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Optimizing Soft Tissue Emergence Profile Around One-Piece Dental Implants

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ABSTRACT

Background and Objective: One-piece implants were introduced many years ago, however, in the last years, they have gained acceptance as a therapeutic alternative for many clinical cases. The soft tissue surrounding the neck of one-piece implants, particularly in the esthetic zone, is a cause for concern despite the clinical effectiveness of these implants. The purpose of this study is to propose a simple way for optimizing soft tissue around one-piece dental implants.

Material and Methods: Between January 2022 and January 2024, a total of 137 patients were treated with single-piece dental implants that were placed in the aesthetic anterior region of the mouth. A temporary crown in the office was created using a flowable composite that was temporary in nature using the mold of the Cervico system (VP Innovato Holdings Ltd, Lemessos, Cyprus). After three months, the patients' rates of success, failure, and complications were evaluated. The Jemt Papillary Index was employed to assess the papilla following the placement of the final prosthesis, a Satisfaction Visual Analog Scale (VAS system) was created to gauge the patient's satisfaction. The data was evaluated by means of descriptive statistics utilizing the SPSS (version 30) package of software.

Results: The mean age of all cases was 32.10 years, with 78 (56.9%) male cases and 59 (43.1%) female cases. After 3 months among 137 inserted implants; 97.8% of the implants were successfully osseointegrated. After removal of the temporary crown a very nice anatomical emergence profile created and the results of papilla index after three months showed that the majority of the cases (84 cases comprises 61.3%) ended with score number 3, which means Optimal soft tissue contour and the papillae fill up the entire proximal space. Finaly the results of Satisfaction Visual Analog Scale (VAS) showed that 120 cases (87.6%) were have most positive response to the dental implant treatment.

Conclusion and Clinical implications: We concluded that using of a customized composite temporary crown fabricated by Cervico system offers a very simple and time-saving technique for the clinician, aiding in splinting the implants and obtaining nice emergence profile around one-piece implants.

Keywords: Aesthetic Zone, Clinical Studies/Trials, Cervico System, Customized Healing Abutment, One-piece Dental implants.

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INTRODUCTION

The profile of emergence is the portion of the complex that includes the bone crest and the free gingival margin. The long-term health and beauty of the dental repairs, including the aesthetic zone, is contingent on this area.[1] The profile's shape is responsible for causing the soft tissue composition to remain and be maintained. This is of special importance in the immediate treatment of practical situations. Profile changes during the healing process (primarily at the stage of recovery) can be utilized to shift the tissues toward the axis and to alter the shape of the papilla.[1]

Since One-piece dental implants became more common, they have been studied in clinical settings in order to address some of the issues associated with two-piece implants.[2] The eradication of both the proximity and the necessity of using an impression coping has a direct effect on the expense of treatment. Additionally, the leakage of microorganisms at the interface between the abutment and the fixture is absent in One-piece dental implants.[3,4] Additionally, they are operated on in a single-stage procedure, avoiding additional surgery on the soft or bone tissues.[5,6]

A single-piece implant is designed to function immediately as well as to be placed immediately in fresh sockets in extraction. The immediate protocol for treatment has multiple benefits over the delayed protocol, including less surgery, less time spent on treatment, and less trauma to the patient. Additionally, immediate placement of the implant after the extraction may preserve the height and width of the alveolar bone and provide the most effective soft tissue esthetics.[7,8]

Despite the aforementioned benefits, one-piece implants have also been subject to a few limitations. After the placement of a single piece of dental implant, the angle of the abutment cannot be altered, this is very important because precise placement of the implant is crucial, [7] whereas the angle of the abutment can be altered in two-piece dental implants, the abutment can be prepared with a specific angle. In one-piece dental implants, the angle of the abutment is predetermined.

Additionally, there are concerns regarding the soft tissue surrounding the neck of a single-piece implant. The objective of this research is to propose a simple method of enhancing the soft tissue around a single-piece dental implant in the esthetics zone.

