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Case report on immediate replacement for maxillary posterior teeth with fixed implant-borne restorations: need – opportunity – feasibility of avoiding conventional sinus floor elevation

Vitaly Pchelnik [A, C, D, F]
DDS, DMD, Private Practice, Lviv, Ukraine
ORCID ID: 0009-0001-8631-2667

Karyna Kryvoruchko [B]
DDS, Private Practice, Lviv, Ukraine
ORCID ID: 0009-0002-3969-2414

Daryna Tolkachova [E]
DDS, Private Practice, Kharkiv, Ukraine
ORCID ID: 0009-0009-4359-958X

Corresponding author. Vitaly Pchelnik, 88 Yevhena Konovaltsya Str., Lviv, Lviv region, 79057 Ukraine
E-mail address: vitalypchelnik@gmail.com

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Abstract

Background. Development of present implant-borne prosthetic rehabilitation approaches focused on the possibility to obtain the most patient-centered outcomes considering not only functional and esthetic criteria, but also time- and cost-beneficial results.

Objective. To represent potential for simultaneous usage of multiple adaptive treatment modalities, including transcrestal sinus floor elevation, angled implant positioning, implant placement within the pterygoid process and intraoral welding, in case of immediate replacement of maxillary posterior teeth with implant-borne fixed restorations.

Case report. 50-year-old male patient referred to dental clinic complaining on bilateral aedentia within the distal regions of maxilla and signs of excessive tooth wear in the projection of frontal mandibular teeth. Intraoral scanning procedure helped to agree plan of proposed complex dental rehabilitation with the patient, and later intraoral scanning results were coupled with CBCT data to plan surgical stage of future interventions through specialized software. During the planning stage implant scan bodies were uploaded from the virtual library and positioned on the virtual model following obtained digital treatment plan. Such approach helped to initiate provisional dentures manufacturing within dental lab even before any surgical intervention was provided. Provisional implant-borne dentures were reinforced with the partial titanium bars disconnected from each other in the area of the pontics during modelling stage, but connected later within oral cavity by welding procedure. Considering the need for realization of immediate implant loading protocol to decrease overall treatment duration, it was decided to position needed number of implants avoiding sinus floor elevation through lateral window approach. Taking this into account dental implant in the projection of tooth 1.5 was positioned in adaptive angled positions following sinus wall projection. The lack of space within the left maxillary region did not allow us to choose the same treatment tactics in this area, so it was decided to place the implant in area of missing tooth 2.5, while providing transcrestal sinus floor elevation position before. Placement of dental implant in the projection of tooth 2.7 was provided into the pterygoid process of the sphenoid bone, considering the need in achievement of corresponding primary stability for the immediate loading approach. All implant were placed by using surgical guides manufactured with 3D printing technology within dental clinic conditions.

Conclusion. Need for avoidance of conventional sinus floor elevation procedure through lateral window access may be interpreted as prerequisite condition for the realization of immediate implant loading protocol in cases of bilateral aedentia at the distal regions of maxilla. Digital planning expands possibilities for effective complex dental rehabilitation and supports reduction of overall treatment duration, nevertheless, such requires sufficient knowledge and experience for correct performance within intricated clinical conditions.

Introduction

Recent developments of implant-borne prosthetic rehabilitation approaches focused on the possibility to obtain the most patient-centered outcomes considering not only functional and esthetic criteria, but also time- and cost-beneficial results [1, 2]. Many patients seeking dental implants treatment characterized with variety of bone proposal's deficiencies represented by different level of manifestations in means of vertical and horizontal parameters linked to residual ridge's configurations, topography distribution and associated bone density scarcity. Deficiency of available bone volume arguments the need for provision of additional bone augmentation procedures, which may prolong treatment duration significantly [3, 4, 5]. To overcome such limitations doctor may adapt implant and prosthetic treatment workflows in the way of avoiding the most interventional surgical manipulations, which on the one hand prolongs the time of rehabilitation, but on the other hand such are usually characterized with significant level of traumaticity and linked with the risk of complications intra- and post-operatively.

Sinus floor elevation through the lateral window approach, even though had been widely used in the clinical practice as a classical method to restore lost bone volume in the projection of posterior maxilla region, associated with the number of drawbacks and complications [6]. Systematic review of Hsu et al. reported that sinus floor elevation through the lateral window approach characterized with the greater number of sinus membrane perforations and post-operational sinusitis development compared to the transcrestal approach, while except that lateral window technique also was associated with such complications as wound dehiscence and exposure of applied bone substitute, which required additional interventions [7]. Results of previous randomized trial also revealed that transcrestal approach of sinus floor elevation characterized with more tolerable postoperative course by dental patients, who also have reported lower postoperative morbidity compared to individual who have undergone lateral sinus floor elevation procedure [8].

Sufficient experience in using modern digital technologies and understanding the biological interaction between dental implants and surrounding bone may support clinical realization of treatment workflow that not only avoids augmentation in general, but contributes to the so-called immediate implant-borne prosthetic rehabilitation, when the patient receives first provisional crowns right away at the end of very first surgical appointment. ITI consensus report highlighted that considering data available from systematic reviews protocol including immediate implant placement and immediate loading considered to be predictable when performed for replacement of single teeth within anterior maxilla region [9], while several previous studies also reported that complete-arch fixed implant-supported rehabilitation seems to be quite successful with immediate implants placement and further immediate implant loading in means of implant survival and patient satisfaction [10].

Applicability of immediate implant placement associated with immediate implant loading protocol for partial fixed prosthetic rehabilitation in the posterior regions of jaw remains to be aspect of relevant targeted investigations, since available data on such approach characterized with significant level of heterogeneity [11]. The effect of data heterogeneity itself regarding above-mentioned aspect may be caused by the fact that immediate protocols can be either linked with different additional augmentation interventions, or can be provided without such through the adaptive and controlled implant placement (titled implant positioning within the projection of sufficiently available bone volume through the static or dynamic navigation), usage of additional bone-recipient zone, such as pterygoid region, and by the usage of short implants or intraosseous screws of modified design.

