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Comparison Of Biological Stability, And Healthy Of Peri-Implant Tissues Of Different Ceramic Crown Materials Restoring A Single Implant. Prospective Clinical Study- 1 Year

Research Article

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Abstract

Statement of Problem: Clinical studies about single implant-supported prostheses made of monolithic Zirconia, Zirconia reinforced lithium silicate crown, and hybrid ceramic crowns are still clinically lacking.
Purpose: The purpose of this randomized clinical trial was to compare biological stability and the health of peri-implant tissues of different ceramic crown materials of a single implant.
Material and Methods: A total of 27 participants received 27 implant supported single restorations. This study was carried out on twenty-seven systemically healthy patients who are missing mandibular first permanent molar motivated to replace the missing teeth with implant restorations. Periapical radiographs and C.B.C.T. scans of the implant site were taken for all patients before treatment to assess bone quality and quantity. Patients were divided into three groups to receive three different super structures; the crown restorations were fabricated from three different materials (monolithic Zirconia, Zirconia reinforced lithium silicate Polymer infiltrated glass ceramic). After delivery of the definitive restorations, Clinical and radiographic parameters (Modified plaque index, Modified bleeding index, peri-implant Probing depth, implant stability quotient, and marginal bone loss) were recorded for all patients at the time of prosthesis insertion and then after 6, 9 and 12 months.
Result: There was statistically significant between the related samples in all variables within the same group along with the follow-up period (modified plaque index, modified bleeding index, peri-implant probing index, marginal bone loss, and implant stability (I.Q.S.) as the level of significance $p \leq 0.05$. However, no statistically significant differences were found between all variables across the three crown materials groups with p values (0.204, 0.812, 0.951, 0.500, and 0.917, respectively).
Conclusion: According to the results of this prospective clinical study, implant restorative materials influenced the superstructure materials can influence dental implant stability, suggesting that using restorative material with low elastic modulus will improved stability. By reducing the stress generated around a dental implant, Polymer infiltrated ceramic can be a promising alternative superstructure material for an implant-supported prosthesis in the future.

Keywords: Esthetic Implant Restorations; All-Ceramic Restorations; Monolithic Zirconia; Zirconia Reinforced Lithium Oxide; Polymer Infiltrated Ceramic.

Abbreviations: Modified Plaque Index (M.P.I.); Modified Bleeding Index (M.B.I); Peri-Implant Probing Depth (P.P.D.) Measuring of Marginal Bone Loss (M.B.L.); Implant Stability Quotient (I.S.Q.); Frequency Resonance Analysis (R.F.A.).

Introduction

However, the Metal Ceramic restorations are yet the paradigm for implants supported restorations. The Ceramic gradually replaced the metal-ceramic crowns in the last decades mainly due to its effects on periodontal tissues, produce picture artifacts, and cause discoloration and adverse response to the free gingiva. Ceramic restorations are biocompatible and have the right colour, although they are liable to body crack or chipping, limiting their usage. Forth at reason, the choosing of Ceramic or Metal Ceramic im-

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plant- sustained restorations remains essential and debatable [1-4].

Because the esthetics is a prime concern and attention to allergic and toxic responses to specific alloys, dentists and patients have been searching for esthetic standard colour restorations. Therefore, the development of high strength dental ceramics, have less tensile strength, which appears to be less brittle, and are less subject to time-dependent stress failure, has dominated the latter part of the twentieth century [5-7].

The longstanding survival of oral implants based on numerous issues; biomechanical factors play a significant role. The choice of implant locations, restoration pattern, and prosthetics material stay significant for the implant restorations' durability and constancy [8-13].

Due to the absence of micro motion of Osseo integrated implants, much of the distribution force is focused on the bone crest. Then this might cause crestal bone resorption plus the following failure of the implant. It has been recommended that trauma -absorbing or overload - damping systems be integrated into the crown or retainer reinforced by osseo integrated implants to decrease over loads on the implant that happen since the absence of Visco elasticity at the bone-implant connection [14].

Because its chemical properties are good, Zirconia has been broadly expanded to fabricate prosthetic devices. It has great mechanical potency, dimensional stability, stiffness, and a modulus of elasticity value (210 GPa) comparable to the alloy of stainless-steel alloy (193 GPa). Zirconia has the highest mechanical properties of any dental ceramic due to the mechanism of transformation toughening, resulting in higher initial strength of Zirconia and fracture stiffness [15, 16]. An in vitro study of zirconium dioxide samples showed instability of 900–1200 MPa and fractured stiffness of 9 to 10 MPa / m2 (17). Furthermore, the capability to transfer light-beam besides its white hue, like the hue of normal teeth, render it valuable in metal-free tooth colour like restoration of the oral cavity [18].

The optical properties of partially Stabilized Zirconia (Y-TZP) Material formerly found opacious white colour can only be used as a framework material upon which aesthetic facing porcelain was utilized to improve the aesthetic feature of the upcoming restorations [19, 20]. Chipping of the weaker porcelain veneer is considering the main functional dilemma of bilayered zirconia restorations, whereas the high strength core of Zirconia is frequently unchanged. Although the new formula can offer the supreme key to remove facing chippings, they do offer neither esthetics features nor several varieties of colours and results to the same extent, porcelain veneering materials have done, and not applicable in aesthetically commanding circumstances [21].

