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The pink esthetic score following immediate implant placement with immediate provisionalization versus CAD/CAM provisionalization in the maxillary aesthetic

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Abstract

The objective of the Study: Evaluation of the soft-tissue profile around the implant in the aesthetic zone of the anterior maxilla utilizing the PES after immediate implant placement with immediate provisionalization versus CAD/CAM provisionalization.

Methodology: A total of 22 patients were randomly selected from the dental implant clinic. Eleven patients for the study group received CAD/CAM immediate temporization and eleven patients for the control group received chairside immediate temporization in the maxillary aesthetic zone.

Results: In each group, there was a statistically significant increase in PES by time (P-value = 0.001). The mean pink aesthetic score of the control group was 9.57(±1.22) immediately and increased to 11.71(±1.13), while the mean PES for the study group was 9.79(±1.19) immediately and increased to 12.60(±1.86) after 4 months. Between the two groups, there was no statistically significant difference in the mean PES. We recorded overall favorable peri-implant soft tissue conditions. The study group showed a higher mean ISQ value than the control group after 4 months (P = 0.019).

Conclusions: Although the CAD/CAM immediate provisionalization technique showed better esthetic results in immediate implant placement in the esthetic zone, no statistically significant difference between mean PES in the two groups. The immediate provisionalization technique in the two groups represents a valuable treatment choice for the restoration of the immediate implant in the anterior maxilla.

Keywords: Pink aesthetic score, immediate, implant, cad/cam, chairside, provisionalization

Introduction

The increasing demand to replace damaged teeth, especially the front ones, in an aesthetic way, has motivated the development of many solutions in dentistry. One of the most successful medical developments in the field of dentistry is dental implants. Dental implants open the door for restoring the smile with the restoration of function, which will restore the patient's self-confidence, which may be affected by the loss of teeth or the loss of part of it [1]. Dental implants have provided great options for dental treatment [2]. If we want to look at the success or failure of implant treatment from a purely functional spot of view, the stability of the implant, the formation of the bone around it and its functional performance is the criterion for the success of the implant [1, 3]. This means that a good percentage of bone may form round the implant [4], but the loss of part of the bone means the loss of part of the soft tissue around the implant which may affect the ideal aesthetic result [5], which is one of the biggest challenges in dental implants [6, 7]. Fürhauser and Belser assessed the esthetic result using pink and white esthetic scores (PES AND WES) [7, 8]. Tettamanti considers PES to be the best aesthetic indicator for a single implant crown [9]. Teeth are the basic structures for the evolution in soft and hard tissues, and the presence of teeth is a prerequisite for obtaining a consistent appearance and ideal aesthetic results [10]. While the loss of teeth leads to the loss of the basic structure necessary to maintain the alveolar ridge as the bony socket surrounding the teeth and the soft tissues change the esthetics [11]. Therefore, science has introduced many techniques to avoid the resorption of the alveolar bone.

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Non-traumatic extraction, immediate implantation, socket preservation, and grafting, whose objectives were to prevent alveolar resorption by prohibiting the collapse of cortical plates and maintaining dimension [13-16]. Extraction with immediate implantation and immediate loading into the aesthetic area is considered challenging to get the aesthetic to satisfy the patient and preserve the bones in the extraction area so you can maintain function and aesthetics in the affected area [17]. Immediate implantation after extraction with temporization aims to preserve aesthetics during osseointegration of the implant [18]. One of the accelerating developments in dental implants is the use of computer-aided design/computer-aided manufacturing (CAD/CAM) due to some prosthetic advantage [19-21]. However, still, the dental implant literature is recorded improving in the field of clinical conclusion after the implementation of immediate provisional with CAD/CAM [22, 23]. Dentists strive to get the optimal result with a provisional design that can rebuild the esthetic smile of the patient using dental implants with successful long-term results [24]. Immediate CAD/CAM temporization

has a success rate and survival, but could not prove that it is superior when compared to immediate chairside temporization or prefabricated temporization [25]. This study objective was to evaluate the soft-tissue profile round the implant in the anterior maxilla utilizing the PES next to immediate implant placement with immediate chair-side provisionalization versus CAD/CAM provisionalization.

Methods

The study was conducted in the dental implant program clinics of the college of Dentistry- Cairo University-Egypt. Patients indicated for implant placement with non-repairable maxillary teeth in the esthetic zone were included. 22 patients were randomly chosen from the Oral and maxillofacial department, the outpatient clinic. The 22 patients were randomly grouped into the control and study groups by sealed envelopes drawn by the patient on the day of the surgery. Patients demographic data chart in [Figure 1]

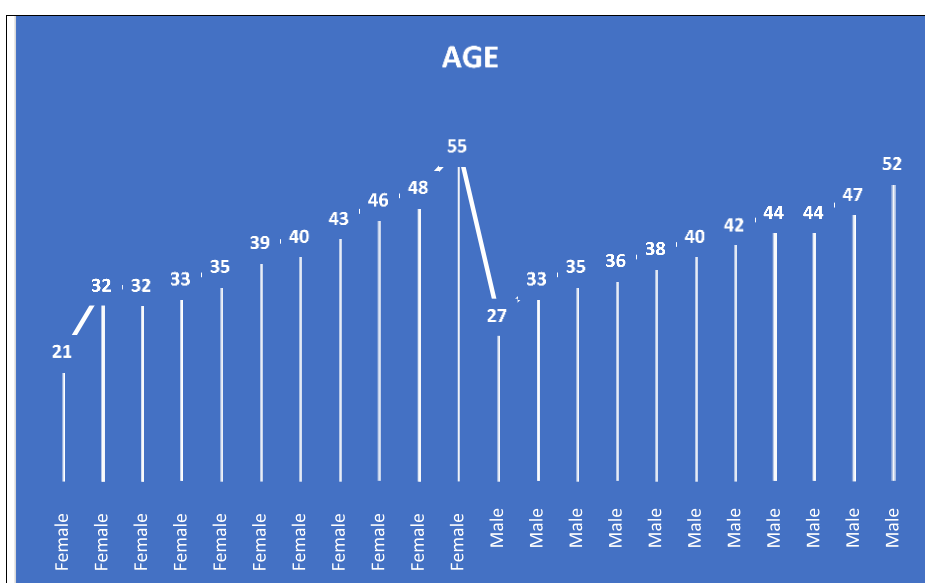


Fig 1: Demographic Data of the Patient Chart

study group: extraction of the tooth and placing the implant immediately followed by CAD/CAM immediate provisional restoration for 11 patients.

