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Pink Power Concept: A Non-Surgical Approach Restoring Soft-Tissue Deficiencies in Anterior Implant-Supported Crowns

KEYWORDS: Implant-supported restoration; Esthetics; Gingival epithesis.

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ABSTRACT Various periodontal surgical procedures for soft tissue preservation or enhancement may not always result a predictable esthetic success in the reproduction of natural mucogingival architecture surrounding implant-supported restorations. An alternative nonsurgical approach is always traced in such clinical situations demanding excellent esthetic outcomes. The pink power concept (PPC) which is an established part of the restorative spectrum, offers spectacular solution in such challenging cases. Properly planned and designed PPC using metal-ceramic restorations modified with gingival-colored porcelain can create a real magic in reproduction of deficient soft tissue in anterior implant-supported restorations.

INTRODUCTION

The performance and success of dental implant therapy is primarily assessed in view of its osseointegration and long-term maintenance .[1, 2]With the introduction of modern implants, the overall implant survival and success rates are expected 90-95% after 5 to 10 years of clinical service.[3-8]The implants placed in the anterior maxilla were not given the prime concerns for esthetic reasons; hence both the clinicians and patients assumed the replacement of anterior teeth with implants an easy and highly predictable treatment.[8]However, various authors reported objective esthetic parameters in their studies while dealing with anterior implant therapy and experienced a real challenge in the achievement of esthetically pleasing outcomes.[9-23]

Generally the esthetic outcome of anterior implant-supported crowns is evaluated according to its resemblance to the adjacent natural teeth making the soft tissue integration of the implant-restoration complex more important. In recent scenario, clinicians are constantly facing a patient population demanding highly esthetic anterior implant therapy. Due to this escalating demand, primary attention has shifted from implant-bone integration to implant-soft tissue integration.[9, 24-29] To achieve an esthetic goals, numerous soft tissue preservation/enhancement techniques including facial contour augmentation have been performed either at the time of tooth extraction or later at the time of implant placement. But the predictability of such procedures and long-term soft-tissue stability around implant-supported crowns after implementation of such procedures are doubtful.[28-30]However; the use of purely technical restorative measures i.e., tooth-colored material can be considered as an alternative treatment modality to restore soft-tissue contour.[10, 31-51]This reestablishment of an artificial gingiva as an integral part of maxillary anterior implant-supported crowns which predictably maintain visual harmony is termed 'artificial gingiva' or 'gingival epithesis'. Unfortunately, this concept of artificial gingiva is not well accepted by the clinicians due to the following reasons:

- Previous attempts led to the fixed dental prostheses (FDP) that were difficult to clean and patients found it more stressful to maintain routine oral hygiene protocol.
- Oral surgeons consider the need for artificial gingiva as a question raised against their surgical procedure and think it as a "defeat". They also consider it as a consequence of poorly planned and/or performed implant surgery.
- Patients who are not informed prior often refuse the idea of artificial gingiva due to its emotional correlation with the removable prosthesis predicament.
- Clinicians consider its application as the last treatment option in the case of major tissue deficiencies or after grafting failures.
- Laboratory technicians understand and appreciate its real potential, but they do not impose the idea of artificial gingiva on the clinician. However, they try to compensate the deficient soft tissue by lengthening the interdental contact area apically with tooth colored ceramics. These efforts adversely affect the normal length-to-width ratio of the concerned clinical crowns.[52, 53]

In view of integrated artificial gingiva in a modern context of implant-supported FDPs, and also to realize its real po-

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tential, the term "Pink Power Concept" is more applicable. The Pink Power Conept (PPC) is a well-defined new approach which reevaluates the application of artificial gingiva as integrated part of an implant-restorative complex replacing single or multiple-unit teeth in the esthetic zone, planned to enhance esthetic predictability. The successful implementation of PPC is further dependent on the meticulous treatment planning while selecting optimal implant type, size, number and position before the extraction of teeth. This article discuss the basic principles of a nonsurgical approach i.e. the pink power concept adjoined with a clinical report which illustrate the use of gingiva-colored porcelain to manage soft tissue deficiencies for anterior implant-supported restorations.