The monolithic zirconia material has unique mechanical and optical characteristics and is designated for monolithic restorations with restricted dental treatment in the anterior or premolar region and conservative dental reduction [22, 23]. The bonding ability and integration of resin-based cement types to zirconia materials have enhanced research and technology. Nevertheless, there is still no appropriate surface treatment to zirconia materials for an expectable adhering in clinical performance [24, 25].

Zirconia reinforced lithium silicate ceramics allow the manufacture of inlays, onlays, crowns, partial crowns, and laminate veneers. Additionally, more esthetic restoration scan be obtained with a cut-back technique. Vita and Dent sply introduced Zirconia Strengthened Lithium Silicate Glass-Ceramic blocks in 2013. The brand name of the Zirconia reinforced lithium silicate glass ceramic block of Vita is Vita Suprinity. The material has translucent(T) and high translucent(H.T.) blocks [26]. The brand name of the Zirconia are in forced lithium silicate glass-ceramic block of Dent sply is Celtra CAD. The material has low translucent (L.T.) and high translucent (H.T.) blocks. Mechanical Values for the fracture toughness (2.31±0.17MPam0.5), flexural strength (443.63±38.90MPa), elastic modulus (70.44 ± 1.97 GPa) and hardness (6.53 ± 0.49 GPa) of Vita Suprinity are significantly higher compared to lithium disilicate ceramic [27].

Hybrid ceramics contains 86% of ceramics and 71% Polymer. Ceramic structure includes, 58- 19%SiO2, 2 -23% Al2O3, 9-11% Na2O, 4-6 K2O, 0.5-2% B2O3 and less than 1% ZrO2 and CaO. Resin structure was composed of tri ethylene glycol di methacrylate (E.G.D.M.A.) and urethane di methacrylate (U.D.M.A) [28].

The most famous example for hybrid Ceramic is Vita Enamic (Vita Zahnfabrik, Ger-many), it is placed in the hybrid ceramics group with flexural strength, elastic modulus, and stiffness (hardness) of the material is 150-160 MPa, 91 GPa, and 2.5 GPa, respectively [29]. The elastic modulus value of Vita Enamicis 30GPa, and the material exhibits similar elastic properties to teeth [28, 29].

The restorations obtained from the Vita Enamic block must be cemented with adhesive bonding systems. In contrary to Nano-ceramics, the inside of the hybrid ceramic restorations is etched with hydrofluoric acid in the concentration of 5% applied on the surface for 1minutes [29, 30].

Numerous techniques have been used to assess the initial bone quality and the effect of implant superstructure on the degree of Osseo integration [31]. Including histomorphometry and histology [32, 33], removal torque analysis [34], pull and push-through tests [35], and radiographic examination [36]. Conversely, because of difficulties of in accuracy and invasiveness, these techniques are not compatible with long standing clinical evaluations.

Due to the need for an on invasive and non-destructive device to evaluate the Osseo integration, a new device named Osste llTM, based on Resonance Frequency Analysis (R.F.A.), was developed [31]. It works by directly attach the transducer to an implant body by smart peg represent R.F.A. values which have been concurrent among variations in implant stability throughout osseointegration, the supra crestal dimensions of the implant as well as a failure of implants and offered a broad variety of rates [37].

This study's primary research question was as follows: Among the three different superstructure materials, does less affect the periodontal measures and stability of a single implant? The null hypothesis was that no differences between the three superstructures materials related to the biological stability and healthy peri implant tissues of implant supported single restoration were evaluated. Clinical guidelines for implant superstructure material are still lacking, so this clinical prospective study's specific objective was to estimate the impact on the stability and health of peri-implant tissues of three different implant superstructure materi-

als; Monolithic Zirconia, Zirconia Reinforced lithium silicate, and Polymer infiltrated glass-ceramic.

Materials and Methods

This study was designed and implemented as a randomized, prospective, and double blind clinical trial, in which the final implant supported crowns were produced by using CAD-CAM techniques. This study included twenty-seven systemically healthy patients (18 females and nine males) ranged in age from 25-40 years, the mean age of 34± 1,6 years with a missed lower first molar, and all patients were motivated to implant placement. The study was permitted by the Ethics Committee, Faculty of Dental Medicine, Al-Azhar University under the registration number AUAREC2019048-10. The ethics committee of the Faculty of Dental Medicine, Al-Azhar University, Assiut is constituted and operates according to ICH GCP guidelines and applicable local and Institutional regulations and guidelines which govern IRB operation. The committee met on 8 April 2019 with agreement. Participants were chosen from the out-patient clinic, fixed prosthodontics department, faculty of dental medicine, Al-Azhar University, and Assiut. All patients explained all procedures, and Informed consent was taken from all participants before any practices were performed. All patients obtained a full clarification of the management methods plus the accompanying advantages and hazards. No identifying information such as patients' images, names, initials, or telephone numbers, has been included in this study. The study population was included all patients who presented for evaluation between March 2018 and October 2019.