Control group: extraction of the tooth and placing the implant immediately followed by chair side immediate provisional restoration for 11 patients.

The criteria of inclusion

- Patients with non-repairable maxillary anterior teeth indicated for extraction.
- Both sexes.
- Patients' age ranges from 20-60 years.
- Non-smoker
- No intraoral hard and soft tissue pathology
- Good oral hygiene.
- No systemic condition that contraindicates for implantation.

Exclusion criteria

- systemic disease that can inhibit the normal healing of the patient.
- E.g., Uncontrolled diabetic patients.

- Psychiatric problems
- Radiotherapy record for the head and neck neoplasia that may affect the implant bone augmentation to the implant site
- Bruxism, emotional instability, immunodeficiency pathology, and unrealistic aesthetic demands.

Intervention

Immediate Implantation with immediate provisionalization in the maxillary aesthetic zone.

General operative procedures

Preoperative Assessment

The participating patients were acquainted with the steps of the research work and informed approval was taken. Then randomized (Randomized computer-generated allocation sequence) was done and all steps have done by the researcher under the supervision of a co-supervisor.

-The surgeon blinded.

-Outcomes assessor was blinded as well as the data analysis.

Patient interview

All patients were estimated by valid history taking and

profound clinical and radio graphical examination and evaluated according to the exclusion and inclusion criteria.

Clinical Examination

1. Participants were examined for suitable Inter- arch and mesiodistal space.
2. The ridge was palpated to inspect the outline for an irregularity that may prohibit the implant procedure.
3. Periodontal examination was done to check the mucosa color, consistency, and contour. Reading of probing depth was recorded and checked for any bleeding on probing.

Radiographic Examination

▪ For each patient preoperative digital panoramic radiograph (OPG) 1:1 magnification or the periapical film was taken to exclude any lesion at the site of interest.

▪ A Cone Beam Computed Tomography (CBCT) scan* was ordered to estimate the labial bone thickness and the palatal bone thickness which should be not less than 1.5 mm, the basal bone width of the apical part of the socket which should be not less than 6 mm, and the available bone height for select the proper implant size to be used. (*Planmeca ProMax 3D Classic, Planmeca, Finland)

The CBCT machine protocol used for all the scans of the study

The Study Group

- Voxel size: 0.25 mm
- Tube voltage: 120 kVp
- Milliampere: 37.07 mAs
- Field of view: 6 cm Height and 16 cm Diameter
- Scanning time: 26.9 seconds

The Implant system

Implant Direct legacy 4 system, The diameters (3.7, and 4.7mm) and length (13 & 16 mm). The implant has a tapered body design and Sandblasting by Large grit which facilitates the osseointegration process. The dental implants have a triple-threaded design which reduces implant insertion time. The same internal hex is shared in all implant sizes.

Pre-operative procedures

1. We discussed with the patients the goals of this study and the steps of Surgery with potential complications and written consent was signed.
2. Before the surgery, we made treatment that included oral hygiene measures directives and plaque control.
3. The primary impression had been made, a study model had been poured and then waxing up was proceeded, and a putty index was constructed.
4. Chlorhexidine HCL 1.25% mouthwash is used by all patients (immediately pre-operatively).
5. The local infiltration anesthesia [Articaine 4% 1:100000 epinephrine] was used.

