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Case report of using partially epithelialized connective tissue graft for peri-implant soft tissue augmentation simultaneously with dental implant placement

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Abstract

Background. The novelty of present case report is related to the fact that it represents achievement of successful results of dental implant-borne rehabilitation in means of forming appropriate pink esthetic profile and sufficient peri-implant soft tissue stability while using for such purpose partially epithelized connective tissue flap simultaneously with delayed implant placement procedure, which to the knowledge of authors have been described in the specialized literature before only in scarce manner.

Objective. To demonstrate clinical option of using partially epithelialized connective tissue graft for peri-implant soft tissue augmentation simultaneously with dental implant placement procedure to enhance peri-implant esthetic profile and optimize soft-tissue stability for further prosthetic rehabilitation.

Case report. Patient 46 years old patient referred to the dental clinic with complaints regarding condition of mandibular fixed denture, which he was using already for 9 years. Also, patient informed dentist that he wants to improve his chewing ability by restoring edentulous distal regions of mandible with implant-borne fixed dentures. Patient previous denture was gently deattached from mandibular abutment teeth while not altering periodontal conditions of any of them during procedure. All the targeted and periodontal treatment was provided based on clinical need. Tissue level implants were placed at the projection of teeth 4.5-4.6 and 3.6-3.7 due to the conventional implant placement protocol. To compensate soft tissue collapse within the implant placement region it was decided to augment such with partially epithelialized connective tissue graft. Graft was shaped, prepared and partially de-epithelialized to overcome issue of volume excess using standard technique. Partially epithelialized connective tissue graft was positioned carefully with the manner of the epithelial portion covering dental implant part, while connective tissue portion was facing inner surface of separated flap, and was covered by a flap. Modified horizontal mattress sutures were used to secure connective tissue graft at the place while retaining its primarily established positions and guaranteeing tension-free flap closure around installed healing abutments. Results of final rehabilitation outcomes with satisfactory appearance of the soft tissue condition around fixed prosthetic construction were achieved at the end of the treatment.

Conclusion. Partially epithelized connective tissue graft combines features of both connective tissue graft, which makes it suitable for mucosa thickness gain, and free gingival graft, whin in turn helps to increase width of keratinized gingiva. Such universal properties make it suitable candidate for the usage simultaneously with implant placement to enhance peri-implant esthetic profile and optimize surrounding soft-tissue stability for further prosthetic rehabilitation.

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Introduction

Peri-implant phenotype formed by width of keratinized mucosa, soft tissue thickness, supracrestal tissue height and peri-implant buccal bone which all characterized by closed relationships regarding each other, that must be respected in means of achieving predictable implant-borne restoration performance without potential esthetic and biological complications [1, 2, 3, 4].

Minimally required parameters of peri-implant phenotype components have been widely described in the literature [5, 6], even though some authors highlighted that there is still a lack of "evidence based-recommendations" for the specifically clarified needed amounts of all above-mentioned peri-implant structures [1]. Careful assessment of initial peri-implant tissues status is a key component

in addressing the need for the further soft tissue augmentation procedure, which may also be interpreted as primary approach for preventing esthetic and biological implant-related complications in future. It may be explained by the fact that peri-implant hard and soft tissues undergo corresponding remodeling patterns after dental implant placement, which in the conditions of initial deficiencies may compromise following functional and esthetic components of peri-implant health [7, 8].

Management of peri-implant soft tissues in case of their deficiencies may be provided at different time periods [9, 10, 11]. Gain of attached mucosa through soft tissue augmentation preferably should be provided before implant placement, which is also applicable for the management of deficient soft tissue volumetric levels [9, 10]. Mancini et al. highlighted that periods of before implant placement and at the stage of healing abutment may be interpreted as a gold standard to provide soft tissue augmentation, which with the high level of predictability will help to achieve desirable peri-implant phenotype [11]. On the other hand, systematic review of Lin et al. revealed that soft tissue augmentation during implant placement provided increase in keratinized tissue width and soft tissue thickness with the same effect as staged approach (after implant placement) [12]. Possibility of providing soft-tissue augmentation during implant placement may shorten the overall treatment time and reduce the number of staged surgical interventions, thus focusing on achieving more patient-centered outcomes.

Different types of graft may be used to achieve desirable peri-implant soft tissue conditions [9, 10]. Connective tissue graft represents "gold standard" for the soft tissue augmentation procedures, but even such may be modified [9, 10, 13]. Partial de-epithelization represents methodology of cutting off epithelium from obtained soft tissue graft while leaving some portion of lamina propria [12, 13, 14]. From the biological point of view partially de-epithelized free gingival graft includes properties of both connective tissue graft, which makes it suitable for mucosa thickness gain, and free gingival graft, whin in turn helps to increase width of keratinized gingiva [12, 15]. Such approach may be provided when the initial anatomical thickness of palatal mucosa is deficient to collect adequate connective tissue graft, but on the other hand partially de-epithelialized graft characterized with less postoperative shrinkage. Previously several case reports have demonstrated success of using partially de-epithelialized free gingival graft for the gingival phenotype modification and achievement of sufficient root coverages in cases of recession [13, 15, 16], but only few reports were focused on using such approach for peri-implant phenotype optimization.

The novelty of present case report is related to the fact that it represents achievement of successful results of dental implant-borne rehabilitation in means of forming appropriate pink esthetic profile and sufficient peri-implant soft tissue stability while using for such purpose partially epithelized connective tissue flap simultaneously with delayed implant placement procedure, which to the knowledge of authors have been described in the specialized literature before only in scarce manner.

Objective

To demonstrate clinical option of using partially epithelialized connective tissue graft for peri-implant soft tissue augmentation simultaneously with dental implant placement procedure to enhance peri-implant esthetic profile and optimize soft-tissue stability for further prosthetic rehabilitation.

Clinical case presentation

Patient 46 years old patient referred to the dental clinic with complaints regarding condition of mandibular fixed denture, which he was using already for 9 years. Also, patient informed dentist that he wants to improve his chewing ability by restoring edentulous distal regions of mandible with implant-borne fixed dentures.

Complex primary diagnostic procedures were held to assess condition of abutment teeth including periodontal probing and cone-beam computed tomography (CBCT). Orthopantomography (OPG) reconstruction obtained from CBCT and filled periodontal chart represented on corresponding figures (Fig. 1-2).