Despite the fact that case reports may not be interpreted as a source of significant evidences, but representation of such helps to highlight the relevance of the existing clinical problem and to demonstrate progress in approbation and adoption of available techniques used for the solution of complex clinical cases by modern modifications within applied clinical workflow. Present case report demonstrates complex rehabilitation of dental patient with bilateral implant-borne fixed partial prostheses at distal jaw regions provided in immediate placement-immediate loading mode within the conditions of bone maxillary bone deficiencies, while avoiding conventional sinus floor elevation procedure through lateral window and using either transcrestal approach at one side and adapting implant placement position on another side instead.

Objective

To represent potential for simultaneous usage of multiple adaptive treatment modalities, including transcrestal sinus floor elevation, angled implant positioning, implant placement within the pterygoid process and intraoral welding, in case of immediate replacement of maxillary posterior teeth with implant-borne fixed restorations.

Clinical case description

50-year-old male patient referred to the dental office complaining on bilateral aedentia within the distal regions of maxilla and signs of excessive tooth wear in the projection of present frontal mandibular teeth. During first diagnostic visit patient informed dentist that he is living in another city and that he is willing to obtain all the needed interventions and rehabilitation in general within the limited number of visits.

Provided complex clinical examination revealed signs of abrasion and cracks within the enamel structure of anterior mandibular teeth, caused by the present masseter muscles' parafunction (Fig. 1-2).

Figure 1. Clinical photo revealing missing maxillary teeth, while also abrasion, cracks, and discoloration of mandibular teeth

Figure2. Clinical photo with retractor revealing missing maxillary teeth, while also abrasion, cracks, and discoloration of mandibular teeth

Data obtained from cone-beamed computed tomography approved deep carious lesions with roots destruction signs being present at the projection of teeth 1.3 and 2.7. Tooth 2.4 was characterized with 7 mm vertical bone defect, and 3rd level of pathological mobility.

Intraoral scanning procedure with the use of 3Shape Trios 3 scanner (3Shape, Copenhagen, Denmark) helped to agree plan of proposed complex dental rehabilitation with the patient (Fig. 3).

Later intraoral scanning results were coupled with CBCT data (Orthophos XG 3D, Dentsply Sirona, Benssheim, Germany) to plan surgical stage of future interventions through coDiagnostiX software (Dental Wings GmbH, Chemnitz, Germany) (Fig. 4-5).

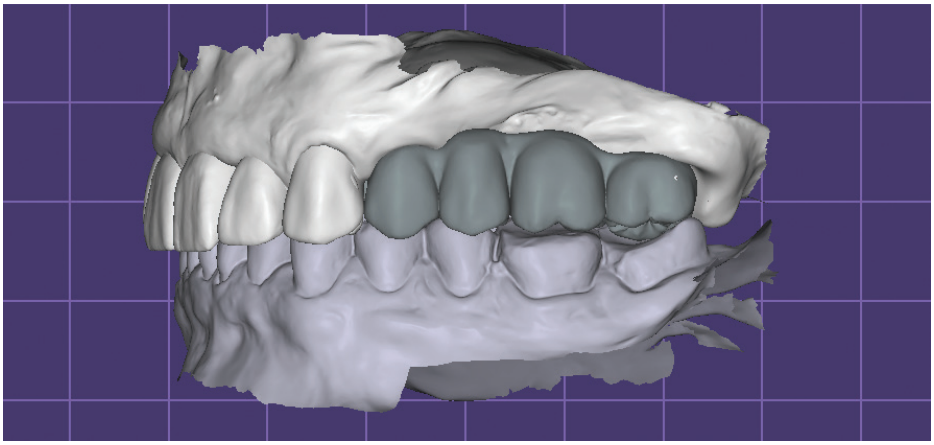

Figure 3. 3D virtual modelling of future prostheses for correct 3D positioning of dental implants (Exocad DentalCAD, exocad GmbH, Darmstadt, Germany)