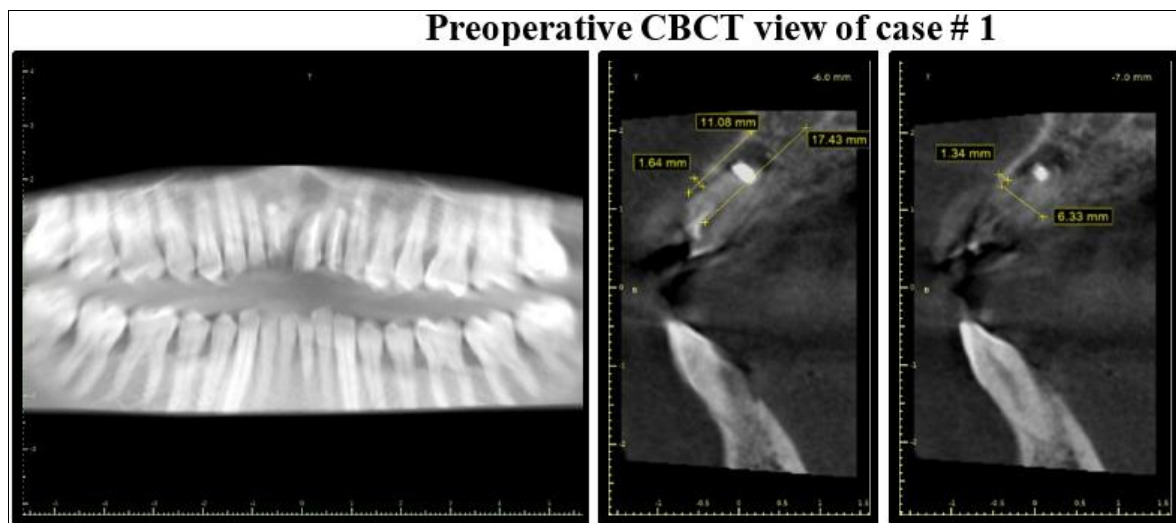


Fig 2: Panoramic view and cross section view



Fig 3: Preoperative occlusal and facial view

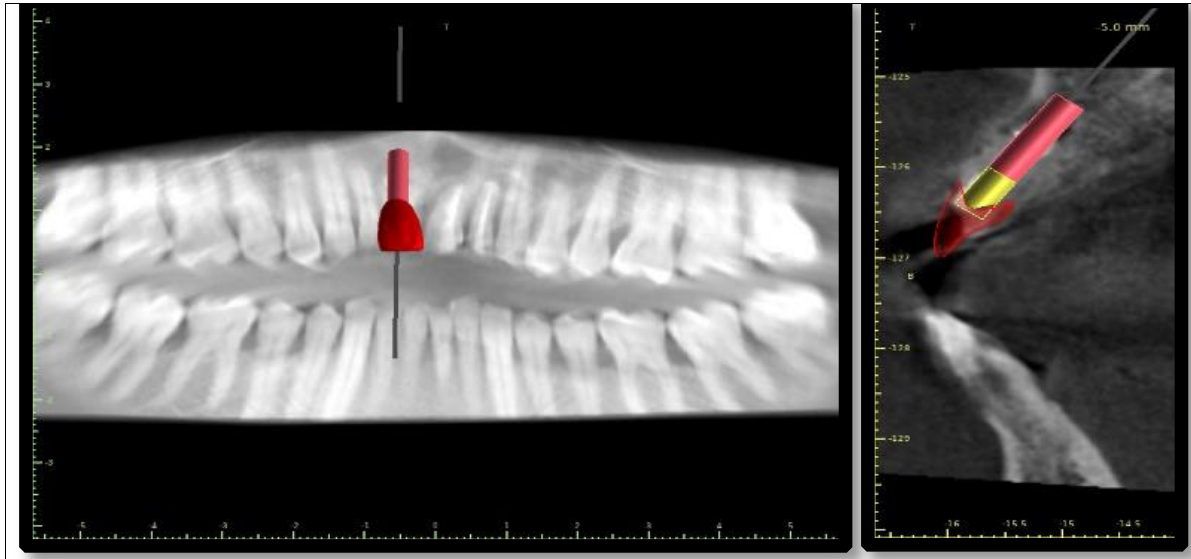


Fig 4: Virtual planning on CBCT

Surgical procedures

Atraumatic extraction was done using tooth luxation with periosteal elevator and removing the tooth using upper anterior forceps [Figure 5].



Fig 5: Atraumatic extraction

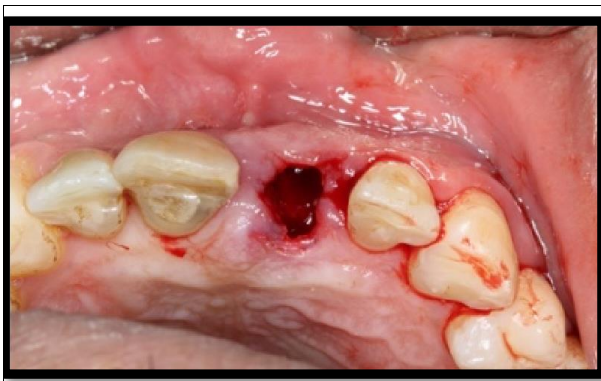


Fig 6: The socket after debridement

Careful mechanical debridement of the socket after extraction was carried out with a bone curette to remove any soft tissue remnants or granulation tissue. All debris was cleaned out with copious saline irrigation [Figure 6]. The Implantation is initiated by engaging the palatal wall to put the implant in a bodily palatal position and to gain sufficient primary stability [Figure 7 a]. This primary stability gained from bone palatal and apical could be enough to be restored immediately with a temporary restoration, and the readings of implant stability quotient (ISQ) were taken.

Implant placement Procedures

Drilling for implant placement is done using an extender drill and Implant Direct legacy 4 system, with diameters (3.7 and 4.7mm) and lengths (13 & 16 mm) used according to the preplanned CBCT [Figure 4]. Drilling is done with copious irrigation and pressure with the thumb finger while drilling and drilling is more palatal to engaging the palatal bone the primary stability of 35 Nmc was achieved with hand wrench. [Figure 7 (a, b, c, d)]

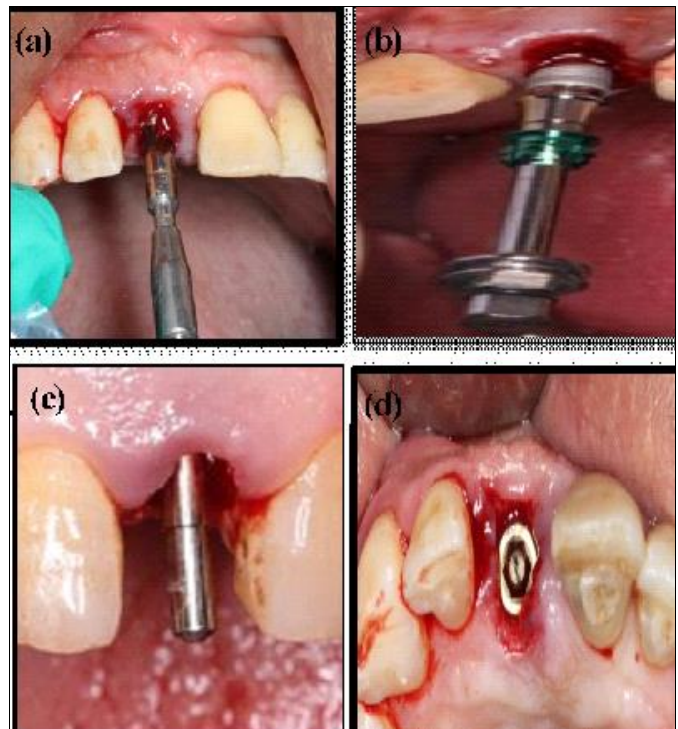


Fig 7: Drilling of the implant with bodily palatal bone engaging, (b) Implant insertion, (c) The parallel pin of inserted implant, (D) the Occlusal view of implant placement.

CAD/CAM Provisional restoration construction procedures

Intraoral scanning was used to scan and take digital records using a scan body and CAD/CAM [Figure 8] and [Figure-9] to design a provisional crown using dental designer software [Figure 10 (a, b, c)] with an emergence profile to Coronal

tissue support and to ensure an "S-shaped" emergence profile would create to allow soft tissue to grow inward [Figure 11 (a, b)]. Then the provisional restoration was screwed [Figure 12]



Fig 8: The scan body for intraoral scanning



Fig 9: Intraoral scanner facial view scan of the upper arch

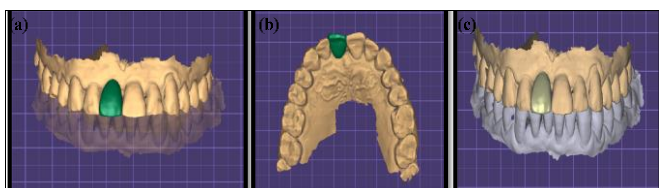


Fig 10: Designing the provisional restorations using dental designer software (a) The facial view of restoration design using dental designer software. (b) Occlusal view of restoration design using dental designer software. (c) Final design of the restoration using dental designer software.