MATERIAL AND METHODS

Patient Selection:

A clinical study on patients who requested tooth replacement via dental implants from January 2022-February 2024, a total of 137 one-piece dental implants were surgically placed for patients. Patients were considered eligible for the study if: they were 20 years old or older; they wanted to have single tooth replacement in the aesthetic region of the mouth; the anterior region (central and lateral incisors and canines). Patients that are pregnant or lactating, have blood disorders, utilize steroidal or anticoagulant drugs, have disorders of immunity, have a smoking habit, have problems with dental hygiene, and are unwilling to maintain their appointment schedule were excluded from the study. Patients had toothless cavities and the causes of the extractions of teeth were documented in the study as periodontal disease, severe decay, root injury, endodontic issues, or trauma.

The ethical approval was granted by the Ethical Committee of the College of Dentistry, Hawler Medical University, Erbil, Iraq. The research followed recognized international rules for the protection of participants in human research, these rules are listed in the Declaration of Helsinki. Before the study began, each patient participating in it received informed consent..

Clinical and Radiographic Evaluation:

After clinical evaluation, a radiographic evaluation using Peri apical radiography and Cone Beam Computed Tomography (CBCT) were done for all patients (Figure 1). In this step we measured the quantity of bone (Hight and width) of available bone.

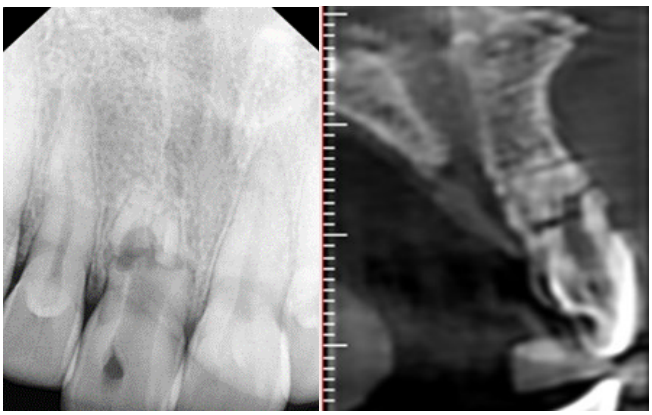


Figure 1: Peri apical radiography and Cone Beam Computed Tomography (CBCT) for one of the patients had history of dental trauma to upper right central incisor when he was a child.

Surgical procedure and fabrication of Customized Healing Abutment:

The implants were placed according to the instructions from the manufacturer. The implants were used in the study are Compressive one-piece implants from ROOTT Implant System (TRATE AG, Swiss).

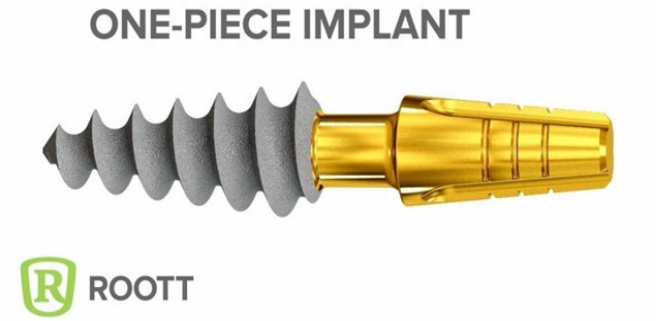


Figure 2: Compressive One-Piece Implants, ROOTT Implant System (TRATE AG, Swiss).

The surgical techniques involved atraumatic extraction with flapless approach followed with implant bed preparation and implant placement (Figure 3).

Figure 3: Extraction of hopeless tooth with immediate implant placement using one-piece dental implants.

Then Instead of placement of provisionals made by the laboratory, we placed a customized healing abutment (as temporary crown) fabricated chairside in the clinic by using the mold of Cervico system (VP Innovato Holdings Ltd, Lemessos, Cyprus) (Figure 4). The material where the customized healing abutment was fabricated is nanohybrid flowable composite resin material (Beautifil Flow Plus X, SHOFU INC, Japan) which added to the cervico mold increment by increment and light cured.

Figure 4: Cervico mold is part of Cervico device that aids in chairside fabrication of customized healing abutments and customized impression posts for any implant system.

