high chemical stability, good mechanical and optical properties as well as excellent biocompatibility and composites having the advantageous elastic modulus similar to dentin, it was thought that combining them would result in an ideal restorative material that provides long-term esthetics. The manufacturer claimed that the use of such material may decrease the load transmitted to bone in attempt to decrease the crestal bone loss and increase the patient satisfaction as well (5)(6)

Implant dentistry is always improving in relation to materials and surgical procedures in the last few decades, concentrating more on improving patient oriented results. At first, success and survival of dental implants was only measured by the phenomenon of osseointegration by alberkston criteria as a rule for analyzing success rates. Success in implant dentistry should ideally evaluate the long-term primary outcome of an implant-prosthetic complex as a whole .as osseointegration alone does not solely provide gingival and crown esthetics. The

shape and form of the peri-implant soft tissue is known for being an important factor in the success of implant therapy. Therefore both osseointegration and prosthetics in function help in the patient satisfaction, which is of great importance for the success of dental implant placement specially in the anterior zone. The goal for any treatment is to satisfy the patient's wishes and demands to replace the missing tooth with both a functional and esthetic replacement. That's why Smith and Zarb extended the criteria by adding optimum esthetics as criteria of implant success. On the other hand, any treatment that should be carried out must always include the patient's view to promote any potential solution, material or treatment that could increase the patient's satisfaction.(7)

Assessing the degree of satisfaction to a certain procedure is done by a Likert-type scale implementing four and seven response categories or through visual analogue scales (VASs). (8) VASs were first described by Hayes and Paterson. Category scales partitioned into subdivisions that occasionally have a numeric and/or adjective label (e.g., 1 = very weak, 5 = medium, 9 = very strong) whereas visual analog scales have no subdivisions. Rather, a visual analog scale is an unstructured line scale ranging at one end with the minimum and the other end maximum ratings (e.g., 'not sweet' to 'extremely sweet'). (9) VAS can be paper based or online. VASs are easily understood and mainly used in assessing pain levels(8)

There was a debate whether responses gathered via VASs are more accurate when compared to others scales. The dispute was settled by Reips and Funke in 2008 and 2012.(10) They favoured VAS over Likert-type because VAS offers better validity, reliability and ease of implementation in both paper based and online based, where each pixel in length of a VAS can be interpreted into a possible value.(10) VAS avoid "scale coarseness" a problem famous in using items with definite response categories. (11) Moreover, VASs are more subjective values when compared to radio button scales. VAS offers more precise answers. (12)

Methodology

Diagnosis

The initial therapy consisted of supragingival scaling and subgingival debridement if needed. The plaque control instructions included brushing and interdental cleaning techniques. Photographs were taken using a professional digital camera and primary impressions were taken using alginate impression material and the study casts were analyzed. Periapical radiographs were taken and a cone beam computed tomograph (CBCT) related to the area of interest was reviewed for adequate evaluation of buccal bone integrity and thickness (not less than 1mm), bucco-palatal bone width, height and density to decide on the suitable implant length and diameter.

Clinical procedure(implant insertion)

The patient was anesthetized. A surgical flap was incised using a surgical scalpel number 15 and elevated using a muco-periosteal elevator. Drilling was done, starting by the pilot drill and sequentially increasing sizes of drills in the implant

surgical kit until the diameter and length of the previously decided upon implant is reached. The implant was inserted then rotated to the required length using a hand driver. No further rotation should be obtainable. To confirm proper insertion a periapical radiograph was taken then suturing of the flap with silk suturing material was done. Three months following implant insertion, the implant was checked for adequate osseointegration.

Healing collars was placed. After proper soft tissues healing the patient was given an appointment for the temporization to ensure moulding of a more natural emergence profile using the dynamic compression technique.

Second stage

Two weeks following temporization the temporary restoration was removed. Using CAD/CAM software a virtual crown was designed. Starting with immediate gingival intraoral scanning after removal of the temporaries to capture the new emergence profile to form the basal shape of the crown. Both the gingival scans and the dental scans form proposal of the crown contours ,contacts and occlusion.of the restoration which was milled from either a lithium disilicate (IPS e.max) or PICN (VITA Enamic) block according to the participant's group.

Crown fabrication

The crowns are then milled either into lithium disilicate or vita enamic.The crowns were then cemented to the titanium base using chemical cured adhesive resin cement. The whole assembly is then secured in fixture by a screw driver. The hole of the screw retained crown is protected by Teflon and then filled by composite resin .centric and eccentric occlusion is checked by articulating paper for premature contacts.