COMMUNICATION BETWEEN DENTAL CLINICIAN, PATIENT AND LABORATORY PERSONNEL

There is remarkable scientific revolution during the past decades in every aspects of dentistry including clinical dental medicine and implant dentistry, though patients are often unaware of biological limitations and their effect on esthetic outcome especially in anterior teeth. These limitations are not operator-related but due to biological variant like bone remodeling after tooth extraction and may create unsolvable conflicts and misunderstandings. Hence, a proper communication should be carried between the dental clinician and the oral surgeon before implementing any treatment. This should also include the patient and the laboratory personnel. Often the laboratory personnel i.e. technicians are not allowed to see the patients and many times they are supplemented by non-standardized clinical photographs of the patient. This lead to less than optimal designed prostheses by technician which is only based on the information supplemented by stone models. The major drawback on technicians' part is that they lack the visible play of dynamic interaction between the teeth and the surrounding supporting musculature. Also the harmonious restoration fabricated on the stone cast may not fulfill the patient's expectations in terms of esthetics. In recent scenario, patients carry a clear picture in mind of their high and unrealistic esthetic expectations. They don't show a total trust in the clinician's ability to guess and decide about the best final result in a given clinical condition. This makes mandatory to have a careful evaluation of the patient before performing implant surgery determining his expectations in relation to appearance. It also makes a better approach to explain the patient about the limitations associated with implant-supported restorations especially in the esthetic zone.

Based on the Pink Power Concept (PPC), following phases of the final implant-supported restorations can be governed:

- Preoperative status analysis
- Diagnostic wax-up
- Clinical try-in
- Mutual initial validation
- Fabrication of surgical guide
- Provisional restoration and mutual final validation
- Bisque bake try-in
- Finalization of the definitive restoration

For the above mentioned steps, the clinician should have standardized clinical photographs with proper display of the teeth and the edentulous ridge. Images should also display the lips of the patient at various degrees of smiling which helps to guide the implementation of envisioned treatment.[54]In the first phase of preoperative status analysis clinician must evaluate and confirm whether a concerned patient will significantly benefit from the idea of PPC. This evaluation should be carried out before tooth extraction in case of patient requiring replacement of maxillary anterior teeth by an implant-supported restoration. This analysis is essential to check the feasibility of artificial gingival which will also help to determine type, size, number, and position of the implants to be placed. This phase or approach is known as "backward planning" which will lead to a restoration-driven decision instead of bone-driven decision.[55]

PREOPERATIVE STATUS ANALYSIS

In planning implant-supported restorations especially in the esthetic zone, the prime concern is always given to the quality and the predictability of the treatment outcome. The two initial diagnostic evaluations which will help to guide the clinician are:

A structured, comprehensive preoperative esthetic risk assessment,[56] and

An assessment of the difficulty level of a given initial situation based on the SAC classification system.[57]

These preliminary diagnostic evaluations will significantly decrease the chances of complications and will contribute to well establish the alveolar ridge alterations after tooth extraction.[58, 59]

Tooth loss in the anterior maxillary region leads to a flattening of the alveolar ridge in the frontal plane. It also leads to a loss of vertical and horizontal bone volume which is more pronounced on the vestibular aspect of the concerned sites. These factors have definite esthetic drawbacks. Vailati and Belser[60] currently recommended strategy which suggests limiting the number of implants placed in the esthetic zone. Previously the clinicians had a bad experience with adjacent implants in the anterior maxilla, where the diminished inter-implant soft tissue height led to unsightly "black triangles". Spear[61] & Spear[62] advocated the avoidance of adjacent implants and utilization of ovate pontics to achieve superior esthetics in anterior maxilla. Jensen et al[63] suggested the evaluation of the patient's smile line to know the extent of the gingiva and the alveolar mucosa exposure during smiling. Author recommended this as the key element of the initial diagnostic process. The exposure of gingiva and alveolar mucosa during maximum natural smiling can be discussed as following:

A) NONE to MINOR soft tissue exposure

In this type, an individual displays no or only minimal gingival tissue, i.e. only the coronal part of the papillae with no soft tissue apically of the clinical crowns. The patients with a learned pattern of smile with a lip constriction should be identified. Such minimal soft tissue exposure can be supplemented with a conventional type of fixed dental prosthesis (FDP) design (without incorporating gingival-colored material), flat emergence profiles and accessible embrasures. The patient is informed about an altered length-to-width ratio of artificial clinical crowns in the future implant prosthesis that might not be spontaneously visible.