The patients had to be free from any systemic diseases, not pregnant, nonsmokers, and at least 18 years old to be involved in the trial participants. They had to miss a first mandibular molar after atleast three months of socket healing, crestal residual ridge width ranging from 6 to 8 mm at the crestal and basal part of the ridge, adequate vertical ridge height of at least 10 mm implant. Finally, the implant site should be free from any pathological condition and a normal occlusal relationship.

Patients were excluded as study subjects under the following conditions: they had severe parafunctional habits; bruxism and clenching; Uncontrolled periodontal conditions or oral diseases; uncontrolled diabetes (defined as HBA1c level >7%) or smoking; alcohol or drug abused a patient; bone disorders; osteoporosis or Paget's disease; pregnancy or receiving contraceptive pills; taking bisphosphonates or steroids presently or within the past three months; a history of radiotherapy in head and neck region; they had a perforated and/or lost labial bony plate; Obvious under cut on the labial cortical plate; Occlusal abnormalities (tilting, drifting and malposed teeth); patients with parafunctional habits (clenching, bruxism); and they were develop mentally disabled individuals; or they did not agree to return for follow-up visits.

Trial magnitude computation and power analysis.

Intended for calculating the sample size, the power analysis was performed using (G-Power, Ver. 3.192 copy right 1992-2014) system for a one-way fixed effect analysis of variance (ANOVA). The standard for significance was set at $\alpha = 0.05$ (type I error) and $\beta = 0.21$ (type II error). The sample size is 9 cases per group nine cases each class, resulting in a power of 0.9958386.

Pre-surgical Evaluation

Radiographic Evaluation

- Standardized periapical radiographs of the implant site by a loop film holder and R.V.G.* were taken using the long-cone paralleling technique and occlusal template and Ez Dent-i viewer software (Ez Sensor HD, Vatech, South Korea).

Preoperative C.B.C.T. (NewTom G.I.A.N.O., Cefla-Dental, Imola(B.O.), Italy) was done to all patients at the base line to evaluate bone quantity and quality, to locate major anatomical features, and to measure the bone height and thickness of the supportive bone. All this evidence was used to formula tea comprehensive investigation consuming specified Town Tom Viewer software (Cefla-Dental, Imola (B.O.), Italy).

Study cast analysis:

- Upper and lower alginate impressions were taken and poured into evaluating the residual ridge and analyzing maxilla mandibular relationships.
- Occlusion is evaluated for any abnormality.

Pre-Surgical Preparation:

Supportive periodontal therapy (full mouth scaling and root planning with manual scalar, ultrasonic scaler, and curette two weeks before surgery) was done following clinical examination as required. Oral hygiene instructions and reinforcement was performed at the end of the appointment. The preoperative medications included the patient rinsed Chlorhexidine gluconate 0.12% to reduce the bacterial load and dose of Augmentin 1g (875 mg Amoxicillin and Potassium Clavulanate comparable to 125 mg of clavulanic acid) twice daily was given orally three days before the procedure. Also, Cataflam® 50 mg had given one day before surgery to minimize postoperative pain. Preoperatively, cleans the wound with chlorhexidine gluconate 0.12% were advocated.

Surgical procedures:

The same surgeon performed all procedures. After local anesthesia administrated, mid-crestal and sulcular incisions were made. Then, a full-thickness flap reflection of the buccal and lingual mucoperiosteal flap was done. Many sizes of Dentium implants (Dentium, U.S.A.) were then positioned following the usual procedure.

Usual Post-Surgical instructions and drugs were provided to the patients as preoperative therapy for seven days and Chlorhexidine mouth washing for two weeks. Participants were commanded to prevent chewing diet in the maneuvered sites for six weeks. Closures were detached between 10 and 14 days after the operation, and each patient was regularly examined for any problems every four weeks.

After three months, submerged healing period, the patients were called back for evaluation of implant success. The criteria for implant success were proposed as following [38]: Lack of determining emotional disorders, such as discomfort, foreign body sensa-

tion, or dysaesthesia, lack of mobility, absence of Peri-implant infection, and absence of radiolucency around the implant. Healing abutments were tightened in a clockwise direction using 35N/cm torques, and suturing of the incision was carried out. After three weeks, the Patients were recalled back. The healing abutment was unscrewed in an anti-clockwise direction for insertion of definitive abutments and impression making.

Patients grouping and randomization:

Patients were organized arbitrarily into the succeeding equal groups using online software (https://www.randomizer.org); digits were hidden in locked envelopes. Neither the patient nor the assessor was aware of the type of prosthesis done.

Group I, nine patients received a monolithic zirconia crown as a definitive prosthesis.

Group II, nine patients received a Zirconia reinforced lithium silicate crown (vita suprinity) as a definitive prosthesis.

Group III, nine patients received Polymer strengthened ceramic (vita enamic) crown as a definitive prosthesis.