Patient satisfaction assessment

Patient satisfaction was evaluated by using the previously mentioned questionnaire, which will be translated. A validation of the Arabic translation was done before using the questionnaire in the trial. Each participant took the questionnaire into a quiet room and was left alone until questionnaire was totally answered. The patients' recorded their satisfaction by means of filling out a questionnaire 1 year after restoration placement. The questionnaire included questions or statements to be answered on a 5-point rating scale ranging from "very dissatisfied" and "not in agreement" (score 1) to "very satisfied" and "in agreement" score 5

Results

A total of 42 patients were enrolled in the study (Group IPS e.max CAD n=22; Group VITA ENAMIC n=22) and were followed up 12months after hybrid abutment crown placement.

Follow-up schedule

Study data was collected at the time of hybrid abutment crown delivery 12 months after hybrid abutment crown delivery.

No Patient attrition:

During follow up period, all patients attended in the control group and in the intervention group. The total numbers of patients that attended all follow up sessions were 18 patients (5 males and 13 females).

After methodology:

All Data was collected, revised, tabulated and entered into the computer. Data was statistically analyzed as follows:

Statistical analysis:

The data were shown as mean & standard deviation(quantitative data).Exploration of the given data was performed using Shapiro-Wilk test and Kolmogorov-Smirnov test for normality and revealed that all data were normal (parametric). Accordingly, Repetitive One-Way ANOVA test was used to compare between different follow up records. On the other hand, comparison between different surfaces was performed by using One Way ANOVA test followed by Tukey's Post Hoc test for multiple comparisons, while comparison between 2 groups was performed by using Independent t-test.

Normality test:

Exploration of the given data was performed using Shapiro-Wilk test and Kolmogorov-Smirnov test for normality. It was revealed that there was insignificant difference as P-value > 0.05 and the concluded data originated from normal distribution (parametric data) resembling normal bell curve.

Patient satisfaction**Group I (Vitaenamic):**

In group I, the maximum was (10) in all questions, the minimum was (6), (5), (4) & (8), while mean $\pm$ standard deviation was (9.21 ± 1.08) , (8.74 ± 1.41) , (7.16 ± 2.09) and (9.21 ± 0.63) regarding Q1, Q2, Q3 & Q4 respectively as presented in table (1) and figure (1).

In Q5, comparison between yes 19 (100%) & no 0 (0.0%) was performed by using Chi square test which revealed significant difference between them as $P < 0.05$, as presented in table (2) and figure (2).

Table (1)Minimum, maximum, mean & standard deviation of Q1, Q2, Q3 & Q4 in group I (Vitaenamic)

Group I (Vitaenamic)				
	Min	Max	M	SD
Q1	6	10	9.21	1.08
Q2	5	10	8.74	1.41
Q3	4	10	7.16	2.09
Q4	8	10	9.21	0.63

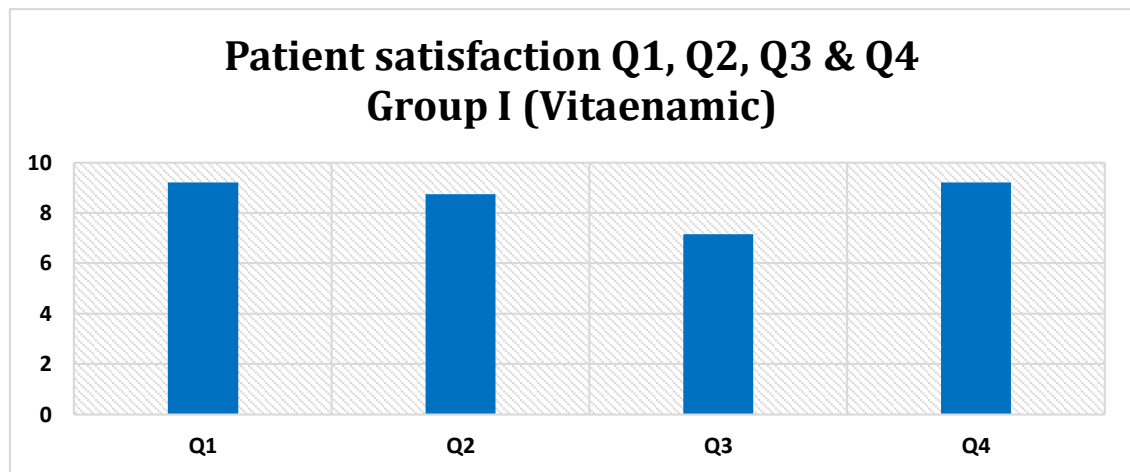


Figure (1) Bar chart showing mean of Q1, Q2, Q3 & Q4 in group I (Vitaenamic)