The Cervico Mold is an in-office tool used for the fabrication of anatomically shaped healing abutments and Provisionals for tow-piece dental implants.[9] And as far as we know we are the first one who are using the cervico system for one-piece dental implants and evaluating its efficacy for optimizing emergence profile around one-piece dental implants.

The steps for fabrication of Customized healing abutments:

Step 1: Preparation of materials and equipment: nano-hybrid flowable composite resin material (Beautifil Flow Plus X, SHOFU INC, Japan), Plastic burnout or plastic impression post and plastic prosthetic analogue for one-piece implant of ROOTT Implant System (TRATE AG, Swiss), Cervico system (VP Innovato Holdings Ltd, Lemessos, Cyprus) (Figure 5).

Figure 5: Plastic impression post and plastic prosthetic analogue for one-piece implants of ROOTT Implant System (TRATE AG, Swiss).

Step 2: The plastic prosthetic analogue inserted to the base of Cervico mold, then plastic impression post for one-piece implant placed on the abutment part of the prosthetic analogue. After that nano-hybrid flowable composite resin material (Beautifil Flow Plus X, SHOFU INC, Japan) added to the open space between the plastic and the cervico mold increment by increment and light cured (Figure 6).

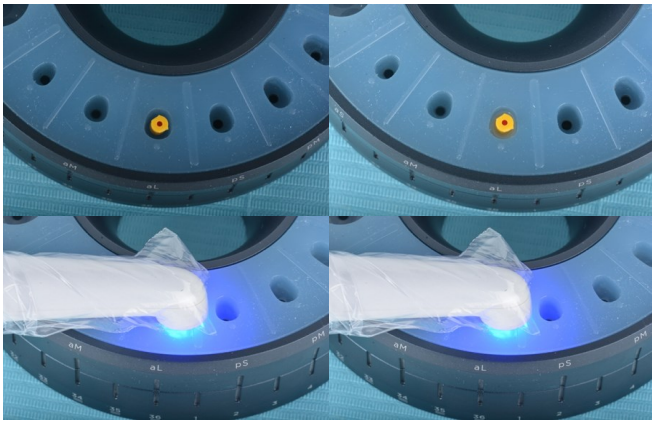


Figure 6: The flowable composite incrementally added to the space between the mold and plastic impression copings.

Step 3: The fabricated customized healing abutment taken out from the mold and polished very well using polishing paste and polishing brush (VDDI, Germany) as the soft tissue around dental implants likes smooth surfaces (Figure 7).

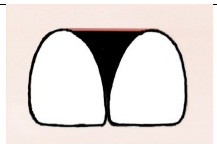
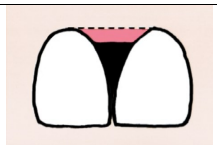
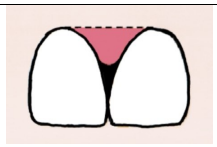
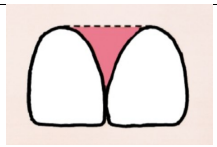
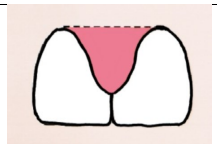
Figure 7: Customized healing abutment polished using polishing paste and polishing brush.

After creating the provisional crown using the Cervico system, the crown is immediately fixed with the use of a one-piece implant that is attached to the abutment (Fuji I, GC Company, Japan). Next, the agent responsible for etching the teeth' proximate surfaces for 15 seconds utilizes a special etching medium. The region is then irrigated with water and dried out with air. A bonding agent has subsequently applied a healing bond to the surface of the custom-made abutment and adjacent teeth, this bond is light-cured. Ultimately, the temporary crown is bonded to the adjacent teeth with a composite resin material that is completely out of position. (Figure 8).

Figure 8: The customized healing abutment which acts as temporary crown splinted with adjacent teeth.

Follow-up and Evaluation :
After a three months interval, implant success/ failure and complications for the followed technique were assessed. The papilla was evaluated after insertion of final prosthesis using the Jemt Papillary Index[10], which grades the papilla on a scale of 0–4, where '0' indicates No papilla present and '3' indicates excellent soft tissue contour; the papillae fill up the entire proximal space and are in good harmony with the adjacent papillae (Table 1).