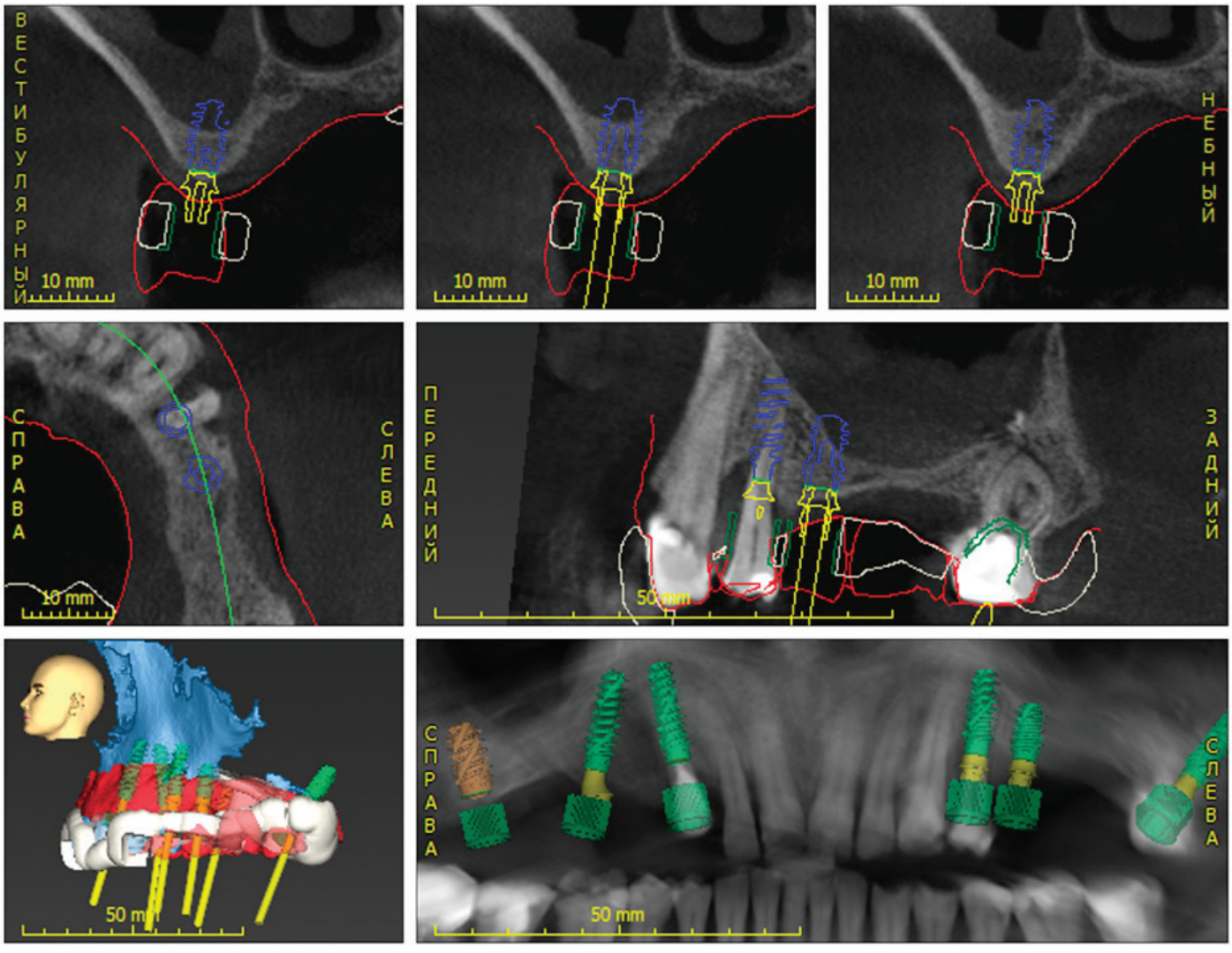

Figure 4. Planning implants positions in coDiagnostiX software (Dental Wings GmbH, Chemnitz, Germany). Planning of placing the implant in area of missing tooth 2.5 with a transcrestal approach for sinus floor elevation

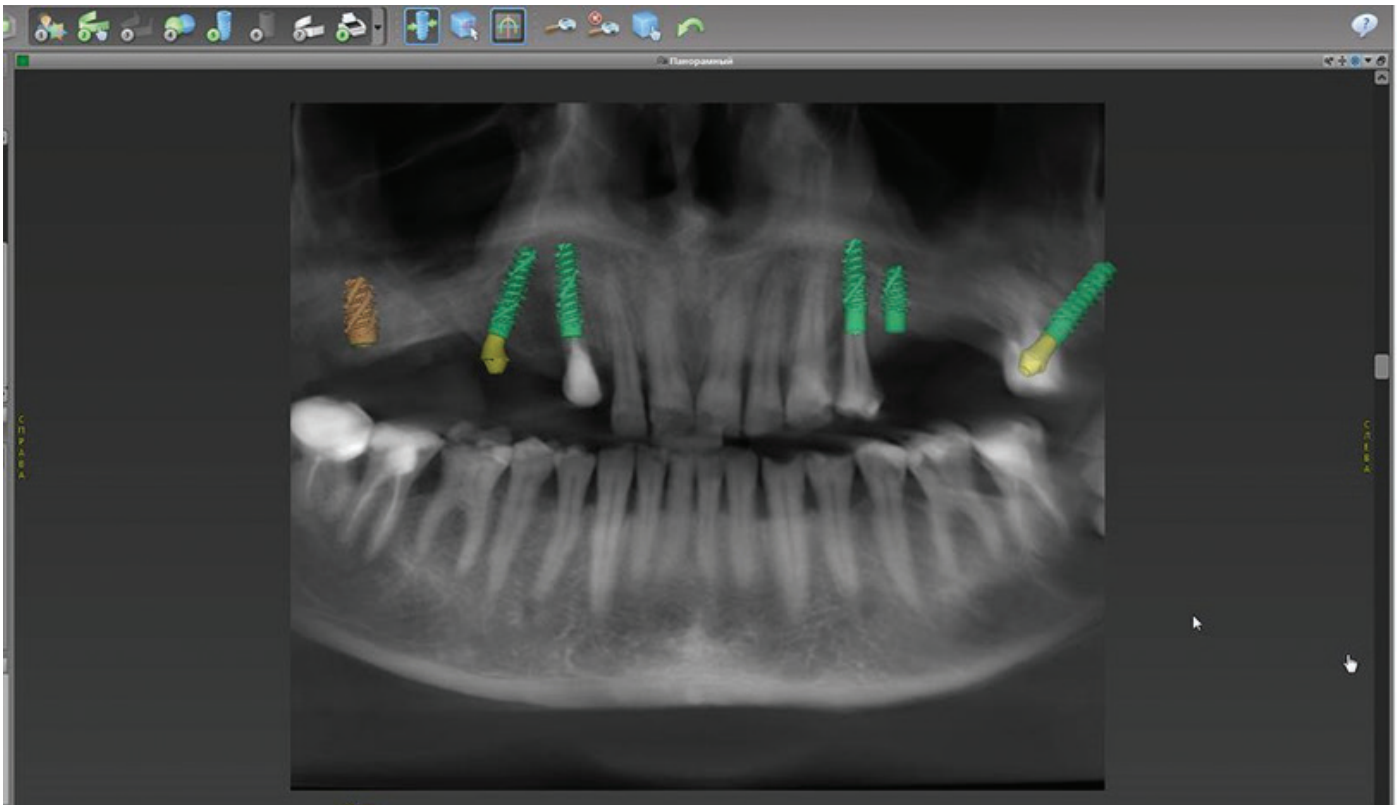

Figure 5. Planning implants positions avoiding the lateral window SFE procedure. For this purpose, the implant in area 15 was positioned angled, in accordance with available sinus wall

Considering the need for immediate implant loading protocol, which helps to decrease overall treatment duration, it was decided to position needed number of implants avoiding conventional sinus floor elevation procedure through lateral window approach. Taking this into account dental implant in the projection of tooth 1.5 was placed in adaptive angled position following sinus wall projection. The lack of space within the left maxillary region did not allow to choose the same treatment tactics in this area, so it was decided to place implant in the area of missing tooth 2.5, while providing transcrestal sinus floor elevation position before it. Placement of dental implant in the projection of tooth 2.7 was provided into the pterygoid process of the sphenoid bone, considering the need in achievement of corresponding primary stability level needed for the immediate loading approach. All implant were placed by applying surgical guides manufactured with 3D printing technology (Asiga PRO, Asiga, Sydney, Australia) at the dental clinic.

During the planning stage implant scan bodies were uploaded from the virtual library and positioned on the virtual model following obtained digital treatment plan (Fig 6). Such approach helped to initiate provisional denture manufacturing within dental lab even before any surgical intervention was provided (Fig 7-8). Provisional implant-borne dentures were reinforced with the partial titanium bars disconnected from each other in the area of the pontics during modelling stage (Fig 9.)