It was found that mandibular fixed denture was supported by seven teeth (4.1, 4.2, 4.3, 4.4, 3.1, 3.3, 3.5), and all other mandibular teeth were absent. Pocket depth equal or greater than 4 mm was registered at the projection of all mandibular abutment teeth (average probing depth was 3.8 mm), while tooth 4.3 also demonstrated the presence of periapical lesion. Teeth 4.1, 4.2 and 3.1 demonstrated significant signs of bleeding on probing. Quality of visualized endodontic treatment was questionable and periodontal prognosis of all abutment teeth was compromised due to the non-adequate fit and altered aligning of present fixed denture. It was decided to take off old prosthetic construction, provide all needed periodontal and endodontic treatment, restore area in the projection teeth with new fixed type of denture, which would not extend over the most distal abutment teeth with any cantilever.

Areas in the projection of teeth 3.6-3.7 and 4.5-4.6 were proposed to restore with implant-borne fixed dentures. Considering visualized bone deficiency and collapse of soft tissue at the above-mentioned regions it was decided to provide corresponding soft and hard tissues augmentation procedures simultaneously with implant placement (Fig. 3). Patient has agreed on all the proposed interventions and signed corresponding informed consent form.

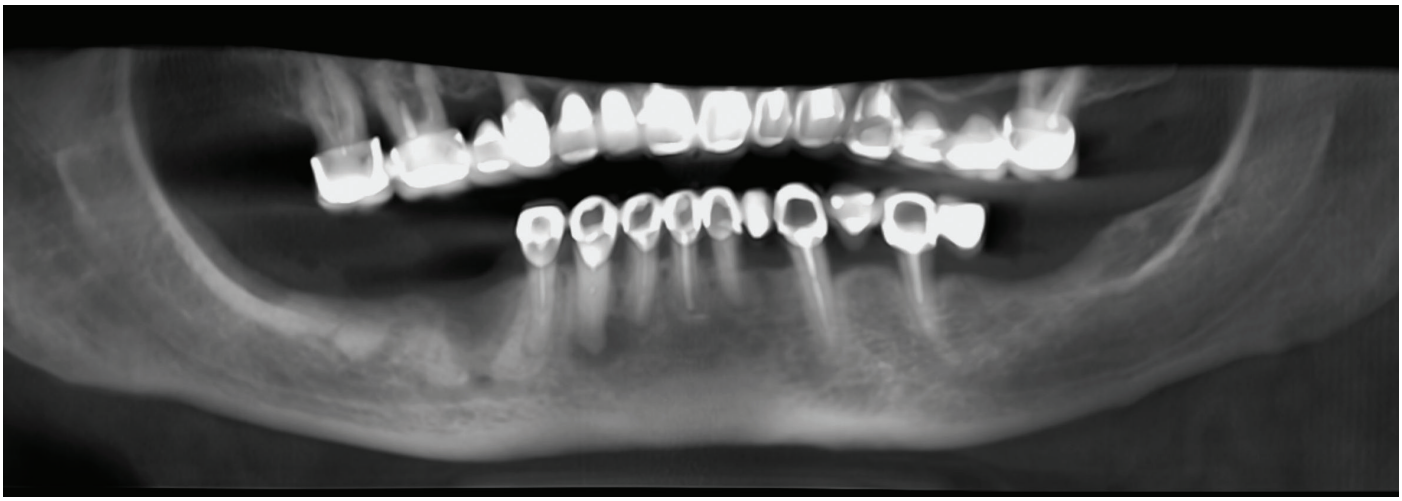

Figure 1. Panoramic reconstruction obtained from CBCT data before treatment

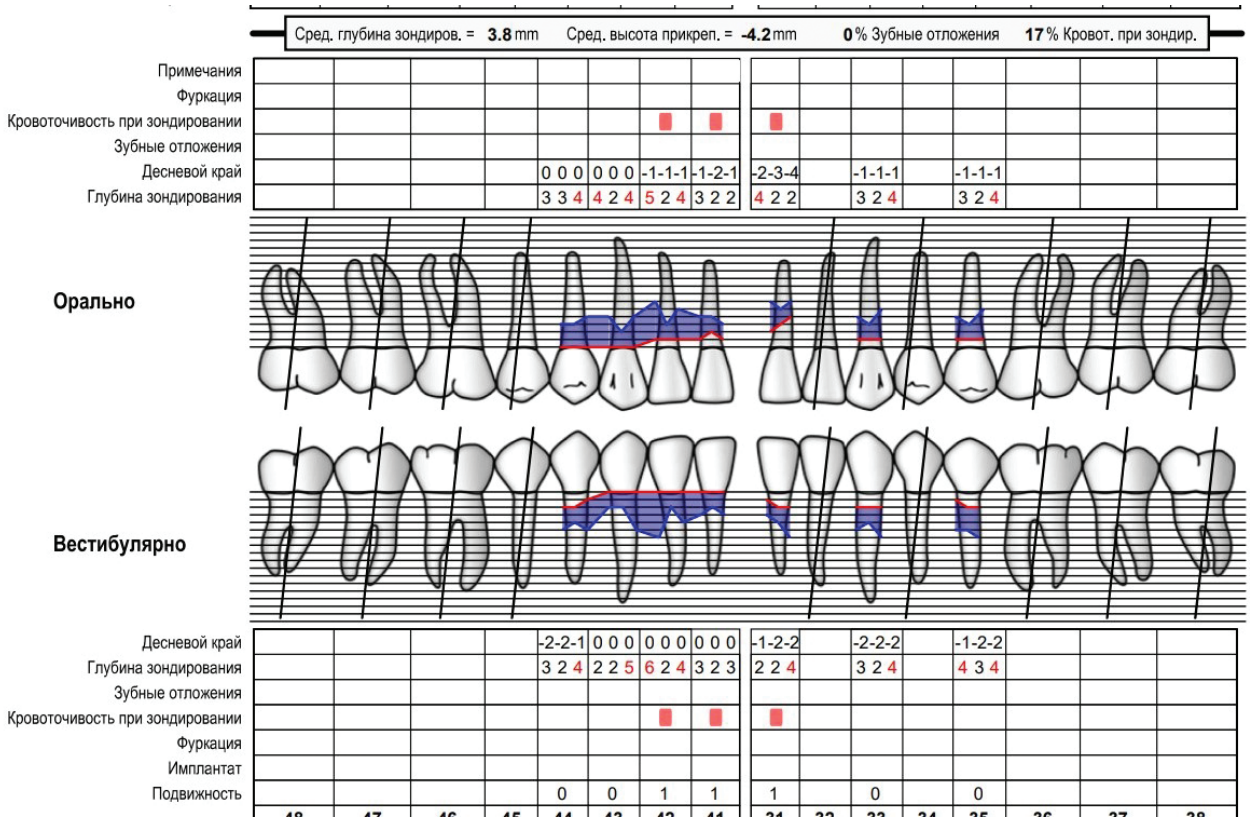

Figure 2. Filled periodontal chart and analysis of the periodontal tissues condition before treatment

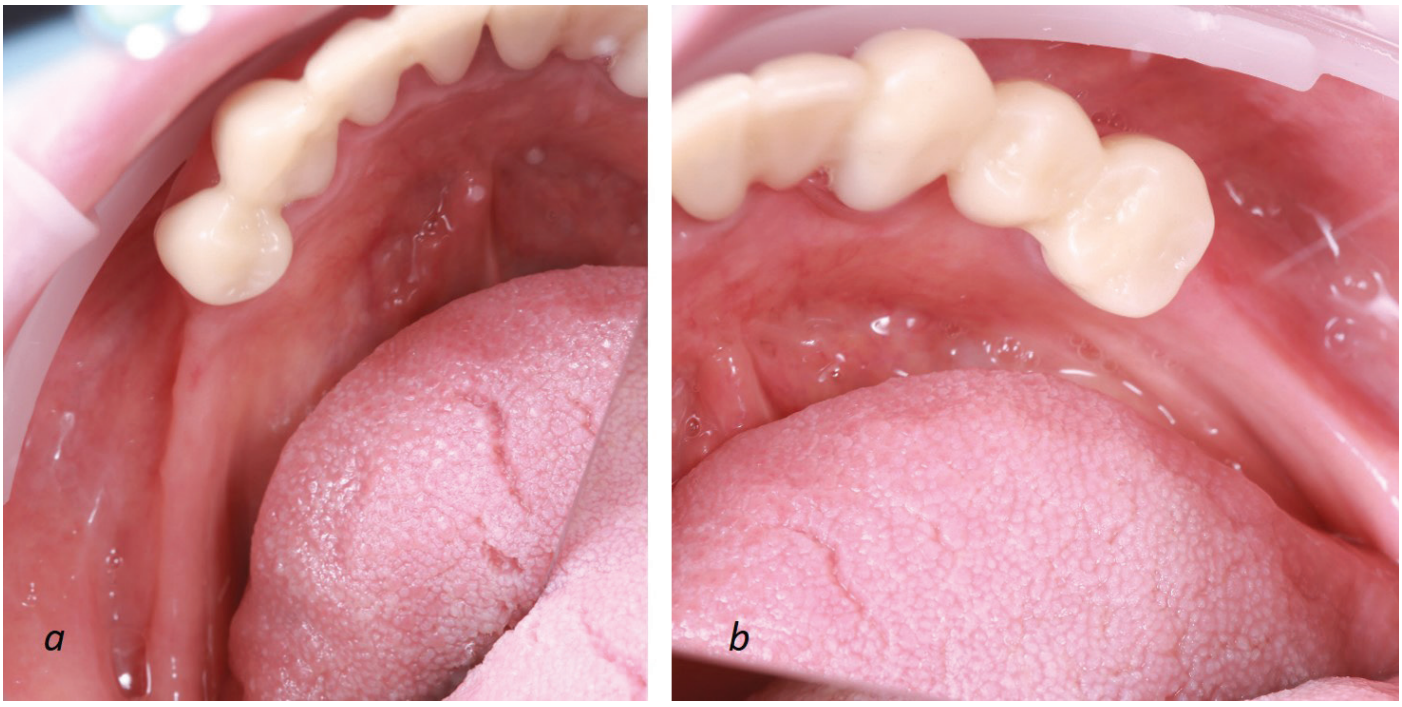

Figure 3. Initial clinical condition of the distal alveolar regions of mandible with limited vertical bone volume and soft tissue collapse. Occlusal view: a – right side, b – left side

Patient's previous denture was gently deattached from mandibular abutment teeth while not altering periodontal conditions of any of them during procedure. All the targeted periodontal treatment was provided based on clinical need. Condition of teeth noticed 3 months after targeted treatment is objectified on the OPG reconstructed from new CBCT-scan and periodontal chart (Fig. 4–5).