B) MODERATE soft tissue exposure (Triangular Type)

In this type, an individual displays the papillae or part of black triangles in the case of tissue recessions during maximum smiling. The junction with the apical mucosa is not visible in this type of soft tissue exposure. This type of soft tissue exposure is the most favorable initial condition for PPC. In the future prosthesis only the artificial papillae will

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be seen whereas the junction between the natural mucosa and the artificial gingival will be hidden behind the upper lip. As only the papillae will be reproduced, the color match with the adjacent natural papillae plays an important role. This is also termed as Triangular Type (T-Type).

Vailati & Belser[60] suggested the placement of only two implants in the case of four missing maxillary incisors, one at the mesial and the other one at the distal end of the prospective edentulous site. Also, the use of narrow diameter implants was recommended for better esthetic results. But, in case of artificial gingiva the implants with regular diameter could be used without any appreciable esthetic loss. In T-Type of soft tissue exposure, regular neck implants offer mechanical strength and final esthetic outcome is assured by PPC.

C) MODERATE to MAJOR soft tissue exposure

In this type of soft tissue exposure, individual completely displays their anterior maxillary gingiva up to a maximum height of 2 mm apical to the cervical border of the clinical crowns representing a "slight gummy smile". This type can be transformed into T-Type by extending the length of the future anatomic crowns of the FDPs in an apical direction.

D) MAJOR soft tissue exposure

In major soft tissue exposure, the gingival is completely exposed, including a visual extension of more than 2 mm from the cervical border of the teeth representing a "major gummy smile". This type is the most challenging while restoring esthetics in implant-supported anterior maxillary FDP. The junction between natural alveolar mucosa and artificial gingival becomes difficult to hide behind the upper lip.

INITIAL PLANNING AND DESIGNING PRINCIPLES OF PPC

The concept of pink power starts with the initial diagnosis phase, so that the final esthetic outcome of the proposed implant-supported resorations is visualized. This is followed with certain treatment phases for which the following steps will be required: 1. finalizing the design, 2. allowing intermediate adjustments and refinement, and 3. obtaining an optimum therapy including final ceramic FDP. This initial validation is followed by early implant placement protocol for the anterior maxilla, which proposes extracting the teeth with as little trauma as possible and then waiting 6 to 8 weeks for soft tissue healing before implant placement at the proposed site.[64, 65] But in certain conditions like poor periodontal condition of the teeth, implant placement is delayed and the respective changes at both the bone and the soft tissue level should be expected. These changes are flattened edentulous alveolar ridges, loss of vertical height of edentulous site, and orofacial width. Hence, duplication of the patient's existing provisional removable partial denture (RPD) to fabricate the surgical template is avoided. There is an obvious discrepancy between the previous and the post-extraction site of the buccal bone of the anterior maxilla. Furthermore, RPD may hide important soft tissue deficiencies due to its labial flange. This makes a comprehensive and meticulous reevaluation of the crestal tissue anatomy, volume and height before implant placement.

A properly designed and implemented PPC crowns should provide an excellent esthetics and cleansability. This is related to the cervical portion of the multi-unit implant-supported FDP which is under PPC consideration. PPC should create a harmonious scalloped mucosa with papillae and eliminate the appearance of any black triangles. It should also reestablish normal length-to-width ratios of the anatomical crowns. The factors which determine the predictability of the future esthetics are: 1. the area of the FDP that is immediately adjacent to the first natural tooth, and 2. the apical transition between the gingival extension and the alveolar mucosa. The routinely encountered problems in the designing of pink ceramic are its overextensions into the interdental embrasures while approaching the mesial aspect of the adjacent tooth. This encroachment would severely jeopardize access for efficient oral hygiene. To avoid this, the laboratory technician may limit the extension of pink ceramic to half of the embrasure, which further creates a "double papilla" situation making an unobvious appearance of the FDP.