Table (2) Frequency & percentages of yes & no answers of Q5 in group I (Vitaenamic)

Group I (Vitaenamic)		
Q5	N	%
Yes	19	100
No	0	0
P value	< 0.0001*	

N: count %: percentage

P: probability level which is significant at $P \leq 0.05$

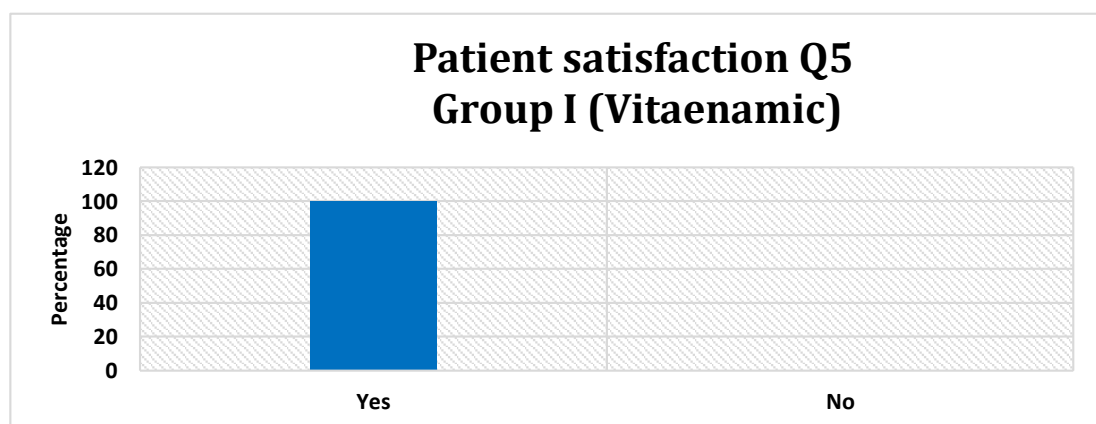


Figure (1) Bar chart showing percentages of yes & no answers of Q5 in group I (Vitaenamic)

1. Group II (E_{max}):

In group I, the maximum was (10) in all questions, the minimum was (8), (8), (5) & (8), while mean $\pm$ standard deviation was (9.37 ± 0.68) , (9.21 ± 0.79) , (7.47 ± 1.47) and (9.11 ± 0.66) regarding Q1, Q2, Q3 & Q4 respectively as presented in table (3) and figure (3).

In Q5, comparison between yes 19 (100%) & no 0 (0.0%) was performed by using Chi square test which revealed significant difference between the as $P < 0.05$, as presented in table (4) and figure (4).

Table (3)Minimum, maximum, mean & standard deviation of Q1, Q2, Q3 & Q4 in group II (E_{max})

Group I (Vitaenamic)				
	Min	Max	M	SD
Q1	8.00	10.00	9.37	0.68
Q2	8.00	10.00	9.21	0.79
Q3	5.00	10.00	7.47	1.47
Q4	8.00	10.00	9.11	0.66