Table 1: The papilla index according to Jemt's description. (10)

Jemt Papillary Index		
Score	**Clinical Situation**	**Description**
0		No papilla present and no sign of a soft tissue slope adjacent to the single restorative procedure.
1		Less than the half of the papilla's height is present. A protuberance on the soft tissue's concavity side is observed, this is adjacent to the single-rooted crown and the adjacent tooth..
2		Some of the papilla's height is present, but it does not extend past the point of contact between the teeth. The papilla isn't completely in sync with the other papillae in its vicinity, between the teeth.
3		Optimal soft tissue contour. The papillae fill up the entire proximal space and are in good harmony with the adjacent papillae.
4		The papillae are hyperplastic and covers too much of the single-implant restoration and/or the adjacent tooth. The soft tissue contour is more or less irregular.

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A visual analog scale for satisfaction (VAS sytem) was created to assess the degree to which patients are satisfied. The scale had a 100-mm-long horizontal stripe that spanned from completely satisfied to totally unsatisfied. At the top of the scale, the question asked: Are you happy with your dental implant treatment? Expressions that were visualized above the line were used to demonstrate success in a graphical manner (Figure 9). All patients were given the scale as a paperweight and were asked to underline the line at a position that reflected their satisfaction. With a ruler, the length of the millimeters was recorded and then converted to points. The VAS system for satisfaction had a range of 0 (worst, totally dissatisfied) to 10 (best, completely satisfied) points..

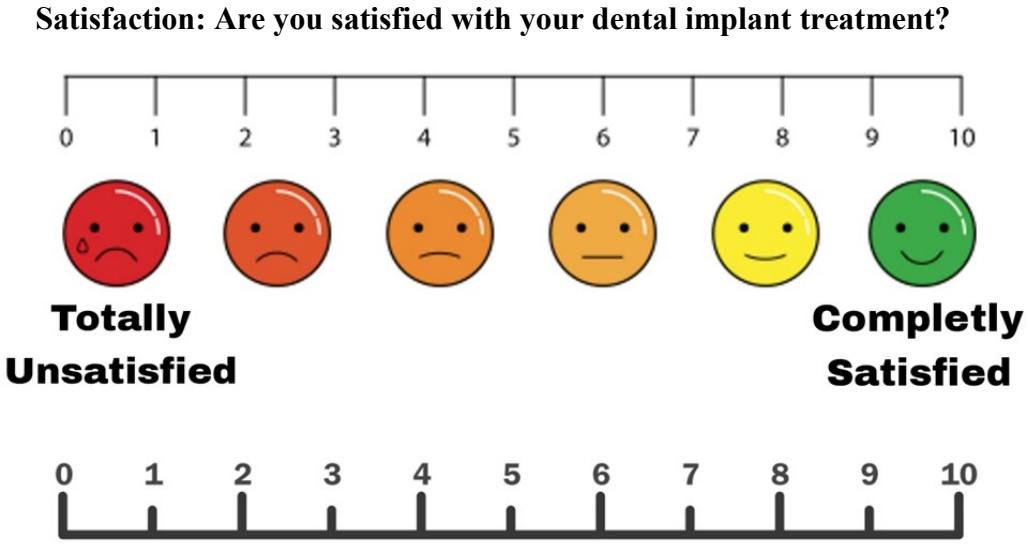

Figure 9: Satisfaction Visual Analog Scale: Respondents rated their level of satisfaction on the above 11-point scale where '10' was the most positive and '0' was the least positive response.

Data Analysis

The data were tested by descriptive data analysis using the Statistical Package for Social Sciences (SPSS, version 30) (IBM Corp., NY, USA).

RESULTS

137 cases were participated in our study from January 2022 to January 2024, of which, 78 (56.9%) were men and 59 (43.1%) were women. The average age of all cases was 32.109 years with a standard deviation of 0.133. deviation of 9.201. The specifics of the gender composition of the participants are documented in (Table 2).

