



The Relevance of Choukroun's Platelet-Rich Fibrin and Metronidazole During Complex Maxillary Rehabilitations Using Bone Allograft. Part II: Implant Surgery, Prosthodontics, and Survival

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For the past several years, preimplant surgery has made it possible, through the use of bone grafting, to obtain a more or less total reconstitution of the alveolar walls. This first therapeutic step allows the adequate positioning of the implants and the long-term success of implant-supported reconstruction.¹⁻⁵ In the first part of this article, we described a new grafting protocol for maxillary rehabilitation, using allograft, Choukroun's platelet-rich fibrin (PRF), and metronidazole. Allogeneic bone (human bone from a tissue bank) is generally considered as an efficient and a secure product.⁶⁻⁹ A small quantity of a 0.5% metronidazole solution (10 mg) can also be used to provide an efficient protection of the bone graft against unavoidable anaerobic bacterial contamination.¹⁰ Choukroun's PRF is a leukocyte- and platelet-rich fibrin biomaterial.¹¹⁻¹³ Used as a membrane or as fragments, PRF allows a significant postoperative protection of

Extensive bone grafting remains a delicate procedure, due to the slow and difficult integration of the grafted material into the physiological architecture. The recent use of platelet concentrates aims to improve this process of integration by accelerating bone and mucosal healing. Choukroun's platelet-rich fibrin (PRF) is a healing biomaterial that concentrates in a single autologous fibrin membrane, most platelets, leukocytes, and cytokines from a 10-mL blood harvest, without artificial biochemical modification (no anticoagulant, no bovine thrombin). In this second part, we describe the implant and prosthetic phases of a complex maxillary rehabilitation, after preimplant bone grafting using allograft, Choukroun's PRF membranes, and metronidazole. Twenty patients were treated using this new technique and followed up during 2.1 years (1-5 years). Finally, 184 dental implants were placed, including 54 classical screw implants (31, Palm Beach Gardens, FL) and 130 implants with microthreaded collar (46 from AstraT

ech, Mölndal, Sweden; 84 from Intra-Lock, Boca Raton, FL). No implant or graft was lost in this case series, confirming the validity of this reconstructive protocol. However, the number of implants used per maxillary rehabilitation was always higher with simple screw implants than with microthreaded implants, the latter presenting a stronger initial implant stability. Finally, during complex implant rehabilitations, PRF membranes are particularly helpful for periosteum healing and maturation. The thick peri-implant gingiva is related to several healing phases on a PRF membrane layer and could explain the low marginal bone loss observed in this series. Microthreaded collar and platform-switching concept even improved this result. Multiple healing on PRF membranes seems a new opportunity to improve the final esthetic result. (Implant Dent 2009;18:220-229)

Key Words: *fibrin, freeze-dried bone allograft, implant, platelet concentrate, platelet-rich fibrin, platelet-rich plasma*

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the surgical site and seems to accelerate the integration and remodeling of the grafted biomaterial.¹⁴⁻¹⁶ The association of allograft, PRF, and metronidazole seems an innovative approach for vestibular bone grafting on the alveolar ridges.

In this second part, we focus on the implant and prosthetic phases after the previously described preimplant grafting procedure, and on the relevance of PRF during this specific part of the treatment. Choukroun's PRF is an easy and inexpensive protocol, and

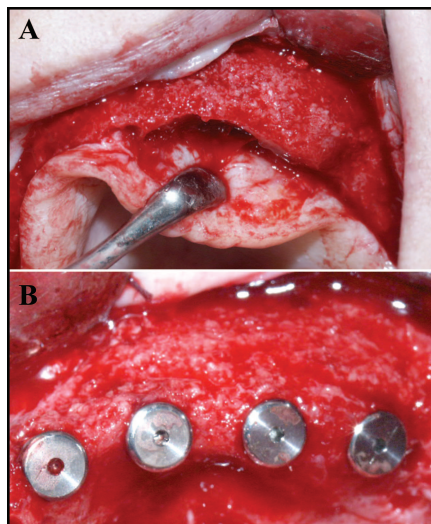


Fig. 1. At the time of reopening on the 90th day after graft surgery (3 months after the beginning of the treatment), the alveolar ridge seemed homogenous, and only a slight surface roughness indicated the original graft site (**A** and **B**).