The amount of soft tissue exposure during the patient's maximum natural smile is the key determining factor to locate the transition between artificial gingival and alveolar mucosa. Both, the dental clinician and the laboratory technician contribute for their ability to create adequate crestal concavity up to this transition, which is essential to maintain effective oral hygiene during flossing. Possibly, the transition between the pink ceramic and the alveolar mucosa should be designed outside the zone of visual exposure. The concerned patient has to be guided accordingly and checked for his perceptual ability and acceptance during the phase of the provisional FDP.

DIAGNOSTIC WAX-UP/ CLINICAL TRY-IN/ SURGICAL GUIDE

Mounted diagnostic casts in an articulator together with the clinical examination of the patient furnish important information for proceeding with a first wax-up of the missing teeth. The laboratory technician is allowed to see the clinical condition of edentulous site and adjacent teeth and is instructed to arrange case-adapted teeth in the most acceptable position but without a flange at the cervical area. The most common mistake at this point is the selection of non-physiologic axially inclined teeth which renders a poor esthetic result. Hence, normal axially inclined teeth are preferred and try-in completed. During try-in, the patient is shown the discrepancy between the remodeled alveolar ridge and the cervical aspect of set teeth. Patient is actively involved in the discussion of treatment planning and given the options of surgical interventions or prosthodontic replacement with artificial gingiva. This flangeless try-in also gives the dental clinician an idea for additional lip support needed for esthetics. Patient is demonstrated the consequences of tooth loss and the associated alveolar bone remodeling making him to understand at an early stage about the lack of supporting tissues. Magne & Belser[66] have discussed a novel porcelain laminate preparation approach driven by a "diagnostic mock-up". They used a silicon key derived from the wax-up and directly pressed tooth-colored acrylic over the previously isolated edentulous area including the two adjacent teeth. This approach has been recommended if the preliminary wax-up is doubtful to the operator.

The patient denying for additional surgical procedure to develop necessary lip support, are the real candidates for the implementation of PPC as an elegant approach. The clinician can also use some gingiva-colored flowable composite to demonstrate the visual reproduction of missing papillae. The patient is discussed with the visibility of the junction between the existing alveolar mucosa and the reproduced artificial gingiva. After this a repeat standardized

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photograph is obtained with the completed diagnostic set-up involving the functional lip position. At this stage, the final treatment is planned whether the patient desire to undergo more invasive surgical procedure or agree for the artificial gingival, after which the fabrication of surgical guide is initiated. This finalized therapy will aid in the precise positioning of the future implants and will offer a little liberty while fabricating artificial gingival integrated FDPs. This also renders adequate distances between implants and adjacent teeth and favors standard diameter implants for the placement.

PROVISIONAL RESTORATION AND MUTUAL FINAL VALIDATION

The next phase involves the confirmation and refinement of planned treatment which includes the fabrication of an implant-supported provisional FDP. As the provisional FDPs will have to stay in place for several weeks, these should possess sufficient mechanical resistance, especially in the region of the pontics and the interdental connectors. This gives a tough challenge for a laboratory technician as he has to provide mechanical resistance as well an additional space for artificial gingiva.

If a gingival-colored flowable composite is available, then a mix of the most suitable pink and a flowable incisal composite is prepared to obtain a pale gingiva-like color that should blend with its surrounding environment. Before its application, the concerned area is isolated with little glycerine gel so that it is easily removed. A little mix is carried with explorer and started from the coronal part of the papillae involved keeping in mind to avoid abrupt discrepancy between the respective height of the first mesial and distal natural papillae of the adjacent teeth. The mix is then extended towards the cervical region so that the material covers the area between the two adjacent clinical crowns or pontics gradually providing normal length-to-width ratio and a distinct triangular appearance of the cervical portion. This is followed by the most critical and challenging area of work i.e. establishment of the precise location and contour of the cervical junction between gingiva-colored material and the natural mucosa. The location of junction is decided by the amount of soft tissue exposure while patient is smiling and also by the anticipation of future maintenance of adequate oral hygiene conditions. On completion of this step, the patient is asked to stand in front of a wall mirror for his appreciation and acceptance of the planned FDP design. Finally the provisional FDP is cemented and the patient is given appropriate oral hygiene instructions. The future appointments may be required for any modifications necessary to establish the final FDP design. In such condition, clinical photographs and study cast are repeated so that laboratory technician generates some guides during the fabrication of the final FDP.