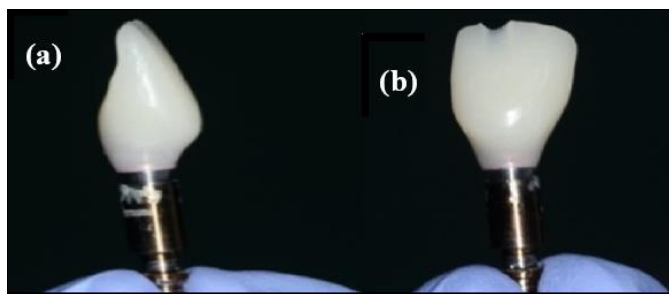


Fig 11(a, b): The S-shaped emergence profile of CAD/CAM provisional restoration



Fig 12: Loading of the CAD/CAM provisional restoration immediately post-operative. (Study group)

**Control group
Preoperative view of case #2**

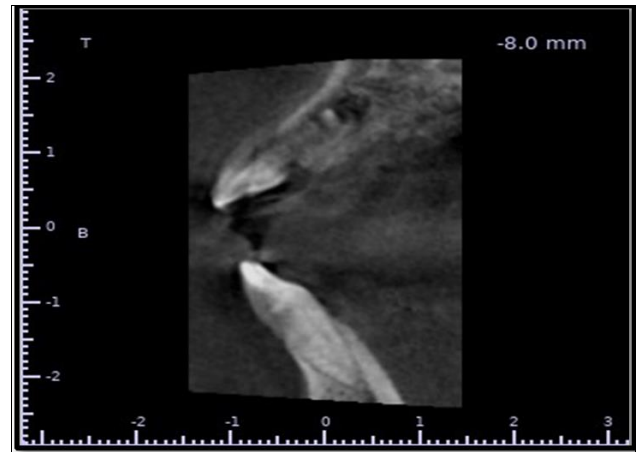


Fig 13: CBCT Cross-section view Preoperative



Fig 14: Intraoral preoperative view

Surgical procedures

Atraumatic extraction was done using tooth luxation with periosteal elevator and removing the tooth using upper anterior forceps. [Figure 15 a, b, c]. implant placement [Figure 16 a, b, c]

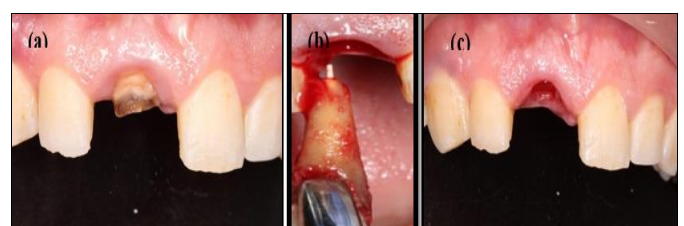


Fig 15(a, b, c): Atraumatic extraction

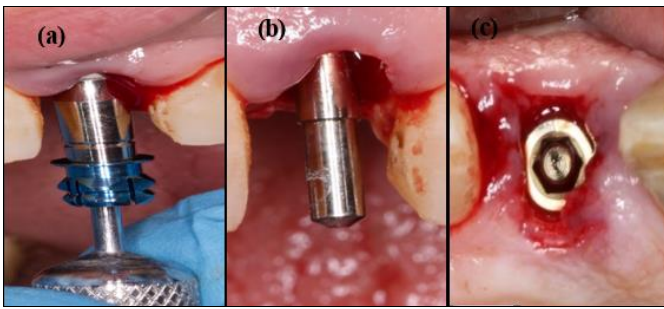


Fig 16: (a) Implant insertion. (b) Facial view of implant parallel pine. (c) Occlusal view of implant placed palatally.

The chairside provisional restoration construction:

A provisional crown was fabricated in the chairside using pro-temp temporary crown material and with an emergence profile for coronal tissue support. S-shaped" emergence profile created to allow soft tissue to grow inward [Figure 17 (a, b, c, d, e, f)] The provisional crown was then screwed.

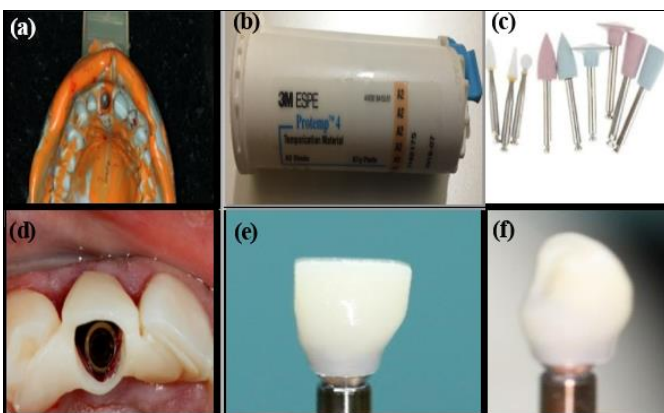


Fig 17: Steps of chairside immediate temporization with finishing and polishing the edges and S-shaped emergency profile (a) Impression (b) Pro-temp temporary material (c) Finishing and Polishing burs (d) creating the temporary crown (e) Facial shape and (f) Lateral shape of the temporary crown

Post-operative care:

Post-operative medications were prescribed as follows: (amoxicillin/clavulanic acid)* tablets 1mg every 12 hours for 7 days, and non-steroidal anti-inflammatory analgesic (Ibuprofen)**400mg every 8 hours orally for 5 days. and 0.12% chlorhexidine*** mouthwash 2 times daily for 14 days. Patients were instructed to follow oral hygiene measures and to use (Chlorohexidine 0.2% mouthwash) for 2 weeks.

Post-operative follow-up in the study group

All provisional restorations were constructed out of occlusion with a space of approximately 1mm clearance and instructed the patient not to occlude on the provisional restoration and to use it for esthetic purposes only.

All patients were clinically assessed at 1 week, 4 weeks, 16 weeks, and 24 weeks postoperatively.

The assessment includes

Implant stability was measured intraoperative (T₁) and 4 months after surgery(T₂), the implant Stability Quotient (ISQ) was measured using the Osstell device.