Min: minimum

Max: maximum

M: mean

SD: standard deviation

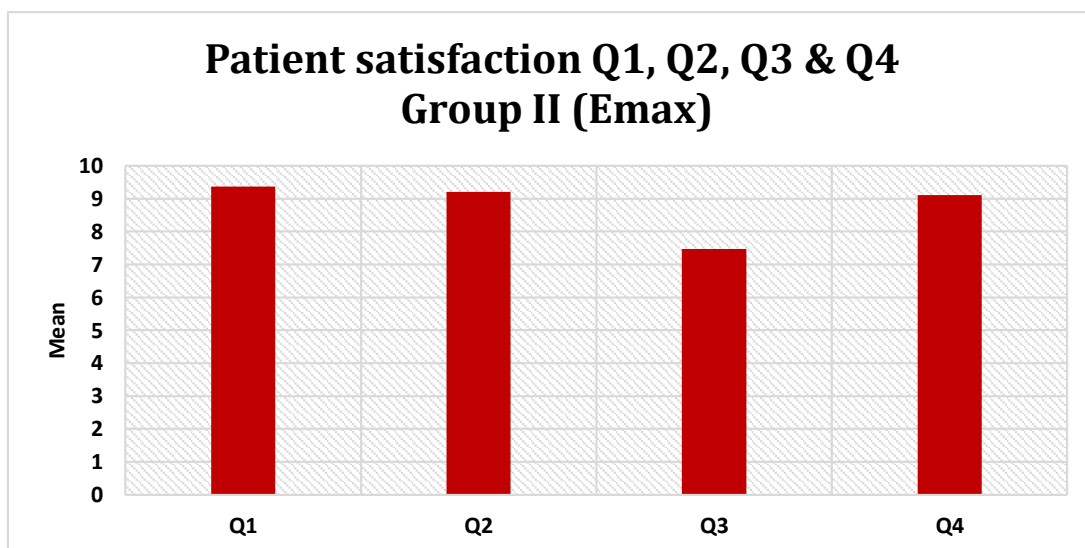


Figure (3) Bar chart showing mean of Q1, Q2, Q3 & Q4 in group II (E_{max})

Table (4) Frequency & percentages of yes & no answers of Q5 in group II (Emax)

Group II (Emax)		
	N	%
Yes	19	100
No	0	0
P value	< 0.0001*	

N: count %: percentage

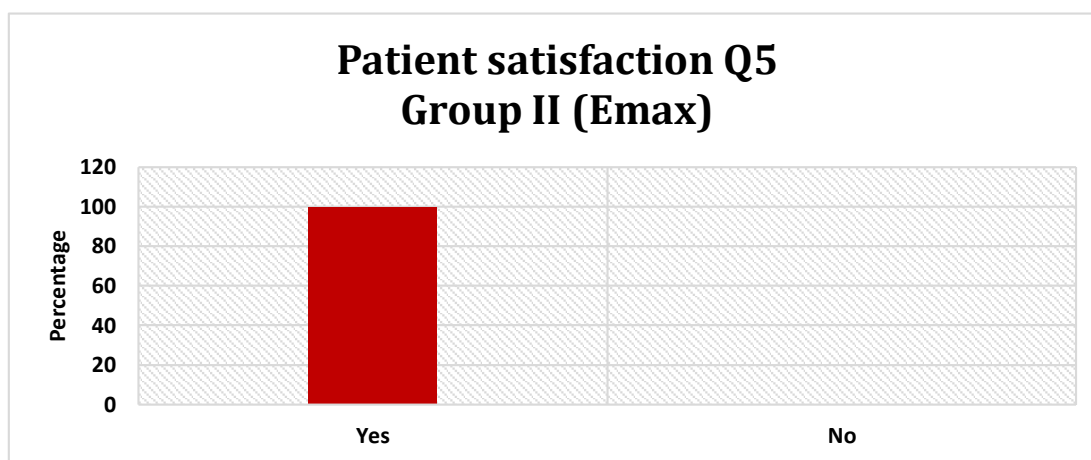
P: probability level which is significant at $P \leq 0.05$ 

Figure (4) Bar chart showing percentages of yes & no answers of Q5 in group II (Emax).

3-Comparison between 2 groups:

Comparison between group I & II regarding Q1, Q2, Q3 & Q4 was performed by using Independent t-test which revealed in significant difference in all as presented in table (5) and figure (5). Also, comparison between them regarding Q 5 was performed by using Chi square test which revealed absolute insignificant difference regarding yes answers as $P=1.00$, as presented in table (6) and figure (6)

Table (5) Comparison between group I & II regarding Q1, Q2, Q3 & Q4:

	Group I (Vitaenamic)		Group II (Emax)		P value
	M	SD	M	SD	
Q1	9.21	1.08	9.37	0.68	0.58
Q2	8.74	1.41	9.21	0.79	0.21
Q3	7.16	2.09	7.47	1.47	0.62
Q4	9.21	0.63	9.11	0.66	0.63