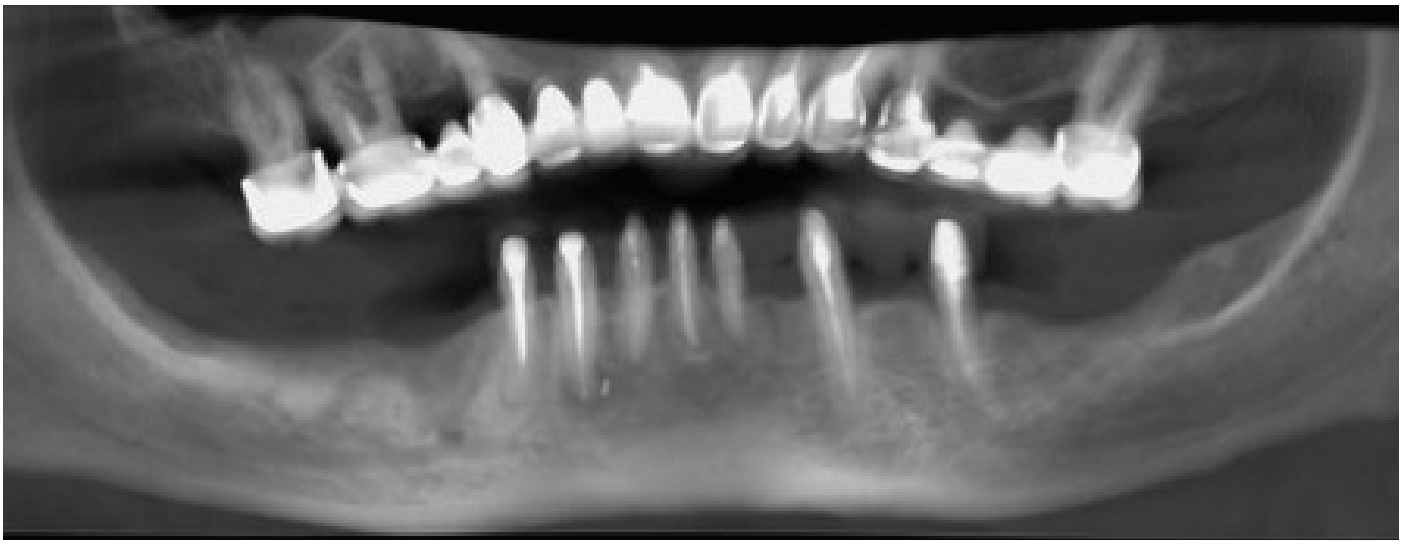

Figure 4. Panoramic reconstruction obtained from CBCT data three months after periodontal and endodontic treatment

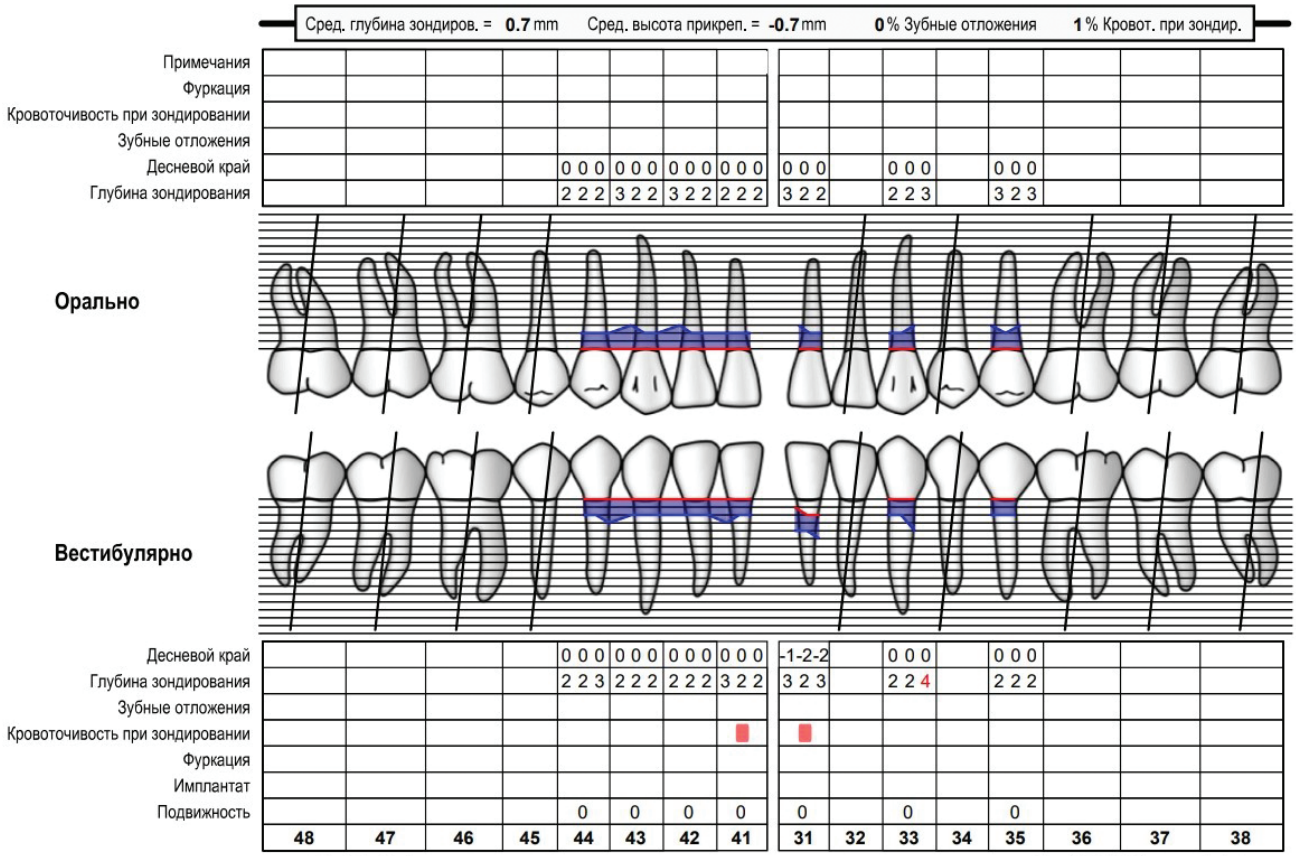

Figure 5. Filled periodontal chart and analysis of the periodontal tissues condition 3 months after periodontal and endodontic treatment

Only tooth 3.3 has demonstrated signs of periodontal pocket with 4 mm depth at the distal region of tooth. Pocket depths at the areas of all other teeth were less than 3 mm (average probing depth was 0.7 mm). Mild signs of bleeding were noted only at the projection of teeth 3.1 and 4.1. Abutment teeth were covered with provisional prosthetic denture. Considering significant improvement of periodontal status, it was decided to start surgical phase of treatment at the projection of distal edentulous regions both on the left and right sides of mandible.

Tissue level implants (Straumann, Villeret, Switzerland) were placed at the projection of teeth 4.5-4.6 (in the projection of tooth 4.5 fixture size was TLC SP NT 10x3.3 mm; tooth 4.6- TLX SP RT 6x3.75 mm) and at the projection of teeth 3.6-3.7(in the projection of tooth 3.6 fixture size was TLC SP RT 10x3.3; tooth 3.7- TLX SP RT 6x3.75) due to the conventional implant placement protocol.