The amount of bone loss was measured after 6 months using the linear measurement from CBCT. (T₃)

Pink Esthetic Score (PES) was evaluated around the implant at the time of crown placement(T₁) and 4 months post-loading (T₂).

- Final prosthesis was loaded after 4 months.
- *Augmentin 1 gram tab., Pfizer, United States of America.
- **Brufen 400MG 30tab. Abbott/Cairo, Egypt.
- *** Orovex mouthwash, Macro group, Egypt

The pink esthetic was evaluated immediately postoperative and 4 months later

Pink esthetic evaluation criteria

The Pink Esthetic Score (PES) recorded 7 values: mesial papilla, distal papilla, alveolar process deficiency, soft-tissue level, soft tissue contour, soft-tissue color, and texture. All values were evaluated with a 2-1-0 mark, with 0 being the poorest score and 2 being the best. The mesial and distal papillae were examined for completeness, incompleteness, or absence. All other values were evaluated by matching with a reference tooth (the corresponding tooth for the anterior region or a neighboring tooth for the premolar region. The superior possible result was 14.

Final restoration construction

Intraoral view at final restoration construction time. [Figure 18(a, b, c, d)].

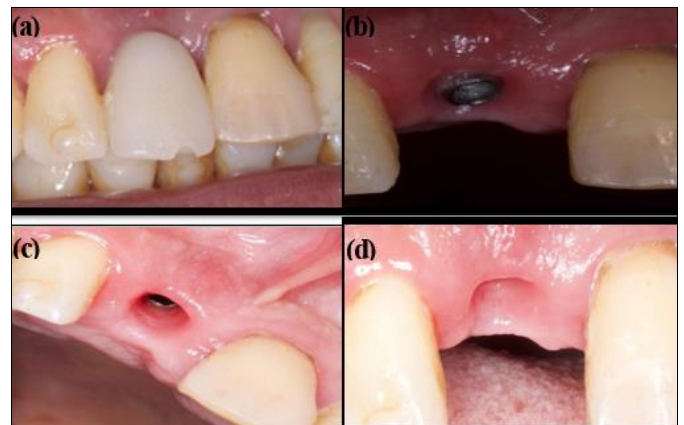


Fig 18: (a) Pink esthetic score and the facial view at 4month postoperative (b) contour of the tissue (c) coronal tissue and the emergency profile around the implant (d) the papilla around the implant

Laboratory Steps

A dental scanner was used to scan the cast and take digital records using a scan body and CAD/CAM to design customized gold anodized abutment and zirconia crown. Dental designer software is used to make the design customized gold anodized abutments and zirconia crowns [Figure 19(a, b, c, d, e)]. The shade of the crown was chosen [Figure-20].

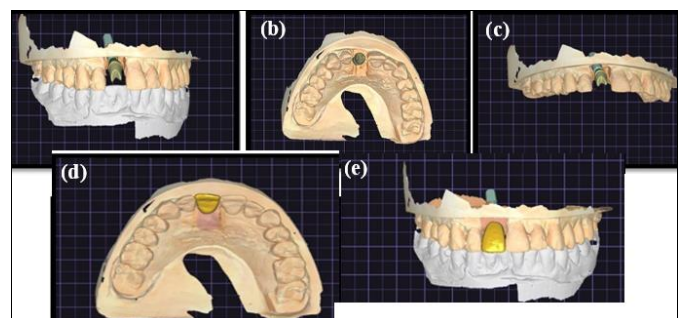


Fig 19: Dental designer software view of customized gold anodized abutment (a, b, c) and zirconia crown (d, e)



Fig 20: Shade of the crown

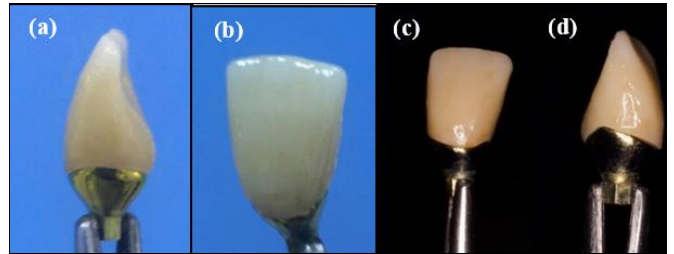


Fig 21: The final restoration lateral view (a, c) and facial view (b, d)

The final crown [Figure-21]. Placement of the final [Figure-22]. CBCT cross-section view and periapical x-ray for the final restoration [Figure-23].



Fig 22: Placement of final restoration (a) facial view (b) the smile of the patient



Fig 23: CBCT cross-section view and periapical x-ray for the final restoration

Result

Statistical methods

The Statistical analysis proceeded using IBM SPSS Statistics for Windows, Version 26.0. $P \leq 0.05$ was the significance level.

1. Demographic data

This study was conducted on 22 subjects from the outpatient clinic of the faculty of dentistry, at Cairo University. The present study was approved by the ethics committee at the Faculty of Dentistry, Cairo University code number (4-17-

21).

The mean and standard deviation (SD) values for age in the study were $38.55(\pm 9.4)$ years old for 11 males (50%) and $42.8(7.6)$ for 11 Females (50%).

I: Pink esthetic evaluation.

Pink esthetic score (PES) evaluation study group case #1 and case #2 (a) Preoperative (b) Postoperative with immediate temporization (c) Final restoration. [Figure 24], Table -1 and [Figure25-Liner chart representing the PES in the study group]