Impression making and laboratory procedures

Impression making steps:

After unscrewed the healing abutment, impressions were made using the open tray technique and silicone impression material (Presdent, Colten, Waledent AG, Switzerland). When setting of impression material, it was validated to be fully customized around the implant and mount. Next, the healing abutment was placed back onto the implant to inhibit soft tissue collapse until the subsequent visit. In the next visit, the analog was coupled with the fixture mount/transfer via grasping the analog in-home. It introduced the long screws across the access holes in the impression ray and strengthened them accurately by the hand screwing, preventing unnecessary overrotation. Impression with the transfer cap attached to the analog, inter occlusal bite recording, opposite impression, and prosthesis color was sent to the dental technician.

Laboratory procedures for the assembly of superstructure

Impression pouring and screwing the titanium base:

The impression with the connected transfer coping was poured with extra hard dental stone(M.A.L.A.K.I.T., Protechno, Girona, Spain) and allowed to set. After which, the transfer cap was unscrewed, and the titanium base was screwed in place using a screwdriver(maximum15 Ncm) and Checked for proper fit in the analog (Figure 1). The base's flat surface was oriented buccally, avoiding contact between the titanium base and proximal teeth. Upper and lower Casts scanning was carried out within the labscanner(Cera Mill map 400, Amann Girbach, Germany). Milling was carried out with an in-lab milling machine (CeraMillMotio n2,AmannGirbach,Germany) (Figure) according to manufacture instructions for each of the three supra-structure materials.

Monolithic Zirconia:

Dry milling of zirconia blank(Wiel and Dental + Technik Gmbh & Co.Kg, Pforzheim, Germany) was carried out with an in-lab milling machine. Zirconia crowns were then separated from the blank carefully with a turbine handpiece. The milled crowns were carefully cleaned thoroughly to remove any adherent milling dust using metal-free brushes and oil-free compressed air. According to manufacture instructions, sintering was carried out in a sintering furnace (Cera Mill Therm, Amann Girbach, Germany).

After sintering, finishing of the restoration was carried out, adjustment of occlusal and proximal contact. Finishing was kept minimal after sintering and done under cooling water and with gentle pressure. After finishing, characterization and glazing were carried out in firing furnace (VACUMAT 6000 M, VITA Zahn fabrik, Germany) according to the manufacturing program the abutment was seated onto the model and screwed into place. After this, Teflon tape was placed into the screw access hole, and the crown fit was verified on the abutment and then removed. Dual cure adhesive resin (TOTAL C-RAM, Itena, Paris, France), with an auto-mix tip, was applied into the crown's intaglio. The crown was seated on an abutment, and Teflon tape was immediately removed from the hole. Any excess around the hole was cleaned, and light-curing was carried out. Silicone high-shine rubber wheel was used to remove excess at margin after curing. The cemented crown with abutment was removed from the model to be screwed on the fixture.

Vita Suprinity:

Wet milling of Zirconia reinforced lithium silicate (vita suprinity, vita zahn fabrik, Germany) crown was carried out with an in-lab milling machine. Fine-grit diamond abrasive tools were used for contouring after the C.A.M. process, and finishing diamonds were used for polishing. Before crystallization, the restorations were cleaned in the ultra-sonic bath. The fitting surface of crowns was acid etched using 5% hydrofluoric acid gel(DENTOBOND, Itena, Paris, France) for 20 seconds and rinsed with acopious amount of water until all acid residue was removed. After drying of etched restoration, Silane was applied for 60 seconds. Dual cure adhesive resin, with auto-mix tip, was applied into the crown, and immediately crown was seated on the abutment, and Teflon tape was removed from the hole. Any excess around the hole was cleaned, and light-curing was carried out. Silicone high-shine rubber wheel was used to remove excess at margin after curing.

Vita Enamic:

After wet milling of Polymer infiltrated glass-ceramic(VITA Enamic, VITA Zahnfab- rik, Germany) crown, a diamond tool was used to cut the sprue. Carbide instruments were avoided since these instruments may damage the material. Only diamond-coated milling tools and special polishers with water and slight pressure was used. Sof-Lex polishing discs were used for pre-polishing; only the medium grain and very fine grain types of Sof-Lex discs were used. Vita Enamic Polishing Set was used for contouring and polishing of the restorations. The external surface was conditioned by sand blasting with 50μm Al2O3 at a pressure of 1 bar. The surface was cleaned thoroughly with a copious amount of water and dried. Using a disposable micro brush, a single coat of Vita Enamic Glaze was applied to all surfaces and polymerized with standard clinical light cure with a spectral range of 350- 500

nm for 60seconds.

The fitting surface of restoration was etched with 5% hydrofluoric acid for 60 seconds and rinsed with a copious amount of water to remove all acid residue and salinized subsequently for 60 seconds. Dual cure adhesive resin, with an auto-mix tip, was applied into the intaglio of the crown. The crown was seated on the abutment, and Teflon tape was immediately removed from the hole. Any excess around the hole was cleaned, and light-curing was carried out. Silicone high-shine rubber wheel was used to remove excess at margin after curing. The crown with abutment was removed from the model to be screwed on the fixture.