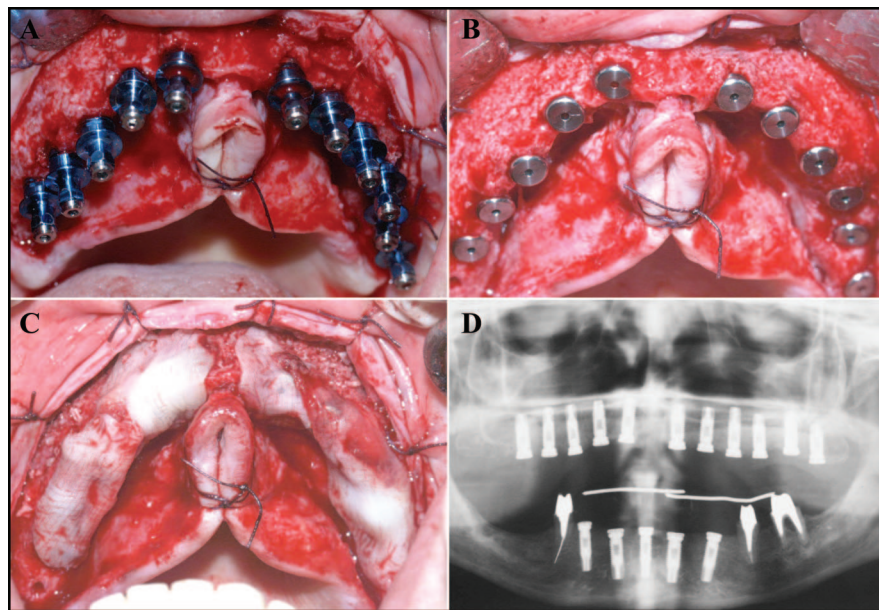


Fig. 2. Eleven maxillary implants were correctly placed in the reconstructed ridges (**A** and **B**). The entire surgical site was covered with PRF membranes, to promote rapid healing of the incision, better control of inflammation at the site, and increased maturation of the peri-implant keratinized gingiva (**C**). The panoramic x-ray, 3 months after implantation showed the adequate implant alignment (**D**).

many membranes can be produced in a short period of time. It was perfected in France by Choukroun et al in 2001.¹⁷ This technique requires neither anticoagulant, nor bovine thrombin (nor any other gelifying agent). Whole blood is drawn in 10 mL tubes without anticoagulant¹⁸ and is immediately centrifuged at 400g for 12 minutes (Process protocol, Nice, France). The result is a platelet- and leukocyte-rich fibrin clot located in the middle of the tube. During implant surgery, PRF should be used as a membrane to foster healing of wound edges and to provide a high-quality gingival maturation. This could increase the peri-implant periosteum resistance and thus diminish the middle- and long-term marginal bone loss around implants. Its impact on the final esthetic result of the rehabilitation could thus be substantial.

CLINICAL ILLUSTRATION

This is the end of the case previously described in part 1.

The Implant Phase

Three months after the graft surgery, the CT scan confirmed that the placement of the implants could be undertaken. During this second surgi-

cal step, the grafts seemed extremely hard and homogenous (Fig. 1). Consequently, 11 implants were placed in the maxillary and five in the mandible (3i Implant Innovations Inc., Palm Beach Gardens, FL) (Fig. 2, A and B). Finally, the implanted ridges were entirely covered with PRF membranes, to further accelerate healing of the soft tissue and to facilitate the rapid closure of the incision (Fig. 2, C). After healing on such a fibrin bed, the gingival tissue displayed a greater level of maturation: it looked noticeably thicker and more keratinized, and should therefore produce a satisfying final esthetic result.