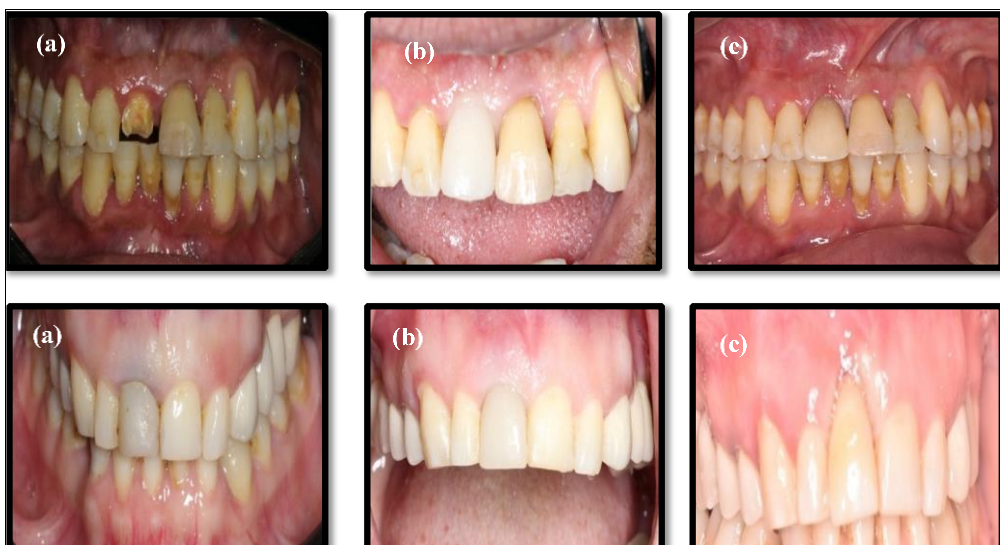


Fig 24: Pink esthetic evaluation of study group case #1 and case# 2 (a) preoperative view (b) Postoperative view with CAD/CAM immediate temporization (c) final restoration facial view

Table 1: Mean (SD) Pink esthetic score of the study group

Time of PES evaluation	Mesial Papilla	Distal Papilla	Level of soft tissue margin	Soft tissue contour	Alveolar process	Soft tissue color	Soft tissue texture	Mean (SD) OF PES
Postoperative	1.53±	1.13±	1.14±	1.44±	1.54±	1.52±	1.49±	9.79(1.19)
4-month later	1.89±0.45	1.75±0.35	1.87±0.51	1.89±0.49	1.47±0.72	1.87±0.53	1.86±0.51	12.60(1.86)

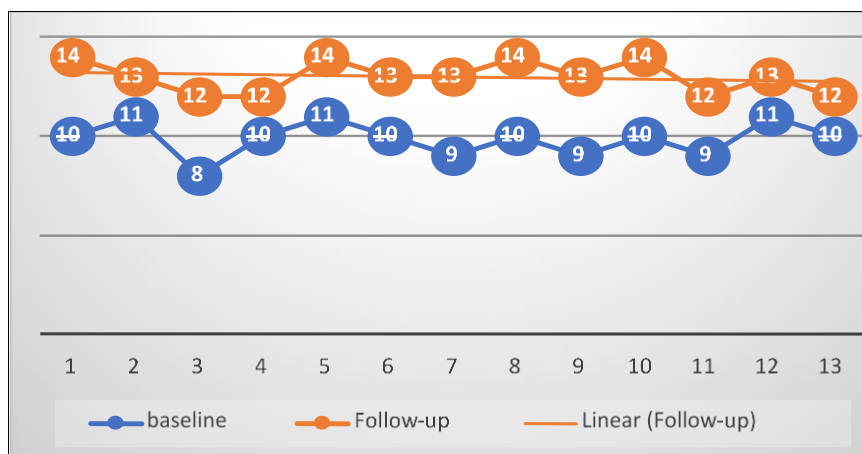


Fig 25: Liner chart for comparison between the PES in baseline (Postoperative) and follow-up (after 4 months) the study group

Pink esthetic score (PES) Control group. (PES) evaluation control group case #1 and case #2 (a) Preoperative (b) Postoperative with immediate temporization (c) Final

restoration [Figure 26], Table -2 and [Figure 27] Liner chart representing the PES in the control group.

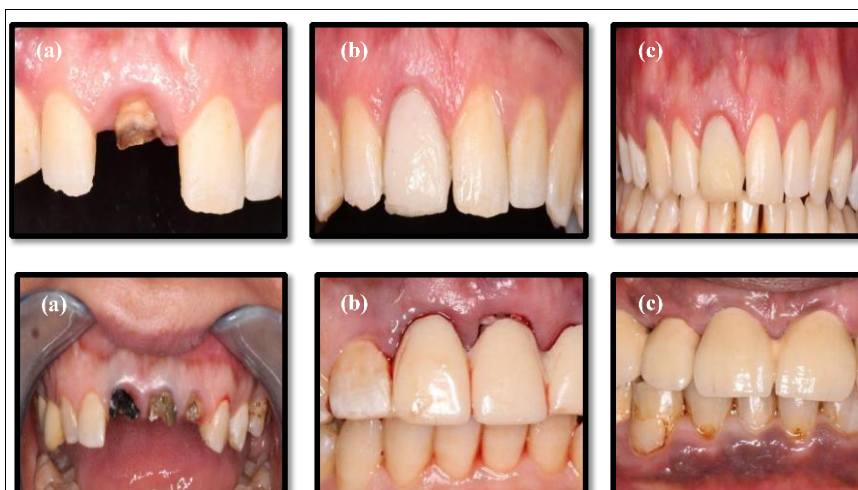


Fig 26: Pink esthetic score (PES) evaluation in control group case #1 and case #2 (a) Preoperative view(b) Postoperative view with immediate temporization (c) Final restoration facial view

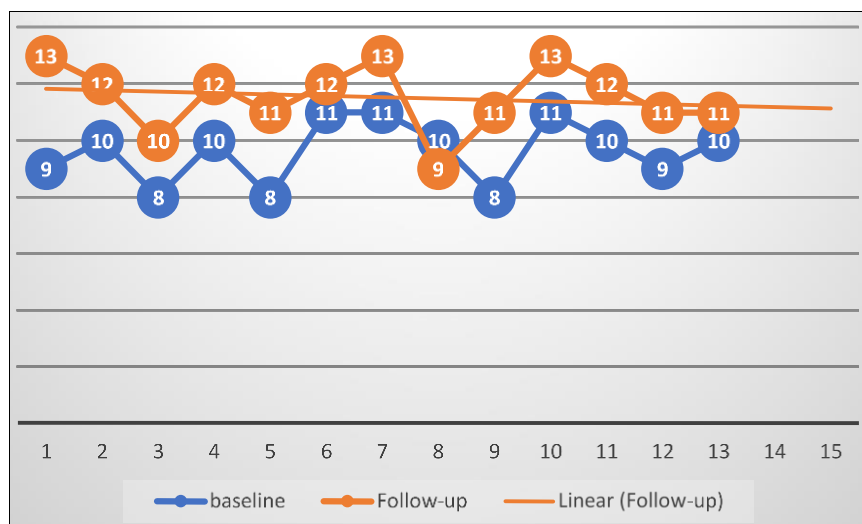


Fig 27: Liner chart for comparison between the PES in baseline (postoperative) and follow-up (after 4 months) in control group