Figure 6. Intraoral scan with virtual scan bodies (STL file) from the coDiagnostiX software (Dental Wings GmbH, Chemnitz, Germany)

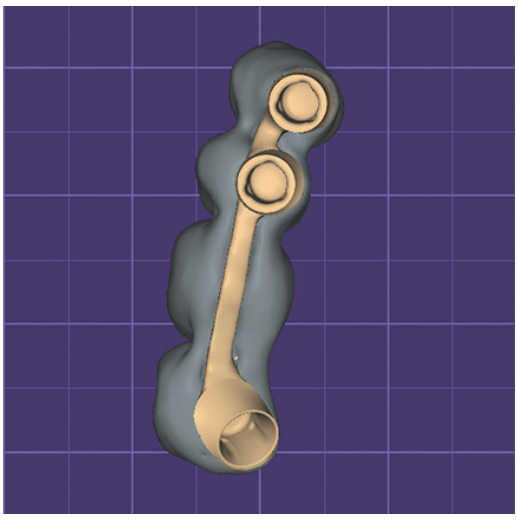

Figure 7. 3D model of future titanium bar and PMMA implant supported fixed provisional denture

Figure 8. Implant supported fixed provisional dentures

Figure 9. Titanium bar disconnected in the area of the pontics at the modelling stage

Atraumatic extraction of teeth 1.3, 2.4 and 2.7 was performed under intravenous sedation. Straumann BLX implants (Straumann, Villeret, Switzerland) were placed in the projection of teeth 1.7, 1.5, 1.3, 2.3, 2.4 and 2.7. In the area of implants placed at the projection of teeth 1.3 and 2.4, additional lateral augmentation of bone ridge was performed using the mixture of Cerabone (botiss biomaterials GmbH, Zossen, Germany) and autologous bone. Augmentation areas were covered with Resorba collagen membrane (RESORBA Medical GmbH, Nürnberg, Germany), and the latter was fixed with Meissinger pins (Meissinger, Neuss, Germany).

Before implant placement in the projection of tooth 2.5 drilling was perfromed with the use of 2.0- and 2.8-mm sized drills through the surgical guide. Afterwards the transcrestal sinus floor elevation was provided with the osteotomes through their sequential increase in diameter and handles used from the navigation set (Fig. 10-12).

Seventeen degrees, 17° angled screw retained abutments were fixed on implant placed in the projection of teeth 1.5 and 2.7. Angled abutments were screwed with 20 N/cm torque.

Fragments of a titanium bar were fixed over screw-retained abutments, and then such were connected with each other by the use of intraoral welding approach, forming continuous titanium bar (Fig. 13).

Figure 10. Intraoral view of drilling through the surgical guide with the 2.0 drill

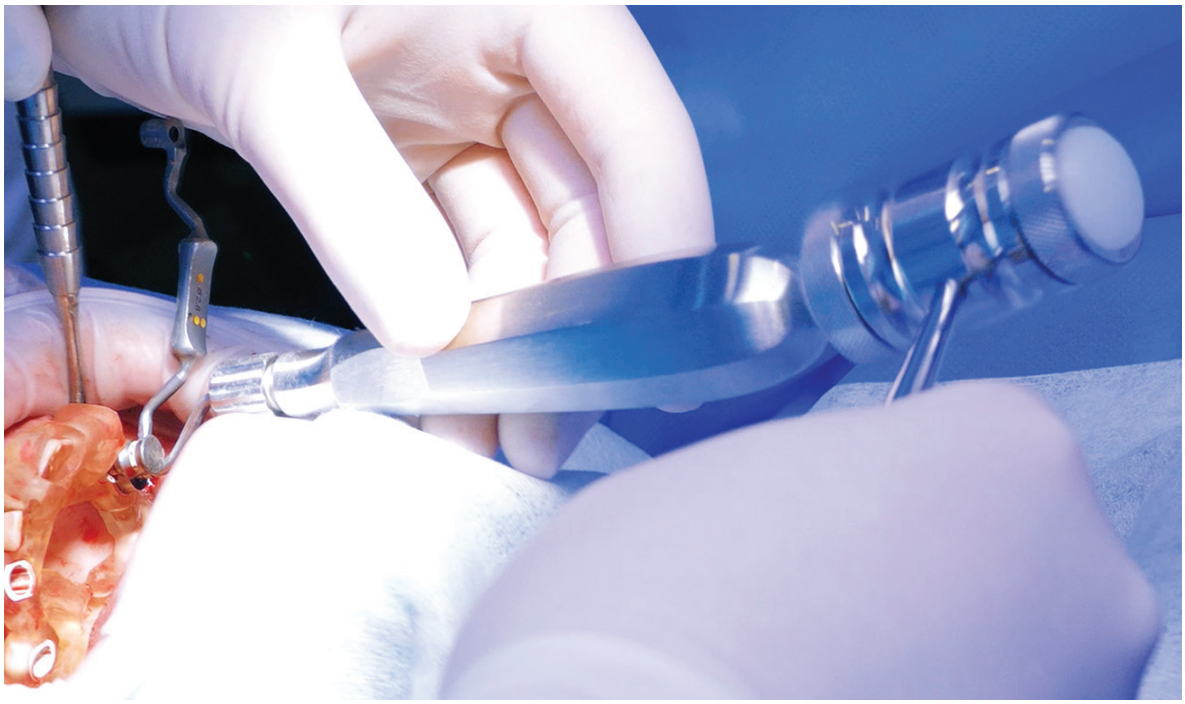

Figure 11. Intraoperative view. Osteotomy through the surgical guide for the maxillary sinus floor elevation with a transcrestal approach