Table 2: Gender of patients enrolled in the study

		Frequency	Percent	Valid Percent	Cumulative Percent
	Female	59	43.1	43.1	43.1
	Male	78	56.9	56.9	100.0
	Total	137	100.0	100.0	

After 3 months among 137 inserted one-piece dental implants only 3 implants were failed which comprises about (2.2%), and 134 implants were successfully osseointegrated which comprises about (97.8%) (Table 3).

Table 3: Success/ Failure of the implants after 3 months interval.

	Frequency	Percent	Valid Percent	Cumulative Percent
Success	134	97.8	97.8	97.8
Failure	3	2.2	2.2	100.0
Total	137	100.0	100.0	

Regarding complications of the proposed technique, only 2 cases of the followed approach were faced a problem in which the customized healing abutment which is made from flowable composite lost its connection to the substrate (Plastic impression post of one-piece implants) and it enters down to the gingival soft tissue. This complication occurred for one of the cases after 1 month and for the other case after 9 weeks; and both managed by placement of new customized healing abutment. (Table 4) shows the percentage of problems/ complications in the proposed technique.

Table 4: Rate of complications among 137 cases.

	Frequency	Percent	Valid Percent	Cumulative Percent
No Complications	135	98.5	98.5	98.5
Complications	2	1.5	1.5	100.0
Total	137	100.0	100.0	

After removal of the temporary crown a very nice anatomical emergence profile created and the results of papilla index after three months showed that the majority of the cases (84 cases comprises 61.3%) ended with score number 3, which means Optimal soft tissue contour and the papillae fill up the entire proximal space and are in good harmony with the adjacent papillae (Figure 10).

Figure 10: Papilla index with score number 3; Optimal soft tissue contour and the papillae fill up the entire proximal space.

And 34 cases (24.8%) ended with score number 2, which means half or more of the height of the papilla is present, but does not extend all the way up to the contact point between the teeth. (Table 5) shows the results of papilla index in the study.

Table 5: Results of papilla index in the study according to Jemt's description.

Papilla Scores	Frequency	Percent	Valid Percent	Cumulative Percent
Score 0	3	2.2	2.2	2.2
Score 1	11	8.0	8.0	10.2
Score 2	34	24.8	24.8	35.0
Score 3	84	61.3	61.3	96.4
Score 4	5	3.6	3.6	100.0
Total	137	100.0	100.0	

Finaly the results of Satisfaction Visual Analog Scale (VAS) showed that 120 cases (87.6%) were have most positive response to the dental implant treatment (VAS from 8 to 10). And only 3 cases (2.2%) were having least positive response to the dental implant treatment (VAS from 0 to 2). (Table 6) presents the details of patient's satisfaction toward the proposed technique of dental implant treatment.

Table 6: Patient assessments of satisfaction of esthetic aspects of the dental implant in the study.

VAS	Frequency	Percent	Valid Percent	Cumulative Percent
.00	2	1.5	1.5	1.5
1.00	1	.7	.7	2.2
5.00	2	1.5	1.5	3.6
6.00	4	2.9	2.9	6.6
7.00	8	5.8	5.8	12.4
8.00	43	31.4	31.4	43.8
9.00	58	42.3	42.3	86.1
10.00	19	13.9	13.9	100.0
Total	137	100.0	100.0	

DISCUSSION

One-piece dental implants have emerged as a viable solution for various clinical scenarios due to their unique structural and functional attributes. Unlike two-piece implants, one-piece implants integrate the abutment and implant body into a single unit. This design offers several advantages, such as eliminating the micro-gap between the

abutment and implant, which is commonly associated with microbial leakage and subsequent crestal bone loss in two-piece systems.[2,3] The current study explores a novel approach for optimizing the soft tissue emergence profile around these implants using a customized healing abutment fabricated with the Cervico system.