Table 2: Mean (SD) Pink esthetic score of control group

Time of PES evaluation	Mesial Papilla	Distal Papilla	Level of soft tissue margin	Soft tissue contour	Alveolar process	Soft tissue color	Soft tissue texture	Mean (SD) of PES
Postoperative	1.45±0.39	1.08±0.87	1.05±0.85	1.40±0.58	1.55±0.66	1.54±0.91	1.50±0.74	9.57(1.22)
4-month later	1.76±0.40	1.59±0.33	1.68±0.52	1.77±0.43	1.34±0.67	1.84±0.51	1.73±0.43	11.71(1.13)

Comparison between Pink esthetic score the two groups

1. Comparison between the two groups Immediately post-operative and four months; there was no significant difference

between median PES in the two groups (P-value = 0.114, Effect size = 0.209) and (P-value = 0.068, Effect size = 0.459), respectively.

Table 3: PES comparison between the two groups by descriptive statistics and results of Mann-Whitney U test.

Interval	Study Group	Control Group	P-Value*	Effect size (d)
Immediate postoperative				
Median (Range)	10(8-12)	10(8-12)	0.114	0.209
Mean (SD)	9.79(1.19)	9.57(1.22)		
After 4 months				
Median (Range)	13(12-14)	12(10-14)		
Mean (SD)	12.60(1.86)	11.71(1.13)	0.068	0.459

*: Significant at P ≤ 0.05

2. Changes within each group

There was a statistically significant increase in PES in both

groups by time (P-value = 0.001, Effect size = 3.329) and (P-value = 0.001, Effect size = 3.056).

Table 4: PES changes within each group by descriptive statistics and results of the Wilcoxon signed-rank test.

Interval	Study group	Control group
Immediate postoperative		
Median (Range)	10(8-12)	10(9-12)
Mean (SD)	9.79(1.19)	9.57(1.22)
After 4 months		
Median (Range)	13(12-14)	12(10-14)
Mean (SD)	12.60(1.86)	11.71(1.13)
P-Value	0.001*	0.001*
Effect size (d)	3.329	3.056

*: Significant at P ≤ 0.05

II: Amount of Bone Loss

A-Horizontal bone height (mm)

Comparison between the two groups: immediately post-operative and 24-weeks, there was no significant statistically difference between the two groups (P-value = 0.986, Effect size = 0.00001) and (P-value = 0.232, Effect size = 0.053), respectively. As regards horizontal bone loss after 24 weeks; the study group displayed statistically significantly lower median horizontal bone loss than the control group (P-value = 0.001, Effect size = 1.8).

B-Vertical bone height (mm) Comparison between the two groups: Immediately post-operative, there was no significant statistically significant difference between the two groups (P-value = 0.159, Effect size = 0.523). The total vertical bone loss after 24 weeks; the study group showed significantly statistically lower median vertical bone loss than the control group (P-value = 0.002, Effect size= 1.354)

III: Implant stability (ISQ unit).

A-Immediately after surgery when comparing implant stability in the two groups, there was no significant statistical difference between the two groups (p = 0.408, effect size = 0.023). four months later, the study group showed a significantly Statistical higher mean ISQ value than the control group (P = 0.019, effect size = 0.178)

B- Changes in ISQ by time within each group

there was a significantly statistical increase in ISQ by time in the both group (P-value<0.001, Effect size = 0.678) and (P-value <0.001, Effect size = 0.455), respectively.

Discussion

The immediate implant insertion in a fresh socket of extracted tooth currently becomes a reliable procedure with high success rates [26, 27]. However, it is a complex process that needs good surgical skills and enough experience to achieve a good aesthetic result [28].

The immediate provisional crown after implant insertion at the time of tooth extraction in the anterior of the maxilla gives promised results in conserving the interdental papilla and facial gingival heights [17, 29, 30].

The mucosa surrounding the immediate implant can recover over the contour of the provisional crown [21]. Maintaining the anatomic architecture of the socket after extraction is an important factor in achieving esthetic outcomes with the immediate implant insertion and immediate placing of restoration in the esthetic zone [12, 18]. The pink esthetic score (PES) estimates the esthetic results of soft tissue surrounding the implant with regarding 7 points [7, 8]. The mesial and distal papilla, soft-tissue contour, soft-tissue level, soft-tissue texture, soft-tissue color, and alveolar process defect. PES may vary over time and can be a useful tool for monitoring soft tissue changes [21]. Pink Esthetic Scores of 10–12 record good esthetic results, while scores of 13 and 14 consider optimum implant esthetics [21]. In this study, we compare the

results of the pink esthetic score of immediate implant placement with immediate provisionalization by CAD/CAM provisionalization with chairside provisionalization.

In this study, atraumatic tooth extraction was performed to reduce the degree of labial bone resorption and preserve the gingival contour after extraction [13, 31]. We used peristomes carefully as recommended for luxation during extraction. Also, we put the implant more palatally positioned to gain primary stability and because the buccal implant position is sensitive to the final placement of the facial gingival margin [32, 33]. In their studies, Chen and Buser recommend ready the osteotomy palatally and preventing the use of bigger size implants to minimize the danger of reverse esthetic results for immediate implant insertion in immediate extraction sites [34].

In this study The mean vertical bone loss for the control group was $0.73(\pm 0.45)$ and it was $0.35(\pm 0.14)$ for the study group while the mean horizontal bone loss for the control group was $0.28(\pm 0.13)$ and it was $0.11(\pm 0.08)$ for the study group.

Degidi *et al.* 2010, mentioned in their study that all implants with major implant stability quotients (ISQs) less than 46 ISQ failed, while those with ISQs greater than 60 experienced successful osseointegration (35). This result is consistent with this study, as the mean implant stability quotient (ISQ) of the control group was 64.8 ± 3.6 and increased to 70.1 ± 1.8 at 4 months, while the mean implant stability quotient (ISQ) of the study group was 65.7 ± 3 and increased to 73.4 ± 2.5 at 4 months.