Implantation into a mature maxillary freeze-dried bone allograft (particularly vestibular thickening of alveolar ridges) is always delicate because of the low quality of the grafted bone in comparison with a natural cortical bone. That is the reason why 11 implants were used: a maximum anchorage was necessary for the full arch maxillary rehabilitation.

In the mandible, bone was dense and five implants were enough for a resistant Brånemark type bridge.

The Prosthetic Phase

After 3 months of tissue integration (Fig. 2, D), the submerged implants could be uncovered, and the healing screws were connected. However, considering the length of the incisions and the substantial gingival remodeling needed before the final prosthesis design, it was decided to let the soft-tissues heal around the transgingival screws—hidden in the patient's complete removable maxillary prosthesis (Fig. 3, A)—for another 3 months (during the summer).

Nine months after the beginning of the implant treatment, it was possible to perform a final impression on healed peri-implant gingival tissue (Fig. 3, B–D), to create the permanent prosthesis. After several fittings and corrections, the implant-supported prosthesis was connected and adjusted to obtain a satisfactory esthetic result (Figs. 4 and 5, A). Therefore, for this patient there was no temporary implant-supported prosthesis to validate the esthetic and functional results of the rehabilitation.

In such a large rehabilitation, global occlusal equilibration is a key for a successful treatment. The distal

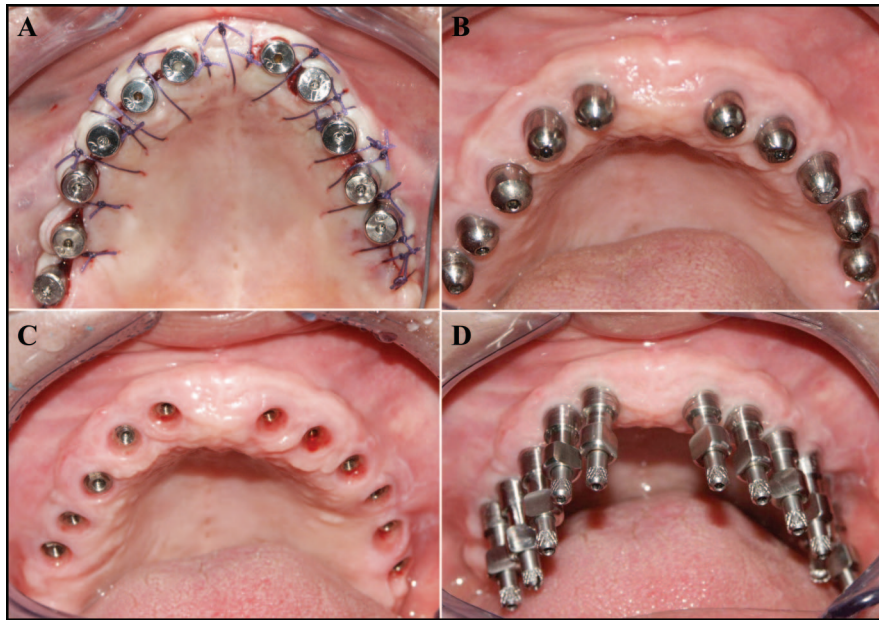


Fig. 3. Three months after implantation (6 months after the beginning of the treatment), the healing screws were connected, followed by 3 more months of healing and maturation of the bone and peri-implant soft tissues (**A**). Nine months after the bone graft, it was possible to make a final impression of the healed surgical site. Peri-implant soft tissue was healthy and thick (**B** and **C**), due to the bed of fibrin membranes covering the graft during the recurring healing phases. This impression was used to create the permanent prosthesis (**D**).