BISQUE BAKE TRY-IN

The definitive implant-supported FDP should fulfill the following key elements:

- Precision and passive fit
- Marginal integration
- Adequate mechanical resistance
- Optimum occlusion
- Axial contours including flat emergence profiles
- Superior esthetics, and
- Efficient cleansability.

The designing of interdental areas should assure adequate mechanical strength along with sufficient space for the artificial gingiva. This difficulty is discussed with the laboratory technician. To overcome this, the interdental connectors are placed slightly on lingual side so that there is enough space to mask their opaque appearance. This also allows the placement of pink ceramic as deep interdentally as is possible to develop better esthetics. Adequate space should also be provided at the border of gingival-colored ceramic and the neck area of the clinical crowns, so that smooth transition of border with the alveolar mucosa is achieved. The establishment of transluceny and physiologic contours are equally important for the success of implant-supported FDP. Hence, a bisque bake try-in of Ceramic FDP for verification at an early stage is recommended. It is better to use gingiva-colored acrylic at this early stage to limit the number of firing cycles of ceramic. This mimicking pink part is verified and directly modified in clinical try-in so that the laboratory technician uses this for duplication in pink ceramics. Otherwise, he can use his perception based on study cast and standardized clinical photographs and can directly sinter the ceramic comprising the pink ceramic. Then he can deliver it to the dental clinician for a chair-side bisque bake try-in.

CASE REPORT

A 32-year-old man presented with an implant-supported provisional restoration on the maxillary right central and lateral incisors. Clinical and radiographic examination revealed the presence of a titanium dental implant (Adin Dental Implants Sys. Ltd., Israel) and a prefabricated titanium abutment (Adin Dental Implants Sys. Ltd., Israel) retaining a tooth-colored acrylic resin provisional fixed restoration. The chief complaints of the patient were the unesthetic look of the provisionals and the uneven level of the gingiva of the maxillary anterior teeth (Fig. 1). The patient's past dental history indicated that periodontal surgery was tried twice to regenerate the peri-implant soft tissue. Therefore, nonsurgical management of the soft tissue around the implant, which incorporated the use of a metal-ceramic definitive restoration modified with gingiva-colored porcelain applied to the cervical portion, was proposed to the patient.

The retained provisionals were removed and the area was cleaned from the residual temporary cement. Then the patient was sent back after screwing the healing caps (Adin Dental Implants Sys. Ltd., Israel) (Fig. 2) and called after a week. A tooth-colored acrylic resin (Pyrax SC-10, Pyrax Polymers, India) fixed provisionals were placed on an interim abutment (Adin Dental Implants Sys. Ltd., Israel), which were modified using light-polymerizing flowable composite (Amaris Gingiva, VOCO, America]) chairside to enhance the peri-implant soft tissue contour.[17]An implant-level impression was made using an impression coping (Adin Dental Implants Sys. Ltd., Israel) (Fig. 3) and a polyvinyl siloxane impression material (Reprosil; Dentsply DeTrey GmbH, Konstanz, Germany).

The abutments were prepared and checked intraorally (Fig. 4). The definitive metal ceramic crowns were fabricated using ultra low fusing porcelain (VITA VMK Master, VITA, Germany) and were then evaluated intraorally. The periapical radiographs were made to verify the precision fit of the abutment and the restoration. The abutment screw was torqued to 32 N cm with a torque wrench, and the screw-access hole was obturated using a light-polymerizing composite resin. The definitive crowns were then luted using glass ionomer cement (Ketac™ Cem radiopaque, 3M ESPE, Germany) [Fig. 5(A) & (B)]. The patient was given proper oral hygiene instructions and was monitored at 2-week in-

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tervals for 2 months, and once every 6 months afterward. The last follow-up appointment of the patient was 1 year following the cementation of the definitive crowns. The patient was satisfied with the appearance of the restoration and was functioning well, and no signs of any complication associated with the new crowns were observed.