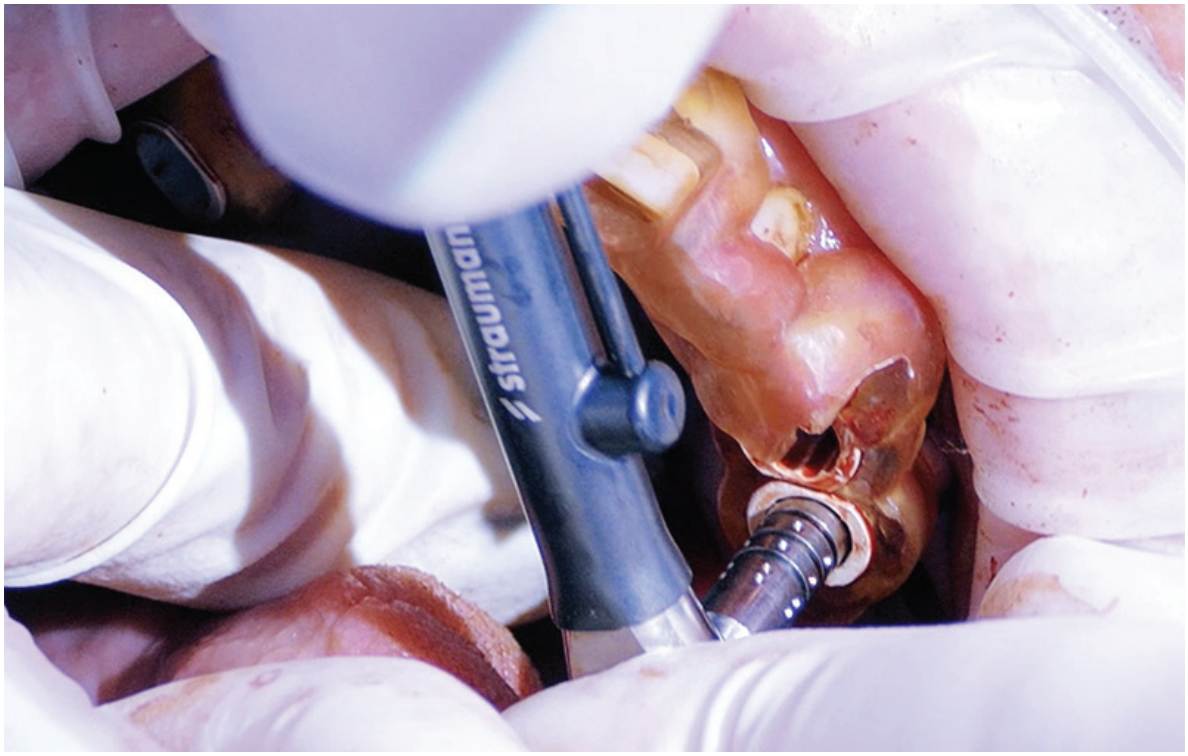

Figure 12. Intraoral view of implant placement

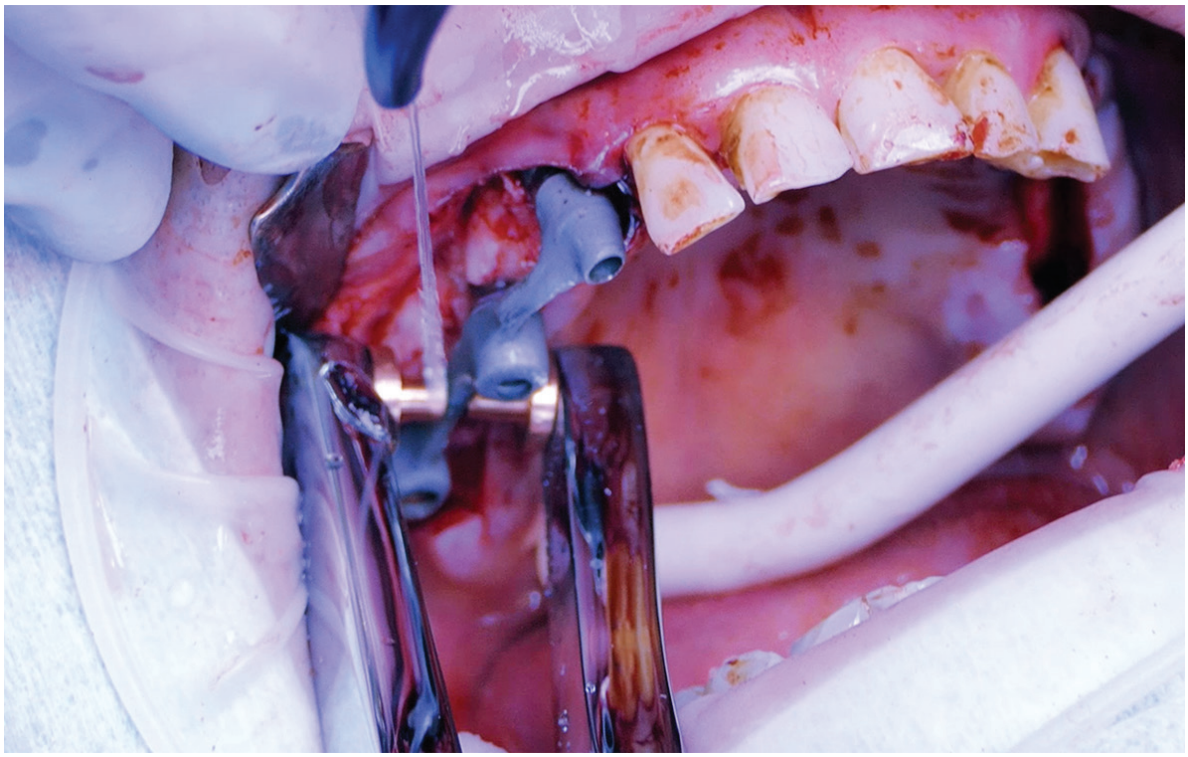

Figure 13. Fragments of titanium bar fixed to all screw retained abutments and then connected to each other using intraoral welding

PMMA provisional dentures were connected to the bar by the two-component composite cement RelyX U200 (3M ESPE, Seefeld, Germany). After that provisional dentures were removed and relined with the use flowable composite. Polishing of relined provisional was provided extraorally. At the end relined and polished provisional dentures were screwed to the abutments with 10 N/cm torque, and 15 N/cm screw torque was provided at the implant level (Fig. 14). Occlusion was checked and corrected by the conventional articulator paper approach.

4 months later restorative treatment of mandibular teeth was provided, and the teeth with pathological tooth wear signs were restored with all-ceramic restorations (Fig. 15). Provisional implant-borne dentures on the maxilla were replaced with definitive zirconium bridges (Fig 16-18).