Delivery of final prosthesis:

After measuring implant mobility, the Definitive prosthesis was tightened using 35N/cm torques, the Teflon pack was applied over the screw, and finally, screw openings were sealed using light-cured composite resin (3M, E.S.P.E.,U.S.A.).

Postoperative evaluation and instructions:

After one week from the insertion of the crowns, the occlusion was rechecked. After one month, the implants' superstructures and tissues were reevaluated, and all participants were reinforced concerning adequate oral hygiene. Photographs and contacts controlled occlusal modifications were verified using the shim-stock protocol. It was also tested if any tested crowns or opposed dentition displayed discernable contact deterioration via the dental probe and magnifying glasses (magnification×3.5).

Clinical Evaluation:

The outcome variables were assessed via one trained dentist who has neither shared the implants' insertion nor provided the superstructure. The subsequent factors were assembled and recorded at

Figure 1. Digital impression of cast and CAD design for the implant crown.

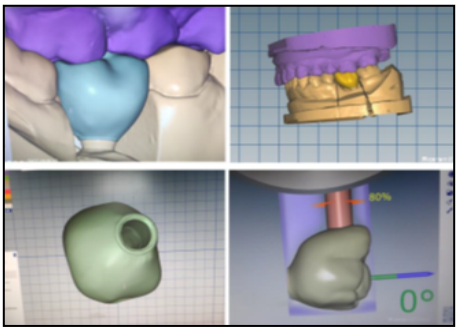

Figure 2. The osstell probe and reading for implant stability.

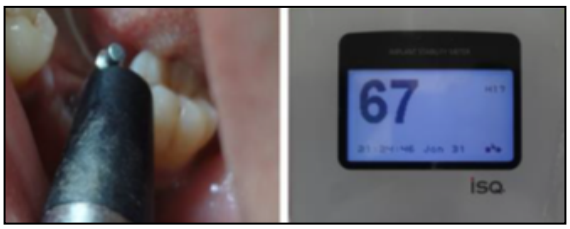

Figure 3. Barchart for the mean of the plaque index, bleeding index, probing index and marginal bone level variables for all the three groups of crown materials

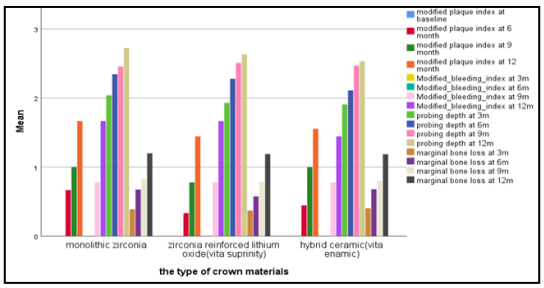

Figure 4. bar chart represent the mean differences for implant stability readings within the follow up period for all the three groups of crown implant materials.

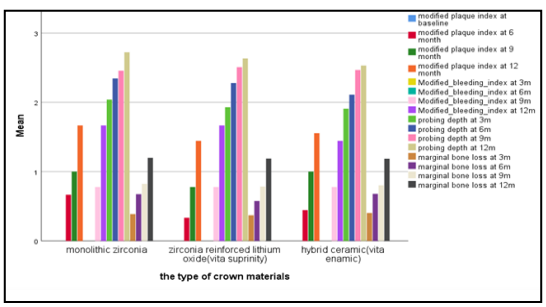

Table 1. Related-Samples Friedman's Two-Way Analysis of Variance by Ranks Hypothesis Test.

	Null Hypothesis	Test	Sig.	Decision
1	The distributions of modified plaque index at baseline, modified plaque index at 6 month, modified plaque index at 9 month, modified plaque index at 12 month,	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	0	Reject the null hypothesis.
2	Modified_bleeding_index at 3m, Modified_bleeding_index at 6m, Modified_bleeding_index at 9m, Modified_bleeding_index at 12m,	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	0	Reject the null hypothesis
Asymptotic significances are displayed. The significance level is .050.				

Table 2. Independent-Samples Kruskal-Wallis Test Summary.

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of MEAN_PI is the same across categories of the type of crown materials.	Independent-Samples Kruskal-Wallis Test	**0.204**	**Retain the null hypothesis.**
2	The distribution of mean_BL is the same across categories of the type of crown materials.	Independent-Samples Kruskal-Wallis Test	**0.812**	**Retain the null hypothesis.**
Asymptotic significances are displayed. **The significance level is .050.**				

Table 3. Tests of Within-Subjects Contrasts by repeated measure one-way Anova(The significance level is .05).