DISCUSSION

The reproduction of natural soft tissue architecture surrounding dental implants placed in the anterior maxilla creates an esthetic challenge for both, the restorative clinician and the laboratory technician. The loss of this mucogingival architecture is due to bone loss after extraction of traumatically injured or periodontally compromised teeth, or due to traumatic surgical extraction. This hard and soft tissue defects can be corrected with surgical reconstructive procedures prior to implant placement. However, the preservation of soft tissue architecture around implants remains utmost challenging. A retrospective study[67] in maxillary anterior region have shown that when the distance from the contact point to the bony crest was greater than 5 mm due to bone loss, the preservation of interproximal papilla may not be predictable. To overcome this problem, various clinical techniques have been reported which include the use of a gingiva-colored acrylic resin façade, [68, 69] a flexible silicone-based tissue colored material, [70] or Andrews Bridge System[71, 72]. The loss of mucogingival architecture around dental implants can also be corrected by applying gingiva-colored porcelain on the cervical portion of implant-supported metal-ceramic crowns.[73-81]

The Pink Power Concept is a conservative alternative to a surgical treatment especially for those patients with systemic or oral risk factors, or in cases when a surgical intervention is contraindicated. This restorative approach allows us to generate esthetically and functionally satisfying outcomes with minimal intervention. Presently available literature provides little information about gingiva-colored materials due to the scarce number of reported clinical reports; a systematic treatment concept has not yet been described. (Zalkind M, Hochman N-1997) Treatment approaches that are minimally invasive and predict excellent esthetics become more and more important. The present scenario of residing society is changing, leading to an increased proportion of patients with periodontal diseases.

The reproduction of the missing soft-tissue dimensions like depth and contour in Implant-supported restorations using a pink ceramic is an established part of the restorative dentistry. The long standing predictability of the basic fundamentals such as cleansability and flat cervical emergence profiles are given prime considerations while designing a well-defined concept and are discussed in this article. The clinician together with their laboratory technician should develop a well planned and designed concept depending on the clinical situations corresponding to the minor-to-moderate soft tissue exposure categories. Such categories need only small amount of gingiva-colored ceramic making it easier to design in terms of adequate access for oral hygiene and may establish a quite spectacular correction in reproducing the missing soft-tissue architecture. This may lead to a drastic improvement in esthetic appearance and patient satisfaction. The pink power concept is based on a structured diagnostic approach which includes diagnostic wax-up of teeth, followed by clinical try-in to confirm its objective validation. To achieve the full benefit of the powerful potential of the PPC, the meticulous application and implementation of the planned design principles must be assured.

The case report illustrates the use of pink porcelain based on the pink power concept as an alternative approach to restore the deficient mucogingival architecture. This non-surgical therapy provides an excellent esthetics without any invasive surgical intervention and hence the patient acceptance is easily gained. A well designed and executed Pink Power Concept can achieve an extraordinary and spectacular result for those who deny undergoing surgical soft-tissue corrections. The patient in this case report was satisfied with the outcomes of the restoration.

CONCLUSION

A non-surgical approach to manage soft tissue deficiencies for anterior implant-supported restorations was presented. Through the use of gingiva-colored porcelain on the cervical portions of the metal-ceramic prosthesis, predictable esthetic results can be achieved. Comprehensive esthetic initial analysis and validation of hard and soft tissues and proper treatment planning based on the pink power concept may be required to obtain an appropriate clinical outcome.

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Fig. 1- Unesthetic provisionals with maxillary right central and lateral incisors

Fig. 2- Intraoral view of dental implants to be restored in area of maxillary right central and lateral incisors

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Fig. 3- Impression copings fixed to obtain implant-level impression

Fig. 4- Prepared abutments fixed and evaluated for its fit

Fig. 5 (A) – Intraoral view of completed definitive implant-supported restoration

Fig. 5 (B) - Intraoral view of completed definitive implant-supported restoration

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