The customized healing abutments serve multiple roles: they maintain the gingival architecture post-extraction, seal the surgical site to retain graft materials, and facilitate the formation of an optimal emergence profile. These abutments are fabricated chairside using a nano-hybrid flowable composite resin material, which offers a tailored fit and immediate functionality.[11] This approach not only reduces the time and cost associated with laboratory-made provisionals but also enhances patient comfort and satisfaction.[12] The use of chairside customization aligns with the principles of immediate loading, which have been shown to preserve alveolar bone dimensions and improve soft tissue outcomes.[13, 14]

The study enrolled 137 patients who received one -piece dental implants in the anterior aesthetic region. The implants demonstrated a high success rate of 97.8%, with only 3 implants failing to integrate. This success rate is consistent with other studies highlighting the efficacy of one-piece implants.[6,15]

Additionally, complications were minimal, with only 2 cases experiencing issues related to the customized healing abutments. These results underscore the reliability of the proposed technique in clinical practice.

A critical measure of success in implant dentistry, especially in the aesthetic zone, is the soft tissue response around the implant. The Jemt Papillary Index was used to evaluate the papilla fill and soft tissue contour. The majority of cases (61.3%) achieved an optimal papilla score of 3, indicating excellent soft tissue contour and complete fill of the proximal space. These findings suggest that the customized healing abutment effectively promotes favorable soft tissue outcomes, essential for achieving aesthetic harmony.[10] Studies have shown that the preservation of papilla and optimal soft tissue architecture are crucial for long-term aesthetic success in implant dentistry.[16]

Patient satisfaction was assessed using a Visual Analog Scale (VAS), with 87.6% of participants reporting high satisfaction scores (VAS 8-10). This high level of satisfaction can be attributed to the immediate provision of a temporary crown, reduced surgical interventions, and the overall aesthetic results. The simplified chairside fabrication process also contributes to a more streamlined and efficient treatment workflow, enhancing the overall patient experience.[17] The positive patient feedback aligns with findings from other studies that emphasize the importance of immediate provisionalization in enhancing patient satisfaction and comfort.[18]

Traditional techniques for managing the emergence profile around one-piece implants often involve multiple steps and extended treatment times. These include the use of laboratory-fabricated provisionals and frequent adjustments to achieve the desired soft tissue contour. In contrast, the customized healing abutment technique simplifies this process, offering a predictable and efficient solution. By using the Cervico system, clinicians can produce anatomically shaped healing abutments that closely mimic the natural tooth anatomy, thereby facilitating optimal soft tissue healing and aesthetic outcomes.[9,19] Moreover, the ability to fabricate these abutments chairside reduces the overall treatment time and costs, providing a significant advantage over traditional methods.[20]

While the study demonstrates promising results, it is not without limitations. The follow-up period was relatively short (three months), and long-term data on implant success and soft tissue stability are needed to confirm the durability of the outcomes. Future research should focus on longitudinal studies with larger sample sizes and diverse populations to validate the findings. Additionally, investigating the application of this technique in different clinical scenarios, such as posterior implants and patients with compromised soft tissue conditions, would provide further insights into its versatility and effectiveness.[21] The impact of various material properties of the customized abutments on soft tissue health and integration also warrants further investigation.[22,23]

The proposed technique offers a practical and efficient solution for optimizing the soft tissue emergence profile around one-piece dental implants. Its application can significantly enhance the aesthetic and functional outcomes of implant

therapy, particularly in the anterior aesthetic zone. The chairside fabrication of customized healing abutments using the Cervico system is a game-changer, providing a simple, time-saving, and cost-effective alternative to traditional methods. Clinicians can adopt this technique to improve patient satisfaction and overall treatment success. This approach aligns with the principles of minimally invasive dentistry, aiming to preserve as much natural tissue as possible while achieving optimal aesthetic and functional results. [24]

CONCLUSION

In conclusion, the use of customized composite temporary crowns fabricated with the Cervico system offers a reliable and innovative approach to managing the soft tissue emergence profile around one-piece dental implants. The technique demonstrates high success rates, minimal complications, and excellent aesthetic outcomes, making it a valuable addition to the armamentarium of implant dentistry. Future studies with extended follow-up periods and larger cohorts will further elucidate the long-term benefits and potential applications of this technique in diverse clinical settings.

Conflict of interest

The author declare that there are no conflicts of interest.

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