Source	PD	Type III Sum of Squares	df	Mean Square	F	Sig.
PD * group	Linear	0.007	2	0.004	0.05	**0.951**
MBL * group	Linear	0.008	2	0.004	0.714	**0.5**
IQS * group	Linear	2.533	2	1.267	0.087	**0.917**

Table 4. Tests of Between-Subjects Effects.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
	MEAN_PD	0.086	2	0.043	1.916	**0.169**
	MEAN_MBL	0.01	2	0.005	1.099	**0.35**
	MEAN_IM	13.81	2	6.905	1.434	**0.258**

the time of final prosthesis insertion and then 6,9 and12 months: **Modified plaque index**(M.P.I.) (39) : Used to assess plaque accumulation around the marginal area around implants. M.P.I. recording was as following: 0 (no plaque detected), 1 (plaque recognized only by running a probe along margin), 2 (plaque visible to the naked eye), and 3 (abundance of soft matter). **Modified bleeding index** (M.B.I.) [39]: Used to assess the degree of gingival bleeding around implants. M.B.I.included 0 (no bleeding when the periodontal probe is passed along margin), 1 (isolated bleeding spot visible), 2 (blood forms confluent red line on margin), and 3 (heavy or profuse bleeding). **Peri-implant probing depth**(P.P.D.) (39): It was measured as the distance from the gingival crest to the bottom of the gingival sulcus at four sites around implants using a Williams probe. Distances were rounded up to the nearest millimeter. **Measuring marginal bone loss** (M.B.L.) [39]: M.B.L. around the implant was evaluated using C.B.C.T. that were taken on the day of the final prosthesis siting (baseline) and the follow-up visits at 6, 9, and 12 months. The distance from a reference point at the implant fixture occlusal end to the most coronal point where the implant's marginal bone contacts were the measure. Four measurements were recorded: mesially, distally, buccally, and lingually for eachimplant.

Measuring of implant stability (I.S.Q.):

Using Osstell™* (ostell™, Integration Diagnostics Ltd., Gote-

borgsvagen, Swe- den), Implant stability quotient (I.S.Q.) values were recorded before delivery of the final prosthesis. The Osstell™ measurements were made by attaching the Osstell transducer (Smart Pegtype 07, No.100380) at the fixture level. The Osstell transducer was screwed manually using the transducer key in a clockwise direction. The transducer was tightened firmly until no more tightening can be accomplished [40].

The Osstell handpiece was directed toward the transducer. The magnetic pulses cause the transducer to vibrate. The instrument measures the frequency of vibration and translates it to the I.S.Q. The scale between 1 and 99 (the higher the I.S.Q. scale value, the better the stability). Measurements were taken in triplicate and averaged to yield the mean baseline I.S.Q. Value for each implant. I.S.Q. readings were recorded (Figure.3), and the transducer was unscrewed in an anti-clockwise direction.

At each evaluation period (6, 9, and 12 months), patients recalled back, composite.

The filing was removed with the Teflon pack. The superstructure-abutment complex was un- screwed and removed from the fixture. The transducer was attached, and measurements were done as for baseline measurements. After which, the superstructure was screwed in place. Teflon pack was applied over the screw, and finally, the screw opening was sealed using light-cured composite resin.fig.2

Statistical analysis:

The records were explored with the statistical package for the social sciences (S.P.S.S.) software (IBM SPSS statistics for windows, Version 26.0, I.B.M. Corp., Armonk, NY, U.S.A.). Variations with a two-tailed p-value ≤ of 0.05 were statistically significant.

Results

A sum of 27 participants was treated effectively in this investigation and prospectively assessed based on the trial protocol. Upon the examination period, all patients agree to participate in the follow-up intervals. There were 18 males and nine females with a mean of 34 years age included in this study. The mean and standard deviation values were computed for each group in each test. Records were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. P.P.D., I.S.Q., and Marginal bone loss data showed parametric distribution, while M.P.I. and M.B.I. data showed non-parametric distribution.

For parametric data (P.D., I.S.Q., and Marginal bone loss), repeated measure ANOVA was used to compare more than two groups in related samples. One-way ANOVA followed by the Bonferroni test was used to compare between more than two groups in non-related samples. A two-way ANOVA test was used to test the interactions between the different mean of variables.

For non-parametric data (modified plaque index and modified bleeding index),Related-Samples Friedman's Two-Way Analysis of Variance by Ranks was used to compare more than two groups in related samples. After the rejection of the null hypothesis, the pairwise comparison between the follow-up period in the related sample was made by Related-Samples Friedman's Two-Way Analysis of Variance by Ranks, and the significance adjusted the Bonferroni correction for multiple tests has adjusted significance values. Kruskal Wallis test was used to compare between more than two groups in non-related samples.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 26 for Windows. For non-parametric data (Modified Plaque Index and Modified Bleeding Index). The null hypothesis was rejected because of the presence astatistically significant differences between related samples in the same group(table. 1).

There was a statistically significant difference between the (baseline and 6m) to (9m,12m) for both groups, whereas the Mean Rank of modified plaque index at the baseline (2.41), modified plaque index at six months (3.98), modified plaque index at nine months (5.57) and modified plaque index at 12 months (7.04). Modified bleeding index at 3m (2.41), Modified bleeding index at 6m (2.41), Modified bleeding index at 9m (5.06),and Modified_ bleeding_index at 12m (7.13) for all groups of super structure implant materials.