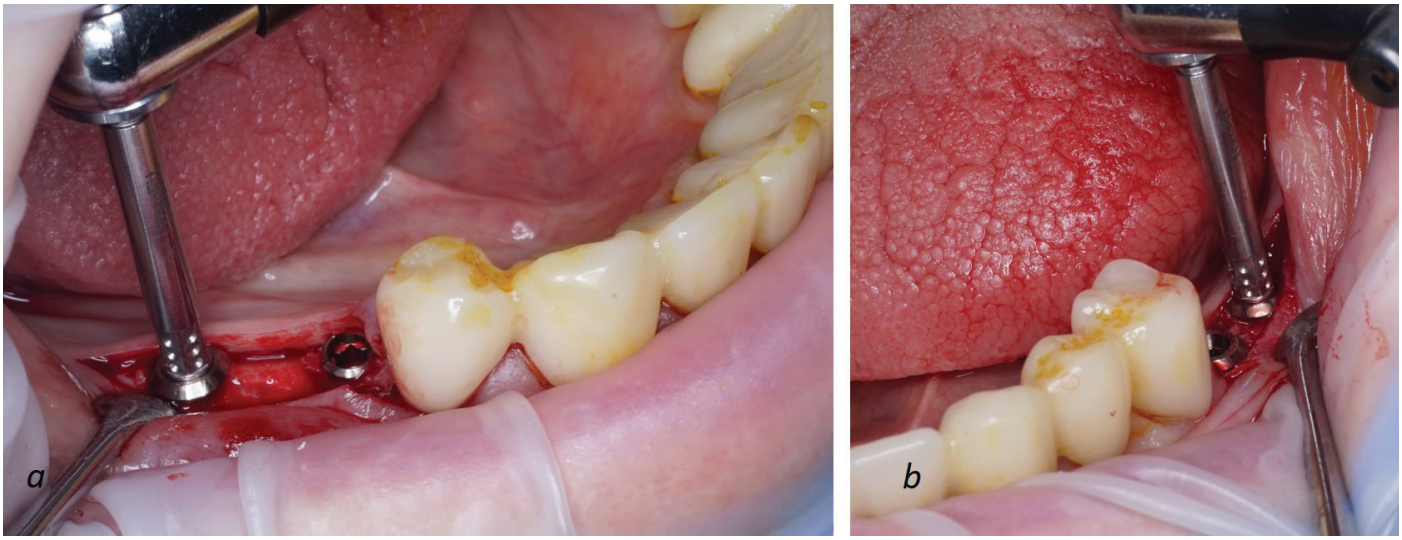

Figure 6. Placement of tissue level implants within the distal mandibular regions due to the conventional protocol. Intraoral view: a - right side, b - left side

To compensate soft tissue collapse within the implant placement region it was decided to augment such with partially epithelialized connective tissue graft. Soft tissue graft was obtained from maxillary tuberosity area, and such was characterized with excess of volume making it not suitable for augmentation (Fig. 7).

Figure 7. Initial volume of obtained soft tissue graft

Graft was shaped, prepared and partially de-epithelialized to overcome issue of volume excess using standard technique. Partially epithelialized connective tissue graft was positioned carefully with the manner of the epithelial portion covering dental implant part, while connective tissue portion was facing inner surface of separated flap and was covered by a flap (Fig. 8).

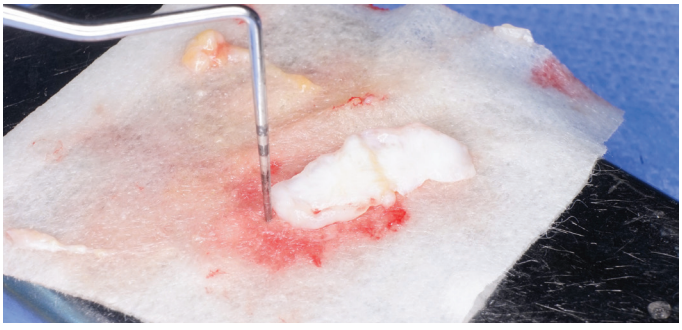

Figure 8. Partially epithelialized connective tissue graft after preparation

Bone particles harvested from the drill during site osteotomy for implant placement after hydratation were used for contoured bone tissue augmentation around installed intraosseous screws (Fig. 9).

Figure 9. Bone particles harvested during site osteotomy and used for the augmentation.

Modified horizontal mattress sutures were used to secure connective tissue graft at the place while retaining its primarily established positions and guaranteeing tension-free flap closure around installed healing abutments. Such complex effect was achieved by suture being looped around the graft and then through the flap, creating «sling» effect that provides support. This technique helps to secure the graft in place and promotes flap adaptation, which is crucial for successful healing and integration (Fig. 10).

Peri-implant tissue condition two weeks after provided surgery could be observed on the figures provided. Full closure outcome was obtained on both sides of mandible (Fig. 11).

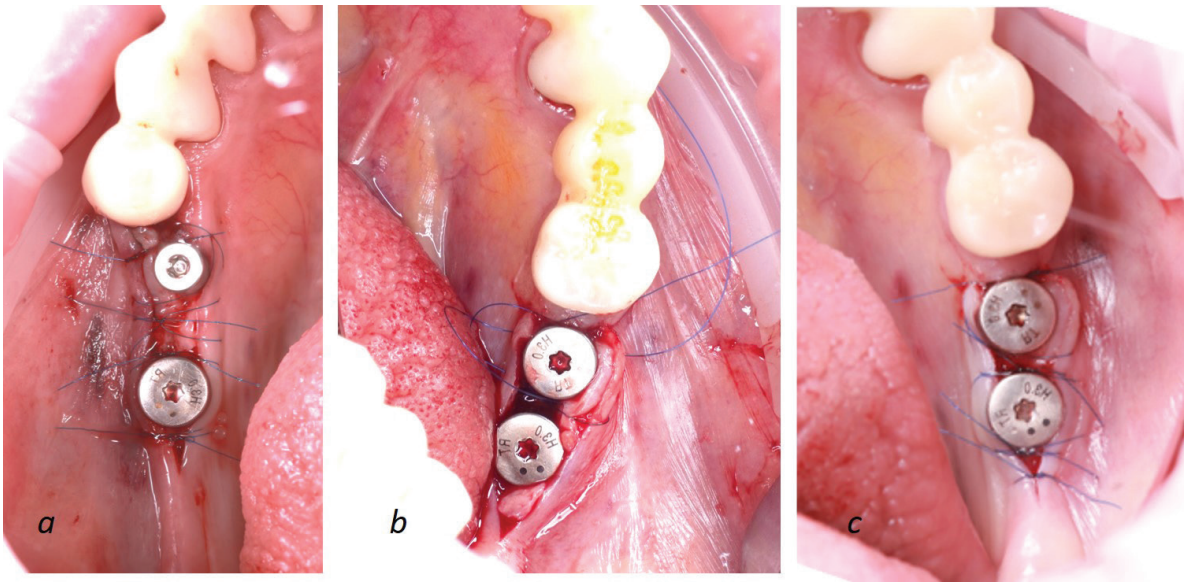

Figure 10. Intraoral photos obtained during and right after suturing with modified horizontal mattress sutures. Intraoral view: a - right side after suturing, b - left side during suturing, c - left side after suturing