Figure 14. Postoperative view. Titanium reinforced implant supported fixed provisional dentures

Figure 15. Intraoral view. 4 months postoperative examination

Figure 16. Replacement of provisional prosthetic construction with fixed implants-supported zirconium oxide bridges and ceramic restorations on the worn mandibular dentitions

Figure 17. Intraoral picture of final prosthetic result

Follow-up examination after three years revealed no complaints from the patient, and no mechanical or biological complications were registered. Marginal bone levels at the projection of dental implants remained stable and demonstrated no signs of pathological saucerization (Fig. 19-21).

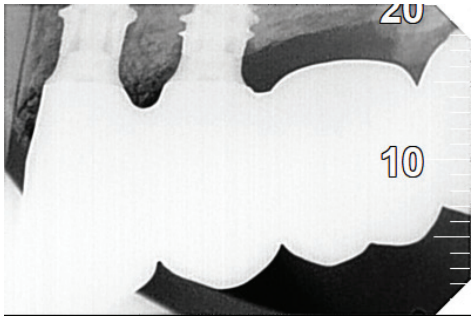

Figure 18. Intraoral X-ray control of peri-implant bone levels after 6 months

Figure 19, 20. Intraoral picture of final prosthetic result, 3 years follow-up

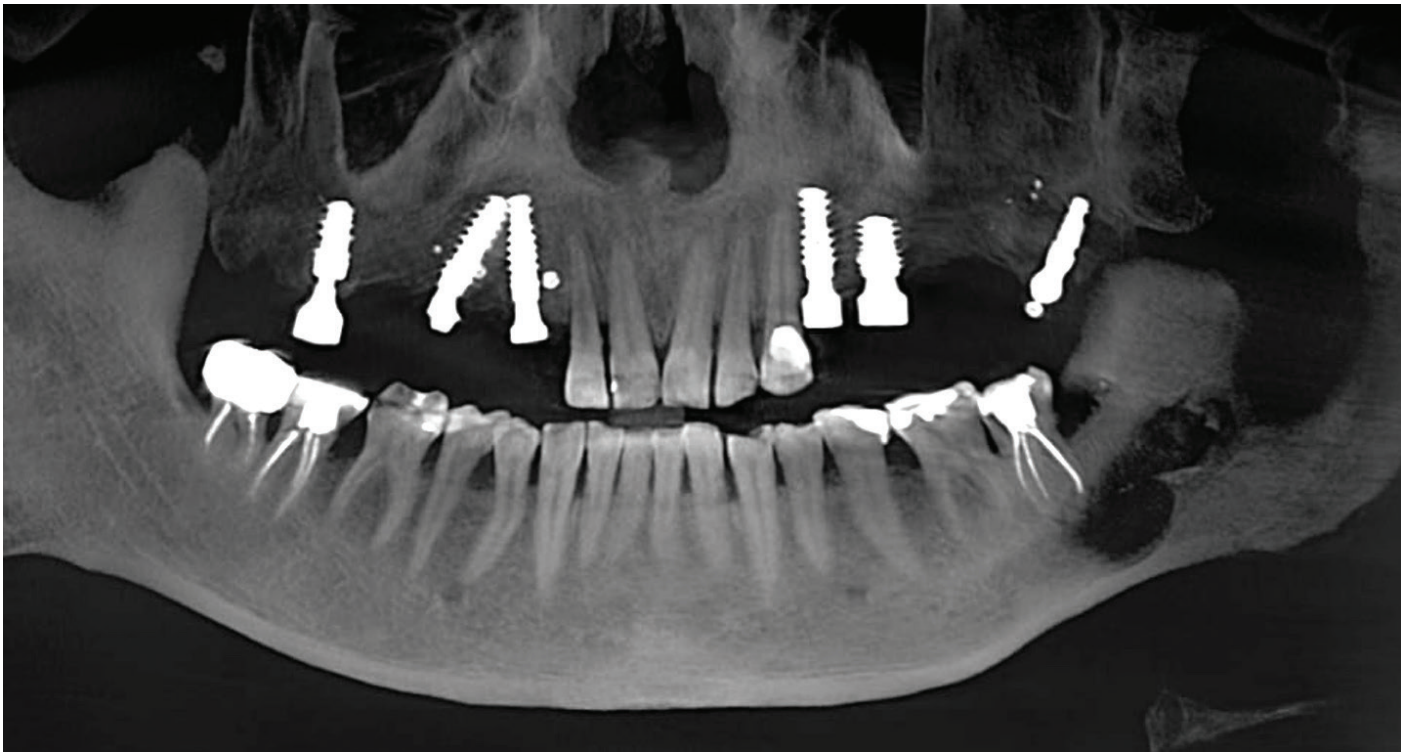

Figure 21. CBCT control of peri-implant bone levels, 3 years follow-up

Discussion

Immediate implants placement combined with immediate loading by fixed implant-borne dentures represent suitable and efficient approach aimed at reducing treatment time and simultaneously at simplifying treatment workflow. Such approach already has shown successful outcomes in cases of single implant placement while also during rehabilitation of fully edentulous jaws [9, 10]. Systematic review of Gallucci et al. revealed that immediate implant placement accompanied with immediate loading characterized with comparable cumulative implant survival rates, while such approach itself may be interpreted as sufficiently clinically documented but needs some time for evidence base increase to be interpreted as scientifically and clinically validated [12]. Patients with fully edentulous either maxilla or mandible obtain the most benefit from immediate implant loading approach due to the possibility to restore their mastification function and esthetic parameters right at the end of implants placement visit, however there are still a lack of strict definitions regarding corresponding inclusion-exclusion criteria for patients' selection suitable for above-mentioned manipulations [13].

Immediate loading of dental implants in partially edentulous patients demonstrates non-inferior results compared to early loading as was observed in 15-years follow up of multicentered randomized controlled study in terms of implant failures, prosthetic failures, complications prevalence, peri-implant bone loss levels and soft tissue changes [14]. However, in the randomized clinical trial with 1-year monitoring Ko et al. revealed that immediate loading was associated with lower implant survival rates compared to early loading in partially edentulous jaws, even though marginal bone level changes were not statistically different between approaches [15]. Systematic review of Del Fabbro et al. noted that weighted implant survival rates have not been significantly different in cases of immediate implant loading for full-arch fixed prosthesis, single tooth replacement and partial fixed prosthesis [16], but in number of studies implant immediate loading remained as questionable approach from the point of predictability when such was realized specifically in the posterior maxilla region [17].