After computing the mean of the related sample in the same variable to show the statistical differences between the two variables (modified plaque index and modified bleeding index) across the three groups of crown materials, the Independent-Samples Kruskal- Wallis Test was applied and reported non statistically significant differences between all crown materials because the null hypothesis was retained (Table.2 & Fig.2).

For parametric data (Probing Depth (P.D.), Marginal Bone Loss (M.B.L.), and Implant Stability values (I.Q.S.)), the repeated measure one-way ANOVA was used, table3.

The null hypothesis was retained because of the significance level of more than 0.05for the three variables related samples for all three groups of crown implant materials. Table 3.

Then, the one-way ANOVA with post hoc test was retained the null hypothesis as the significance level was more than 0.05. There are no statistically significant differences between the mean of the three variables tested for all crown implant materials tested (Table 4 & Fig 3).

The interaction between the groups for all mean variables retained the null hypothesis because of the significance level above 0.05 (Fig.4).

Discussion

To the excellent of our know-how, the use of recent esthetic materials to restore the implant-supported prosthesis and preserve implant components' health was clinically investigated. It is important to note that selecting superstructure materials for the Implant-abutment complex is a critical issue in direct contact and affects periodontal tissues' health. In the present study , three types of ceramic superstructure materials were used: monolithic Zirconia, Zirconia reinforced lithium silicate Ceramics, and Polymer infiltrated ceramic.

As all patients in the present investigation had posterior D1 and

D2 bone type, the submerged healing period was four months, this following a study [41] stated that the healing and progressiv bone loading sequence for D2 bone require less time than D3 and D4 where six or more months of undisturbed healing is required.

In the current study, a screw-retained prosthetic system was used to facilitate measuring the secondary implant stability using resonance frequency analysis (R.F.A.) (Osstell™) by merely unscrewing the prosthesis. This process would be complicated with a cement-retained restoration that would necessitate traumatic removal of final cemented restoration at evaluation periods with a high risk of the prosthesis and/or implant components fracture. According to a study [42], this is reported that mobility can only be reliably tested if individual implants are accessible for evaluation. The entire prosthetics concept is based on the requirement that the superstructures be retrievable to measure mobility.

In the current study, the monolithic Zirconia is used to minimize chipping of veneering Porcelain. Anew formulation of (Y-TZP) has been launched to be finished in a complete contour outline. Although these formulations may offer the definitive result to remove veneer chippings [43, 44], they do not deliver either esthetics properties or numerous variety of shades and effects as do porcelain facing materials; a requirement that not of Prime importance in the current study where restoration of the posterior edentulous area was done.

Recently, indirect dental material is a lithium silicate-based glass-ceramic reinforced with zirconia particles(Z.L.S.).This material is delivered merely for CAD-CAM equipment, which allows the material to be used for anterior and posterior crowns, superstructures on implant abutments, veneers, inlays, and on lays. However, not enough laboratory or clinical information was published concerning this material [45].

The last materials used were VITA Enamic from VITA, which has two interpenetrating three-dimensional network structures; the dominant fine-structure ceramic feldspar network (86 percent by weight or 75 percent by volume) is reinforced by a polymer network consisting of methacrylate polymer (14 percent by weight or 25 percent by volume). The values of elastic modulus, hardness, and fracture strength are as follows: 30.14 GPa, 2.59 GPa, and 1.72 MPa•m-0.5 respectively [46], all of which were obtained for human dentin and enamel. Vita Enamic has the highest Vickers hardness of 189.8 (46)50.50, with the highest filler content (73.1 percent mass) compared to other hybrid ceramics and composites. In addition, VITA Enamic has two-body and tooth-brushing wear comparable to natural enamel wear. [47]. All these features notably, the low elastic modulus numbers nominated those materials to be used as an implant superstructure better to distribute occlusal forces on the implant component system.

In the present study, the mean modified plaque index (M.P.I.) in all groups during the observation period indicated minimal plaque accumulation around the implants and acceptable oral hygiene practices by the patients. In the comparison between groups, there were no statistically significant differences ($p>0.05$) where ($P=0.204$) for the mean of the time intervals.

A study [48] stated that bleeding on probing has high specificity but low sensitivity, meaning that its absence indicates disease stability. In the current study, the mean modified bleeding index (M.B.I.) along the observation period in all groups indicated minimal inflammation and tissue stability around the implants, and in the comparison between groups, no statistically significant differences ($p>0.05$) with ($p= 0.812$) across all the groups.

The average probing depth was not exceeded 3 mm at all observation periods in all groups (the highest mean of probing depth was 2.62 mm). This investigation compatible with another study [49], a study that concluded that successful implants generally allow probe penetration of approximately 3 mm after implant loading measured from the crown margin to the sulcus base. These findings reflected an excellent soft tissue healing around dental implant across all groups as not statistically significant differences between related means($p=0.169$).