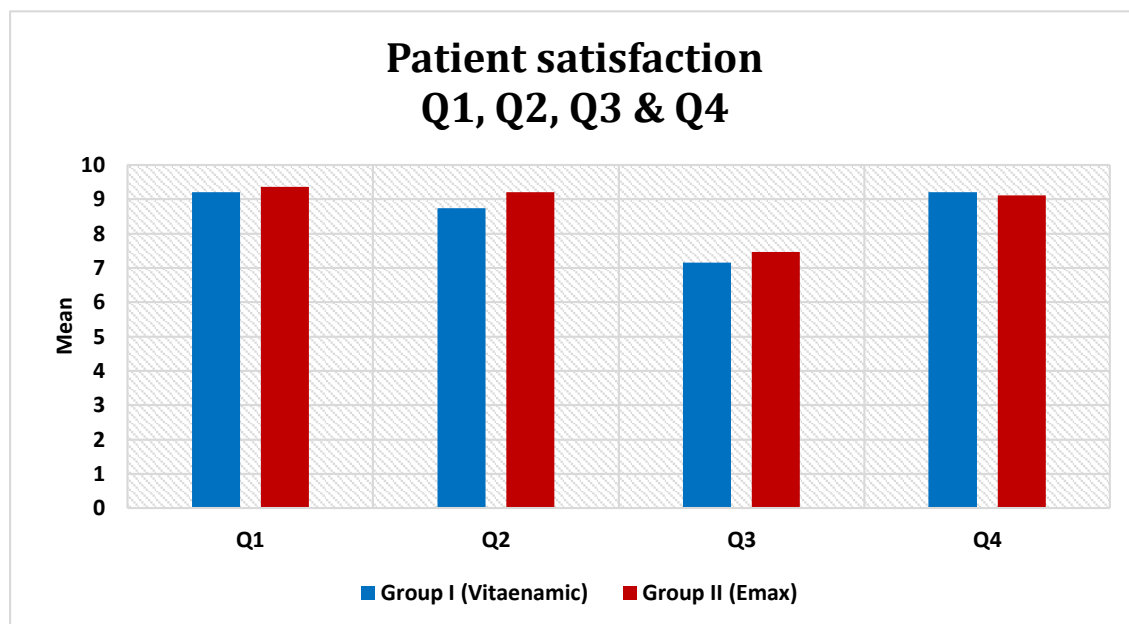


Figure (5) Bar chart showing Comparison between group I & II regarding Q1, Q2, Q3 & Q4

Table(6) Comparison between group I & II regarding Q5:

	Group I (Vitaenamic)		Group II (Emax)		P value
	N	%	N	%	
Yes	19	100	19	100	1.00
No	0	0	0	0	----