Immediate loading approaches were well-accepted by dental patients, even though patient satisfaction with immediate and early or even conventional treatment modality seems to be analogical [18]. Most of studies available in the databases demonstrated high level of patient satisfaction with immediate loading either with single implant placement scenario or in full-arch rehabilitation cases, while there is a lack of studies focusing on two-three units partial implant-fixed dentures [18]. In present case report it was found that patient was fully satisfied regarding obtained rehabilitation results through immediate loading protocol in partial fixed implant dentures.

In critical deficiencies of bone volume at the posterior maxilla, when there is lack of bone to follow even with titled implants, short and extra-shorts implants remain an alternative to sinus floor elevation procedure if the immediate implant loading is preferable [19]. Cumulative survival rate and mean bone loss of immediately loaded short and extra short implants were not statistically different from such of immediately loaded conventional implants when both types were placed at posterior maxilla and mandible [20, 21]. Meta analytical processing of literature data supported suggestions that immediate loading does not compromise the survival of short implants compared to early or delayed loading. Significant volume of evidence even support suggestions that there is no difference in prosthetic complications between short and conventional implants installed in posterior atrophic maxilla [22].

In present case report it was possible to avoid usage of short dental implants, instead some other treatment modalities were used. First of all, adapted dental implant angled positions were realized. Residual ridge configuration allowed to use tilted implant approach at the one side of the maxilla to restore dentition with implant-borne partial denture. Previously Batista et al revealed that tilted implants did not demonstrate any differences regarding survival rates compared to axially-place implants, however tilted implants presented higher potential marginal bone loss levels, when used as support for fixed partial dentures [23]. However, such difference was not noted while comparing tilted and axial implant for full-arch rehabilitation of completely edentulous atrophic maxillae with immediately loading approach. Brinkmann et al. have not found any differences in marginal bone loss among axial and tilted implants both in partial and full rehabilitations [24]. Even though marginal bone loss levels may be different between axial and tilted place implants, available evidences still support use of tilted implants as predictable treatment option (Del Fabbro, 2022).

One of the implants in present case report was installed within the pterygoid process to overcome bone deficiencies at the projection of sinus floor. Body of available evidence supports present approach, demonstrating that survival rates of implants placed within pterygoid process are analogical to such placed within other regions of either mandible or maxilla at least at the period of up to 6 years [26, 27]. It should be highlighted that in most cases and researches present within available literature pterygoid implant placement was provided under scenarios of full-arch fixed implant-supported prosthesis, while in present case report above mentioned approach was applied for fixed partial implant-borne prostheses rehabilitation. On the other hand, usage of pterygoid implant may also be interpreted as an intervention to optimize treatment const and obtain higher patient-oriented benefit from the treatment, considering that such approach eliminates the need in sinus floor elevation, which is more cost-consuming and traumatic manipulation [28]. Adequate virtual implant planning, especially in cases of using tilted implants or such placed within pterygoid process, plays crucial role in following prosthetically prioritized implant workflow [29]. Recent finite elements study highlighted that considering presence of D4 type of bone within pterygoid region inclination of implant at 70 degrees in relation to Frankfort plane may be interpreted as the most optimal from biomechanical point of view to minimize risk of potential treatment failure [30].

In present clinical case report attempts were provided to eliminate sinus floor elevation through lateral window access considering surgical complexity and traumaticity of such manipulation. Even though at one side of the maxilla need in sinus floor elevation has been overcome by tilted implant position, critical deficiency of bone on another side required transcrestal sinus floor elevation. Transcrestal approach characterized with minimized invasiveness and higher tolerability by the patients [31]. In means of assuring adequate bone support for placed implants both lateral window and transcrestal approaches characterized with analogically effective potential [8]. Parallel-arm randomized trial revealed that with the residual bone height of more than 4 mm transcrestal sinus floor elevation reduces costs and duration of manipulation, while also linked with decreased morbidity levels [32]. Survival rates of implants inserted within areas of sinus floor elevation through transcrestal approach and non-grafted maxillary areas did not significantly differ [33]. Proper case selection and operators experience remains the most influential factors regarding dental implants functional prognosis in case of placement within transcrestal sinus floor elevated regions [34].

Some inconsistencies regarding criteria applied for the approval of possibility for immediate implant loading have been described in previous studies [17]. Implant insertion torque was used by surgeons after the implant placement to provide decision regarding immediate implant loading varied in the range from 15 Ncm to 45 N/cm, while some clinicians reported using reverse torque as an intraoperative criterion at the level of 30 N/cm. Other criteria were represented by implant stability quotient level recorded by resonance frequency analysis devices. It is worth to mention that in some cases ISQ levels were used as solitary criteria, while in other such were combined with insertion torque criteria, and relationships between such were different in represented scenarios to be used as combination criteria, but in most cases ISQ should outreach score of 50-60 [17]. Intraoral welding of meso-structures to improve implant stability under immediate loading represents one of the approaches for the optimization of complex rehabilitation protocols. Dovigo et al. described this technique as instantaneous loading, and it has shown beneficial workflow improvement in full-arch rehabilitation cases [35, 36, 37]. Present case report describes approach where intraoral welding was used to optimize implant stability in case of fixed partial denture at the posterior maxilla region, which to the authors knowledge was not widely described in the literature available for analysis.