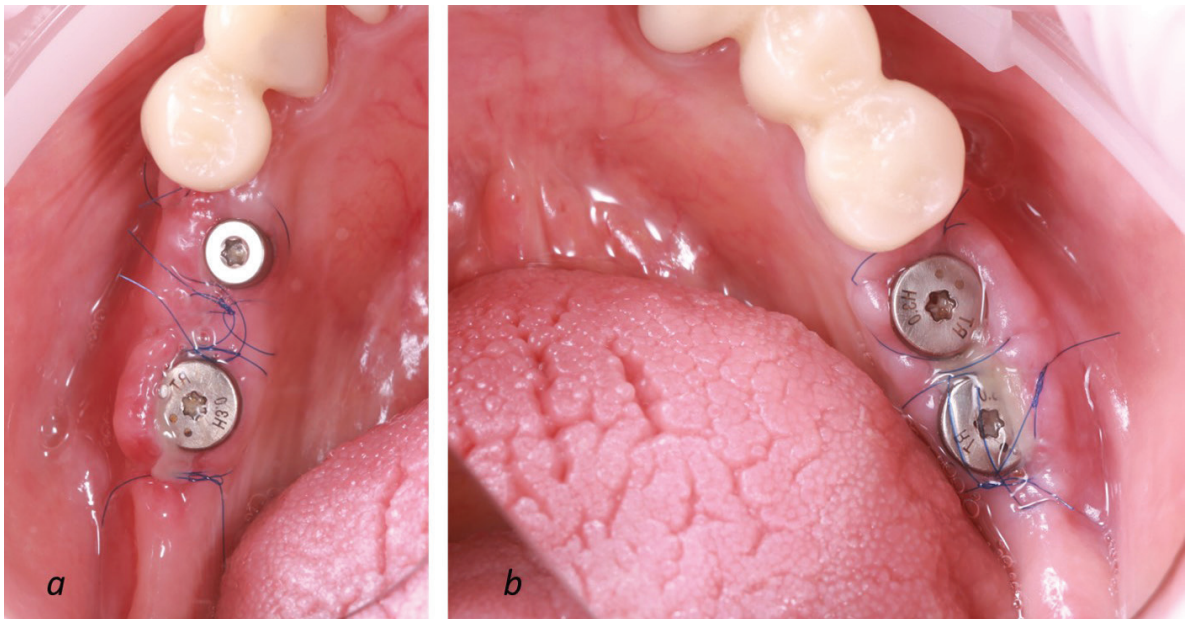

Figure 11. Peri-implant tissue condition two weeks after surgery. Occlusal view: a - right side, b - left side

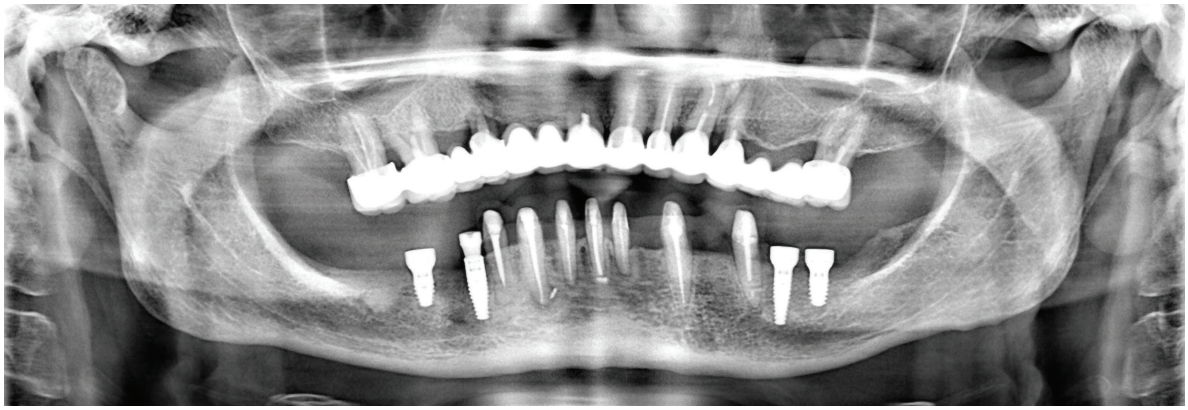

Figure 12. Panoramic X-ray obtained before prosthetic phase of treatment

Ten weeks after the surgery tissue demonstrated fully satisfactory conditions. Panoramic X-ray demonstrated no signs of alteration in implant osseointegration process (Fig. 12).

Results of final rehabilitation with satisfactory appearance of the soft tissue conditions around fixed prosthetic constructions could be observed on corresponding figure (Figure 13).