In our study, there are no statistically significant differences across all groups ($p=0.350$). Still, group III showed less marginal bone loss at 12 months with a mean (1.11) than (1.22) (1.19) for a group I and II, respectively. It hypothesized that group III showed a lower value of marginal bone loss (M.B.L.) than other groups at 12 months because of good mechanical behavior of final prosthesis in better stress distribution pattern due to low elastic modulus number. This finding was similar to that concluded with another study [50] who reported that prostheses made of a rigid material, such as Metal can cause a high impulse load on the implant and the supporting bone; Resin prostheses, on the other hand, absorb shock and therefore reduce the load on the implants and their bone structure. On the other side, the present study was not in agreement with a 3-dimensional finite element analysis (3-D F.E.A.) study that examined the stress built into both bone and implant abutment units when using three different materials (gold alloy, porcelain, and acrylic or mixed resin) for 3-unit prostheses supported at both ends by the implant. The study showed that similar loads were found in bone and implant-abutment units with gold alloy and porcelain prosthesis models. On the other hand, using acrylic or mixed resin instead of gold or porcelain did not reduce the level of stress in the bone, even in the absence of a metal structure [51].

Osstell™ was used in the present study to measure implant stability at the day of prosthesis insertion and after 6, 9, and 12 months to evaluate the degree of biologic stability and success. This is supported with a histomor phometry study [52], Showed that the values of Resonance Frequency Analysis (R.F.A.) are well related to the degree of bone contact with the implant. The implant is stimulated by an oscillating sensor implanted on it, and the specific resonance of the implant/bone resonant system is recorded electronically in the range of 5 to 15 kHz. The values of Frequency Resonance Analysis (R.F.A.) are clinically associated with changes in the implant's stability during bone healing, damage to the implant, and integration of the supra crestal parameters. These data confirm the use of R.F.A.in assessing changes in bone healing and osseointegration after implant placement.

From the point of view of some authors [53, 54], the R.F.A. was supposed to reflect the implant's rigidity in the surrounding bone tissue. Stiffness can be affected by the thickness and density of the bone layer surrounding the implant. Therefore, high structural rigidity can be expected in case of implant contact with increased bone. This viewpoint was found to be corresponding to the R.F.A. of the current study, which gradually increased over the observation period on all groups.

In this study, the mean implant stability quotient (I.S.Q.) values for three groups evaluated at prosthetic insertion were 67.67, 66.56, and 67.89, respectively. The implant stability quotient (I.S.Q.) values at the time of supra-structure insertion can be viewed as a small number compared to values after the next evaluation period. The mean (I.Q.S.) values across the three groups at the end of the follow-upevaluationwere73.44, 75.78, and 77.56, respectively. Also, there was no significant difference (p=0.730) between all groups at the supra-structure insertion time. This would be expected and interpreted as the implants in all groups were not subject to any loading during the healing period.

The implant stability quotient (I.S.Q.) values for three groups after 6, 9, and 12 months of supra-structure insertion were (66.89, 70.11 and 71.57), (66.14, 70.29 and 71.00) and (73.44, 75.71, and 77.43) respectively that can be viewed as a higher number in comparison with values at prosthesis insertion. This would be expected since the implants after prosthesis insertion may have lower stability due to progressive osseointegration and increased bone maturation 57.152, The I.S.Q. Values were higher in group III followed by group II while group I showed the lesser values. This could be interpreted by increased occlusal loading and stress transmitted to the implant with zirconia supra-structure in comparison to vita suprinity and vita enamic may be due to the increased occlusal force may be attributed to the higher elastic modulus of zirconia crown compared to Suprinity and enamic crowns. This agrees with a study that examined the shock-absorbing capacity of nine different restorative materials (Zirconia, two glass ceramics, gold alloy, three composite resin, and two acrylic resin) and concluded that composite resin and acrylic resin crowns were more able to absorb shock from the occlusal force and in turn decrease stress on implant than Zirconia, ceramics, and gold crowns [55].

In the present study, there was a correlation between marginal bone loss (B.M.L.) & implant stability quotient (I.S.Q.); this in agreement with a study [56] found that there is an indirect correlation between marginal bone loss around mandibular implants and implant stability; as bone loss increased, the I.S.Q. Values decreased. On the contrary, another study [57] found no correlation between marginal bone loss and R.F.A. during a 1-year evaluation period.

Conclusion

Within the limitation of this study, we can conclude that:

1. Modified Plaque and Bleeding indices are periodontal parameters that mainly in- influenced by the patient oral care and oral hygiene instructions. The implant superstructure materials are highly polished and adapted to the abutment margin.
2. The superstructure material can influence dental implant stability, suggesting that using a low elastic modulus material will improve stability by reducing the stress generated around a dental implant.
3. The highest implant mobility and marginal bone loss values were recorded with zirconia superstructure followed by vita Suprinity and vita enamic as the last two materials maintain the inclosing bone's usual biological loading. So, it diminishes the risk of peri-implant bone deficiency because of stress shielding.
4. Vita enamic can be a promising superstructure material for an implant-supported prosthesis in the future.
5. More clinical trials are required to estimate the capacity of these materials further intensively in implant prosthodontics. Moreover, extended evaluation periods are required to accurately evaluate the effect of those materials on implant stability and marginal bone loss.

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