Systematic review of different loading protocols revealed that immediate loading characterized with one of the lowest mean bone loss levels during first year of monitoring, which was statistically significantly lower than for conventional loading approach [38]. Follow-up examination of presented case report revealed that after three years of fixed implant-borne prosthesis in function marginal bone levels at the projection of dental implants remained stable and demonstrated no signs of pathological saucerization

Analysis of three-four-unit fixed dentures used to the restore posterior maxilla region and supported by dental implants demonstrated that scenarios of immediate and conventional loading of such characterized by analogical outcomes in 3-year monitoring conditions within the provided split-mouth randomized controlled trial: marginal bone loss, complications rate and proportions of implant and prosthesis failures in both groups were minimal and not statistically different [39]. Targeted systematic review of D'Albis et al. demonstrated that immediate loading of implant-borne fixed partial dentures for the treatment of edentulous posterior regions characterized with 96.5% success and just 8.2% complications prevalence with no difference being observed between maxillary and mandibular region [11]. Results of prospective cohort study revealed that patients with immediately loading single or partial maxillary provisional prosthetics characterized with low-risk profile regarding early mechanical and biological complications occurrence [40]. The most frequent complications associated with immediate implant loading either in partially or fully edentulous patients have been observed in first six months (up to 60.9% cases) and during the first year (75%). In present clinical case observation was provided for 4 years, and no complications have been noted during this monitoring period. Amato F. and Spedicato G. demonstrated that three-unit posterior implant fixed dental prostheses with immediate loading characterized with successful performance over the 10 years monitoring with cumulative success rate over 98.9% [41]. Such results are highly related to the outcomes in present case report, because Amato F. and Spedicato G. provided provisional fixed prostheses at the same day of implant placement, as it was in present case report, while in number of previous studies immediate loading varied during one-three days after implant placement.

It may be resumed that complex of used treatment modalities including transcrestal sinus floor elevation, angled implant positioning, implant placement within the pterygoid process and intraoral welding, was supported by available evidence base and resulted in successful outcomes of complex patient rehabilitation through immediate replacement of maxillary posterior teeth with implant-borne fixed restorations.

Conclusion

Need for avoidance of conventional sinus floor elevation procedure through lateral window access should not be interpreted as prerequisite condition that limits the realization of immediate implant loading protocol in cases of bilateral aedentia at the distal regions of maxilla. Even under complicated initial clinical conditions combination of several adaptive approaches such as transcrestal sinus floor elevation, angled implant positioning, implant placement within the pterygoid process and intraoral welding, help to obtain reliable long-term results of immediate replacement of maxillary posterior teeth with implant-borne restorations. Digital planning expands possibilities for effective complex dental rehabilitation and supports reduction of overall treatment duration, nevertheless, such requires sufficient knowledge and experience for correct performance within intricated clinical conditions.

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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Звіт про клінічний випадок негайного заміщення бічних зубів верхньої щелепи фіксованими реставраціями на імплантатах: потреба – можливість – доцільність уникнення традиційної процедури синус-ліфтінга

Віталій Пчельник [A, C, D, F]
DDS, DMD, приватна практика, Львів, Україна
ORCID ID: 0009-0001-8631-2667

Карина Криворучко [B]
DDS, приватна практика, Львів, Україна
ORCID ID: 0009-0002-3969-2414

Дарина Толкачова [E]
DDS, приватна практика, Харків, Україна
ORCID ID: 0009-0009-4359-958X

Відповідальний автор для листування: Віталій Пчельник, вул. Євгена Коновальця, 88, Львів, Львівська область, 79057 Україна
E-mail: vitalypchelnik@gmail.com

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:
негайне навантаження, дентальний імплантат, CAD/CAM технології, синус-ліфт, внутрішньоротове зварювання

Анотація

Вступ. Розробка сучасних підходів до ортопедичної реабілітації з опорою на дентальні імплантати зосереджена на можливості отримати результати, які б були максимально орієнтовані на пацієнта, враховуючи не лише функціональні та естетичні критерії, а й результати, прийнятні за часом і ціною.

Мета. Продемонструвати потенціал для одночасного використання кількох адаптивних методів лікування, включаючи транскрестальне підняття дна верхньощелепної пазухи, кутове позиціонування імплантатів, встановлення імплантатів у крилоподібний відросток та внутрішньоротове зварювання, у разі негайної заміни верхньощелепних бічних зубів незнімними реставраціями на імплантатах.

Клінічний випадок. 50-річний пацієнт звернувся до стоматологічної клініки зі скаргами на двосторонню втрату зубів в бічних відділах верхньої щелепи та ознаки надмірного стирання твердих тканин фронтальних зубів нижньої щелепи. Після проведеного внутрішньоротового сканування і отримання цифрових відбитків, з пацієнтом був узгоджений план можливої комплексної стоматологічної реабілітації. З метою планування хірургічного етапу втручань були поєднані результати внутрішньоротового сканування з даними КПКТ за допомогою спеціалізованого програмного забезпечення. На етапі планування прототипи імплантатів були завантажені з віртуальної бібліотеки та розміщені на віртуальній моделі відповідно до отриманого цифрового плану лікування. Такий підхід допоміг розпочати виготовлення тимчасових зубних протезів у зуботехнічній лабораторії ще до будь-якого хірургічного втручання. Тимчасові конструкції на імплантатах були армовані частковими титановими стрижнями і роз'єднані один від одного в області проміжків на етапі моделювання. З'єднання цих частин відбулося вже в ротовій порожнині за допомогою зварювання. Враховуючи необхідність реалізації протоколу негайного навантаження імплантатів та з метою скорочення загальної тривалості лікування, було вирішено розмістити необхідну кількість імплантатів, уникаючи підняття дна верхньощелепного синусу методом відкритого латерального вікна. Приймаючи це до уваги, зубний імплантат в позиції зуба 1.5 був розташований в адаптованому кутовому положенні вздовж стінки верхньощелепного синусу. Брак кісткової пропозиції зліва не дозволив нам обрати таку ж тактику позиціювання імплантату в позиції відсутнього зубу 2.5, тому було прийнято рішення розмістити імплантат одночасно з проведенням хірургічної процедури транскрестального підняття дна пазухи. Розміщення зубного імплантату в проекції зуба 2.7 було проведено в крилоподібний відросток клиноподібної кістки, враховуючи необхідність досягнення відповідної первинної стабільності для негайного навантаження. Усі імплантати були встановлені у супроводі хірургічних шаблонів, виготовлених за

допомогою технології 3D-друку в умовах стоматологічної клініки.

Висновок. Необхідність уникнення традиційної хірургічної процедури синус-ліфту через латеральний доступ може бути інтерпретована як необхідна умова для реалізації протоколу негайного навантаження імплантатів у випадках двосторонньої втрати зубів в бічних відділах верхньої щелепи. Цифрове планування та адитивні технології розширюють можливості для ефективної комплексної стоматологічної реабілітації та сприяють скороченню загальної тривалості лікування, проте це вимагає достатніх знань та досвіду для правильного виконання в складних клінічних умовах.

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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