Figure 13. Satisfactory appearance of soft tissue conditions around fixed prosthetic constructions 1.5 years after

Discussion

Present case report demonstrates possibility and clinical efficiency of using partially epithelized connective tissue graft for the peri-implant soft tissue augmentation simultaneously with dental implant placement procedure. In previous critical review of Mancini et al. soft tissue grafting at the stage of implant placement was categorized as less predictable compared to timing of before implant placement taking into account that soft tissue graft is undergoing shrinkage and its integration may be greatly affected by remodeling patterns and ongoing healing changes, which take place right after implant placement [11]. However, in case of immediate implant placement soft tissue grafting targeted at restoring the volume of soft tissue may be provided simultaneously with the implant placement itself. Combination of immediate implant placement together with soft tissue grafting by sub-epithelial connective tissue graft when replacing a single tooth in the esthetic region helped to reach greater retention of marginal bone levels and level down the risk of vestibular recession development by restoring adequate soft tissue thickness in comparison when no additional soft tissue augmentation was provided [17]. Effect of soft tissue grafting linked to peri-implant phenotype optimization may be characterized as valuably lasting in time regarding maintenance of marginal bone level, soft tissue level and peri-implantitis prevention [18]. In the systematic review of Poskevicius et al. authors have pointed that soft tissue grafting in conjunction with implant placement results with the same effect as soft tissue augmentation procedure around previously installed implants in the mean of keratinized tissue width increase [19]. However, soft tissue grafting at the second stage of implant surgery provided more increase in tissue thickness, when compared with grafting simultaneously with implant placement. In present case report it was demonstrated that partially epithelialized connective tissue graft may be effectively used during late implant placement procedure supporting peri-implant tissue stability and optimizing surrounding gingival profile [19].

Aldhohrah et al. revealed that augmentation with subepithelial connective tissue graft has shown significant improvements in buccal tissue thickness, mid-buccal gingival level and marginal bone loss in peri-implant region compared to situation with no grafting provided in cases of immediate and delayed implant placement [20]. In cases of soft tissues augmentation provided simultaneously with delayed implant placement usage of subepithelial connective tissue graft and acellular dermal matrix was characterized with the same effect on buccal tissue thickness and width of keratinized gingiva [20]. Network meta-analysis provided by Travelli et al. pointed out that combination of coronally advanced flap and connective tissue graft or acellular dermal matrix helps to achieve the best outcomes for mucosal thickness gain, while apically positioned flap with free gingival graft was the best option for the keratinized mucosa width gain [2]. Systematic review of Thoma et al. revealed that usage of autogenous connective tissue graft together with apically positioned flap may reduce bleeding indices, decrease marginal bone loss levels, and improve peri-implant health [10]. Partially epithelialized connective tissue graft which was used in present study characterized with dual properties of connective tissue graft for the increase in gingiva thickness, while it may also enhance in keratinized tissue width as with the use of free gingival graft.

De-epithelization of soft tissue graft could be obtained either with blade, burs (abrasion approach) or laser approach in cases of extraoral procedure [21]. Study provided by Ching-Yi et al. demonstrated that abrasion approach characterized with greater frequency of epithelium remnants verification within de-epithelized graft, but proportion and thickness of epithelium areas compared to lamina propria, and submucosa was statistically analogical between samples obtained with two above-mentioned approaches [21]. However, in case series of Makker et al. it was established that intraoral de-epithelization with bur provided lower mean percentage of epithelial remnants compared to extraoral blade method [22]. Bara-Gaseni et al. proposed new intraoral de-epithelization method realized with the bone scraper, which in the experimental study demonstrated the least residual epithelium areas compared to scalpel and intraoral diamond bur techniques [23]. Systematic review by Hazrati et al. highlighted that level of epithelium removal during de-epithelization of connective tissue graft using lasers was not quantitatively reported in any of the included studies, however laser approach shows some minor superiorities in esthetic criteria compared to blade approach [24]. Results of parallel group randomized clinical trial revealed that extraoral and intraoral gingival graft de-epithelization methods characterized with analogical clinical efficiency in means of treatment outcomes [25]. That is why in present case report de-epithelization was provided by the classical approach with the blade and in extraoral manner.

Advantage of partial de-epithelization is that connective tissue part is positioned in direct contact with under- and overlying vascularized tissue, while epithelial parts help to overcome risk of connective tissue necrosis [26]. It should be noted that quantity of studies regarding the use of either partially epithelized connective tissue graft or partially de-epithelized free gingival graft in implant dentistry is limited. Previously Fawzy et al. reported that de-epithelialized free gingival graft could be effectively used with delayed implant placement to improve thin gingival biotype [27]. Frisch et al. reported successful outcomes of using partially epithelialized connective tissue graft for the treatment of peri-implant recession in presented case-series among fifteen patients [26]. Such approaches helped to stop recession progression, while also to gain keratinized mucosa width to 2.2±1.1 mm and achieve full implant recession coverage in 64% of cases [26].

Randomized clinical trial with one year monitoring demonstrated that usage of de-epithelialized free gingival graft may cause complications in the late period or monitoring in the form graft's reepithelization, formation of epithelial bands, occurrence of cul-de-sac [28]. It is worth mentioning that such complications specifically in late period of monitoring were observed only in cases of using de-epithelialized free gingival graft, while no in the cases of using free gingival grafts and connective tissue grafts [28]. From the obtained data authors had concluded that connective tissue grafts may be interpreted as more reliable option for soft tissue augmentation compared to de-epithelized free gingival graft in terms of risks for the development of late complications. Taking this into account it should be highlighted that de-epithelization of free gingival graft either full or partial remains overly sensitive technique in practical realization, therefore clinicians with the lack of appropriate experience should use it with caution.

Short comparative summary of partially de-epithelized connective tissue graft, subepithelial connective tissue graft and de-epithelialized gingival grafts provided within the table below (Table 1).

Table 1. Comparative summary of partially de-epithelized connective tissue graft, subepithelial connective tissue graft and de-epithelialized gingival grafts

Graft Type	Healing Time	Aesthetic Results	Patient Satisfactionw
PECTG Grafts	Stable, minimal complications (Frisch & Ratka-Krüger, 2020) [26]	High keratinized tissue width, excellent color match (Frisch & Ratka-Krüger, 2020) [26]	High satisfaction, low pain (Frisch & Ratka-Krüger, 2020) (Zangrando et al., 2021) [26, 29]
SCTG Grafts	Comparable healing time (Zucchelli et al., 2010) [30]	Better color match and texture harmony (Beymouri et al., 2023) [31]	Lower stress, better chewing ability (Zucchelli et al., 2010) [30]
DGG Grafts	Longer healing time (Zucchelli et al., 2010) [30]	Inferior color match (Beymouri et al., 2023) [31]	Higher stress, more discomfort (Zucchelli et al., 2010) [30]

Naziker et al. reported that de-epithelized connective tissue graft supports better esthetics outcome quantified by photographic ΔE parameters, while VAS scores obtained was analogical both for de-epithelialized free gingival graft and conventional free gingival graft in 6 months follow up [32]. However, authors pointed out that partially de-epithelized free gingival graft characterized with pinkier appearance compatible with the recipient site, while conventional free gingival graft characterized with more whitish representation [32].