In this study, we placed immediate temporary crowns without occlusal contact and good primary stability in both groups, measured by an insertion torque greater than 35 Ncm or a resonance frequency greater than ~65 RFI and appropriate patient status and cooperation.

In the study group, we used CAD/CAM and an Intraoral scanner to take digital intraoral records and fabricate a digitally customized provisional crown. CAD/CAM provisional restoration has a predictable fit and durability, and modifiable prosthesis parameters including finish line location, the emergence profile, thickness, and external contour [19, 20]. The digital design can aid in conserving the 3D tissue topography [36]. CAD/CAM provisional restoration can preserve the pink esthetic score [37].

In the control group, the provisional crown was made chairside with an emergence profile with S-shape to permit extreme space fill by the coronal soft tissue surrounding the implant as reported by Gluckman [38]. High pink esthetic scores and soft tissue stability can be gained by this technique of temporization during the follow-up. the internal beveled chamfer is recommended, which permits the outfit of an S-shaped emergency profile for the restoration which can create a sufficient prosthetic room, should not be minimal blanching of the facial gingiva. The provisional restoration should not have touched excursive motion or maximum intercuspation [39]. In the control group after the removal of the temporary restoration, we found a slight reduction in the soft tissue contour in one case. We think this complication is due to inflammatory lesions of the surrounding peri-implant tissues and poor oral hygiene leading to bacterial biofilms attacking the soft tissue leading to peri-implant mucositis. We prescribed antibiotic and anti-inflammatory drugs and improved oral hygiene and advised the patient to use mouthwash for two weeks. Scott B. Ross *et al.*, concluded that the presence of characteristics such as the use of a custom anatomic interim abutment, gingival biotype, implant diameter, surgical method, and/or the tooth extraction purpose could affect the rate of gingival recession [40]. Khzam *et al.*

estimated the esthetic results by dimensional change analysis of the midfacial soft tissue when using immediate implant placement and provisional restoration. They reported in 11% of the cases in progress soft tissue recession (>1 mm) [41]. In another study, they test modification in the contour of the labial soft tissue post-extraction and immediate implantation and temporization (Tian *et al.*, 2019A continuous alteration in the labial soft tissue contour during a one-year follow-up was recorded (mean 0.62) [42].

The PES assessed by (Fürhauser *et al.* [8], Gehrke *et al.* [5], and Belser *et al.* [43] and was suggested to yield reproducible esthetic results. PES is the most esthetic index able to remake suggested for clinical use (Tettamanti *et al.* 2016) [9]. Pink Esthetic Scores of (10–12) are defined by (Stephen T Chen and Daniel Buser) as a good esthetic result, while scores of (13 -14) mark ideal implant esthetics [44].

Within the groups of this study, the pink esthetic score median and range in the control group was 10 (8-12) after the operation and increased to 12 (10-14) after 4 months. The pink esthetic score median and range in the study group was 10 (8-12) after the operation and increased to 13 (11-14) after 4 months. The pink esthetic score of J G Wittneben *et al.* (2016) values of 7 in set A and 7.65 in set B were lesser than the result of this study [45].

Pieri *et al.* consider PES of ≥ 8 clinically acceptable [46] (93). Also, Cosyn *et al.* reported that PES < 8 is unfavorable and PES from 8 to 12 were considered favourable [47]. The mean PES in the present study was $11.71(\pm 1.13)$ in the control set and $12.60(\pm 1.86)$ in the study set after 4 months of implantation. Rudolf Fürhauser *et al.*, registered a PES result of 11.6 after 6 month [21].

The mean (SD) PES of the CAD/CAM provisional restoration group (the study group) in this study improved from $9.79(\pm 1.19)$ immediately post-operative to $12.60(\pm 1.86)$ after 4 months.

This result can be compared with the result registered by Michael Payer *et al.* (2012) [20], where they evaluated PES in immediate implants were restored with immediate CAD/CAM provisional restoration their results were improved from 8.13 (± 1.5) to 10 (± 2). Also, the PES of Jiabao Zhuang *et al.* (2021) with CAD/CAM provisional restoration improved from 8 to 12(24). Vincent J. J. Donker *et al.* (2022) mean PES was 7.3 (± 1.2) and improved to 8.3 (± 1.3) [48].

The PES of the Chairside provisional restoration group (control group) in this study improved from $9.57(\pm 1.22)$ immediately post-operative to $11.71(\pm 1.13)$ after 4 months. Edith Groenendijk *et al.* (2020) scored mean PES improved from 9.9 to 12.1 which is comparable to this study [18] (96). Robert Noelkin *et al.* (2013) scored mean PES = $11.3(\pm 1.8)$ which is approximate to the results of our study [16] (97). JYK Kan *et al.* (2018) scored PES = 13 which is slightly higher than this study. Nearly to that Alberto Sicilia-Felechosa *et al.* (2019) scored PES = 12.4 [49].

In our study, the pink esthetic scores of the study group were slightly higher than those of the control group, but no statistically significant difference. These found are consistent with what was mentioned by long *et al.* (2017) [25, 65] and Comparable to the conclusion of J.G. Wittneben *et al.* (2016) [45] in their study and Amir Raei *et al.* (2021) (67) in a systematic review and meta-analysis when they said no significant differences in esthetics outcomes between the two fabrication methods found [50]. Ulf Schepke *et al.* (2016) concluded that using CAD/CAM is not associated with an advance in clinical performance or patient gratification [51]. The results of our study did not match those of Michael Payer

et al. (2012), Jiabao Zhuang, and Vincent J.J. Donker *et al.* (2022) because they believe that CAD/CAM restoration yields better results with a statistically significant difference in their study [20, 24, 48].

Conclusions and Recommendations

Thus, within the limitation of this study, the following could be concluded: Although the CAD/CAM immediate provisionalization technique showed better esthetic results in immediate implant placement in the esthetic zone, no statistically significant difference between mean PES in the two groups. The immediate provisionalization technique in the two groups represents a valuable treatment choice for restoring the immediate implant in the anterior maxilla. Which can provide an improvement in the tissues surrounding the implant. Also, Furthermore studies with long-term follow-up are needed.

In this study, we found that the study group showed a significantly Statistically higher mean ISQ value than the control group after four months of immediate implant placement with immediate provisionalization. There is a need to study the reason for this difference in the stability after four-month we recommend future studies concerning this point.

Conflict of Interest

Not available

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Reference

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