M: mean

SD: standard deviation

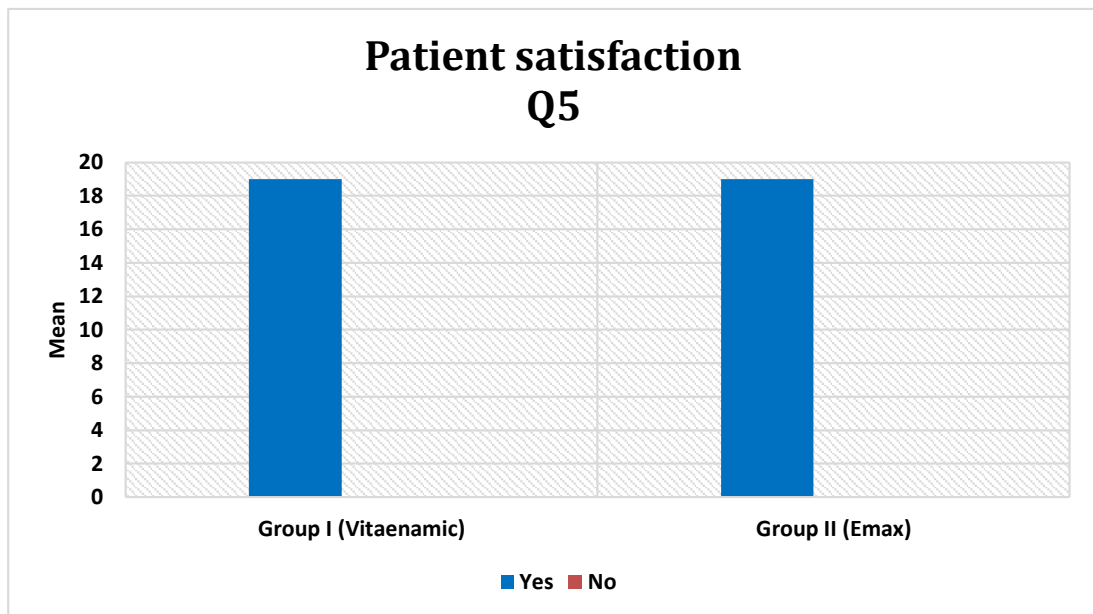


Figure (6) Bar chart showing comparison between group I & II regarding Q5

Discussion

This study was a randomized, double blinded clinical trial where randomization was carried out by using computerized sequence generation (www.randomizer.org) to eliminate the risk of selection bias of the included patients. It provided a comprehensive comparison between the lithium disilicate and vita enamic abutment groups in terms of patient satisfaction. The increasing esthetic demand in implant dentistry is directly related to the materials, techniques and treatment procedures. The material of the implant abutment used in the esthetic area is of extreme importance for the esthetics and biomechanical features. Therefore a variety of materials consisting of gold, zirconia, alumina, lithium disilicate and polymeric materials instead of titanium for implant abutments would be highly desirable. ⁽¹³⁾

All restorations included in this study were in the esthetic zone in compliance with patient's maximum smile. The most visible teeth in dental arch where esthetics, shade and patient satisfaction play a pivotal role for successful restoration. Lithium disilicate ceramic (IPS e.max CAD) has been used in this study as a superstructure on both of the groups for the different abutments. It is considered one of the esthetic ceramics due to the needle-like lithium disilicate crystals embedded in a glassy matrix that reduces internal scattering of the light as it passes through the material. In addition to the characteristic chameleon effect of this restorations. ⁽¹⁴⁾

Computer-aided design and computer-aided manufacturing (CAD/CAM) offers a new technology to create tooth colored restorations. Using

CAD/CAM results in the production of restorations with higher value and translucency, increase patient satisfaction, time saving and adequate strength. They also produce restorations with a natural appearance, make tooth restoration easier, faster, and more accurate. ⁽¹⁵⁾ The ultimate goal of the therapy is to satisfy the patient's desire to replace a lost tooth with a functional and esthetic solution. Hence, criteria for successful implant therapy should always incorporate the patient's view. If objective indices by clinicians are not correlated with the patients' esthetic perception, the practitioner may be overlooking potential treatments or materials that could better satisfy the patients' needs. In this study, the patients were presented with four simple but specific questions, and the scores of the combined answers were considered for the overall patient's satisfaction. Only one question had a binary choice of a Yes or No. Using the VAS was advocated by, **Albornoz et al.** ⁽¹⁶⁾ both studied the difference in patient satisfaction between titanium abutments and zirconium abutments. They showed that VAS is a subjective scale that helps the patients to express their esthetic evaluation and overall treatment satisfaction compared with assessment by clinicians. This was in harmony with **Cho et al.** ⁽¹⁷⁾ that used the VAS claiming that it could be applied to evaluate the patient's subjective esthetic evaluation. The questionnaire evaluated the patient's satisfaction with the esthetics of an anterior single tooth implant. **Hosseini et al.** ⁽¹⁸⁾ performed a randomized controlled trial comparing the use of zirconium crowns versus that of metal ceramic crowns on implant single supported restoration. ⁽¹⁹⁾

The difference between the two groups was not noticeable using the VAS, although the patient's self-esteem was high with implant supported single crowns. Concerning the patients' satisfaction with esthetics and function in comparison to the adjacent natural teeth and the overall satisfaction, the patients were highly satisfied. This is due to the effort paid to characterize every crown to highly match the adjacent teeth. However, on a professional point of view, where Elrifai et al performed a separate study deeply analyzing white esthetic score and pink esthetic score of both e.max and vita enamic hybrid abutment crowns, a statistically significant difference was found between the two groups, favouring e.max CAD. This may be due to the inherent translucency parameters of the lithium disilicate, which is proven to have a higher translucency parameter. In addition to, the staining protocol of VITA ENAMIC negatively influenced the restoration esthetics over time. Deep discoloration and wear off the stain layer was noticed. ⁽²⁰⁾

Conclusions

Within the study limitations the following were concluded

- 1-Lithium Disilicate and Vita Enamic hybrid abutment crowns reported high scores of patient satisfaction throughout the follow up period
- 2-hybrid abutment crowns showed excellent esthetic results in the anterior zone.

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Funding & conflict of interest

This study received no particular financing from any donor in the public, corporate, or non-profit sectors. Legal remark This study was carried out in accordance with all of the laws of the country's human subjects' investigative committee standards and policies of the ethics committee of scientific research- Faculty of Dentistry- Cairo University- Egypt.

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