As any other grafting procedure with autogenous material usage of partially de-epithelized soft tissue graft causing post-operational discomfort at the donor region. Zucchelli et al. previously established that the level of pain observed at the donor regions correlates negatively with the residual thickness of soft tissue layer which covers palatal bone [30].

It should be also highlighted that not only partially de-epithelized connective tissue graft itself, but complex procedure of soft tissue augmentation helped to obtain successful outcome. In present case specific suturing approach was also provided to secure the graft in place and promotes flap adaptation by so-called «sling»-effect, which is crucial for successful healing and integration. To achieve the most individualized outcome customization of healing abutment may be used as valuable approach preserving surrounding soft-tissue level, promoting its biologically adapting contouring and enhancing its regeneration [33, 34, 35]. In present case report the most adapted size of healing abutment was chosen among available ones taking into account future profile of prosthetic construction.

Generally, correct implant positioning, soft tissue augmentation, biologically oriented suturing and gingiva contouring with the healing abutment were the components of complex treatment approach, responsible for the achievement of proper peri-implant tissue stability and esthetic appearance.

Conclusion

Partially epithelized connective tissue graft combines features of both connective tissue graft, which makes it suitable for mucosa thickness gain, and free gingival graft, whin in turn helps to increase width of keratinized gingiva. Such universal properties make it suitable candidate for the usage simultaneously with implant placement to enhance peri-implant esthetic profile and optimize surrounding soft-tissue stability for further prosthetic rehabilitation. Further research is recommended to explore the long-term outcomes and potential applications of PECTG grafts in other clinical scenarios.

Ethical aspects

Authors confirm that they have followed all relevant ethical norms and requirements during the treatment described within present case report and preparation of present manuscript. Authors obtained full patient's agreement regarding publication of following case report, and such was approved by corresponding consent form signed by the patient personally. No information in present case report may disclose any personal data about the patient, which further may be used for patient's personal identification. Any information related to patient's identity disclosure was either deleted or anonymized within present case report.

Authors confirm that they have followed CARE guidelines while preparing present case report with intention for further publication.

Conflict of Interest

Author does not have any potential conflict of interests that may influence the decision to publish this article.

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Використання частково епітелізованого сполучнотканинного трансплантата з метою одночасної дентальної імплантації та аугментації періімплантних м'яких тканин. Звіт про клінічний випадок

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A – розробка концепції та дизайну дослідження, B - збір та або систематизація даних дослідження, C - аналіз та тлумачення даних дослідження, D - написання публікації, E - критичне доопрацювання тексту публікації, F- остаточне затвердження.

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Ключові слова:
сполучнотканинний трансплантат, деепітелізація, періімплантатні м'які тканини, дентальна імплантація

Анотація

Вступ. Новизною представленого клінічного випадку є досягнення успішних результатів імплантат-ортопедичної реабілітації завдяки формуванню адекватного «рожевого» естетичного профілю та забезпечення стабільності періімплантатних м'яких тканин із застосуванням частково епітелізованого сполучнотканинного трансплантата одночасно із відтермінованим встановленням дентальних імплантатів. За наявними відомостями, подібна методика лише епізодично описувалася в спеціалізованій літературі.

Мета. Продемонструвати клінічну можливість використання частково епітелізованого сполучнотканинного трансплантата для збільшення об'єму періімплантатних м'яких тканин під час встановлення дентальних імплантатів з метою покращення естетичного профілю та оптимізації стабільності м'яких тканин для подальшої протетичної реабілітації.

Клінічний випадок. Пацієнт, 46 років, звернувся до стоматологічної клініки зі скаргами на незадовільний функціональний стан нижнього фіксованого протеза, яким користувався протягом 9 років. Крім того, пацієнт висловив бажання покращити жувальну функцію шляхом відновлення беззубих дистальних ділянок нижньої щелепи за допомогою ортопедичних конструкцій фіксованих на імплантати. Попередній протез було делікатно демонтовано з опорних зубів без порушення їх пародонтального стану. Усі необхідні терапевтичні та пародонтологічні втручання були проведені відповідно до клінічних показань. Дентальні імплантати були встановлені у позиції зубів 4.5–4.6 та 3.6–3.7 згідно зі стандартним протоколом Tissue Level. З метою компенсації дефіциту м'яких тканин у зонах імплантації було прийнято рішення про їх збільшення частково епітелізованим сполучнотканинним трансплантатом. Трансплантат був сформований, підготовлений та частково депітелізований для уникнення надмірного об'єму за стандартною методикою. Трансплантат був розташований таким чином, що епітелізована частина покривала ділянку імплантата, тоді як сполучнотканинна частина прилягала до внутрішньої поверхні відшарованого клаптя й була закрита ним. Для фіксації трансплантата застосовували модифіковані горизонтальні матрацні шви, що забезпечували стабільність його позиції та герметичне закриття клаптя навколо формувачів ясен. У фіналі лікування досягнуто задовільних функціональних та естетичних результатів із належним станом м'яких тканин навколо ортопедичної конструкції.

Висновки. Частково епітелізований сполучнотканинний трансплантат поєднує властивості сполучнотканинного трансплантата, придатного для збільшення товщини слизової оболонки, та вільного ясеневого трансплантата, який, у свою чергу, дозволяє розширити зону кератинізованої ясеневої тканини. Завдяки універсальним характеристикам він може бути доцільним варіантом для застосування одночасно зі встановленням імплантатів з метою покращення періімплантатного естетичного профілю та підвищення стабільності навколишніх м'яких тканин для подальшої протетичної реабілітації.

Заява про конфлікт інтересів
Цим автор підтверджує відсутність зв'язку з будь-якою організацією чи компанією, яка може мати будь-який фінансовий або нефінансовий інтерес до матеріалів дослідження, розглянутих в цій статті.

Заява про фінансування
Не було отримано жодного фінансування для допомоги в підготовці та проведенні цього дослідження, а також для написання цієї статті.

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