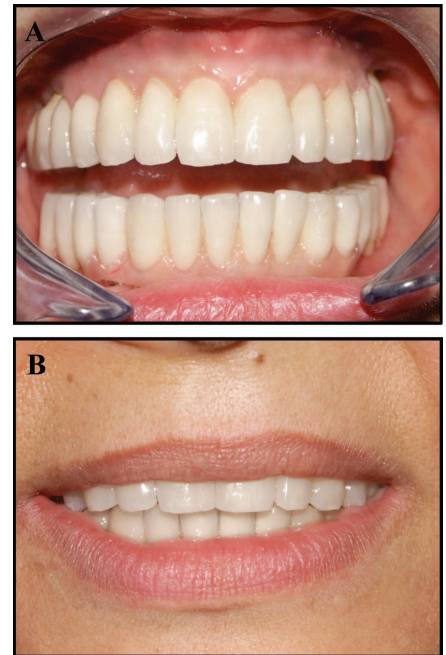


Fig. 4. The permanent prostheses were produced (**A** and **B**). Despite the severity of the initial resorption, the total length of the rehabilitation did not exceed 10 months.

cantilever on the maxillary left side was not absolutely necessary but seemed better for the symmetry of equilibration. The mandibular triple cantilever was possible because of the implant lengths (diameter 4, length 15 mm) and the bone density. Posterior mandibular implantation was possible, but in this case, it could be considered as overtreatment. Four years after the end of treatment, rehabilitation is clinically and radiologically successful (Fig. 5, B).

A Retrospective Study on 20 Successive Cases

Using the previously described protocol, a series of 20 successive similar cases were treated by the same surgeon between June 2002 and June 2007, using three different implant systems, 3I Osseotite (Palm Beach Gardens), AstraTech Osseospeed (Mölnådal, Sweden), and Intra-Lock (Boca Raton, FL). Finally, 184 implants were placed: 54 3I implants in five patients, 46 AstraTech implants in five patients, and 84 Intra-Lock implants in 10 patients. Patients were all healthy and nonsmoker (mean age, 55 years), 15 women and 5 men.

The mean number of implants per patient was 10.8 with 3I implants, and only 9.2 and 8.4 with AstraTech and Intra-Lock implants, respectively. In the first patients treated with this new protocol, a high number of 3I implants were used for maximum anchorage in the grafted volume of these full-arch rehabilitations. However, AstraTech and Intra-Lock implants are microthreaded at the collar and gave a higher biomechanical resistance: it was thus decided to reduce the number of implants per rehabilitation with these two systems.

The criterion for treatment evaluation was a simple qualitative variable related to three possible treatment outcomes.¹⁹ Success was reached if no clinical implant mobility, no radiographic peri-implant translucency, no neuropathic sign, or pain or infection symptoms were observed. Moreover, after 1 year of functional loading, the vertical bone loss must be less than 0.2 mm per year. Failure was admitted when the implant was not functional or has been removed. Finally, an ailing outcome was defined if the implant was still in the patient's mouth, but did not answer the criteria allowing to classify it as a success or as a failure.

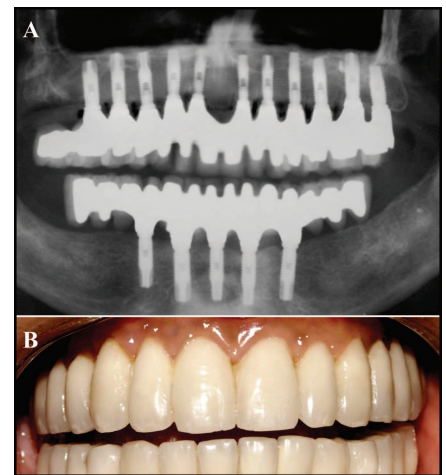


Fig. 5. The final panoramic x-ray after permanent prosthesis connection (**A**). Four years after the end of treatment, esthetic result is stable (**B**).

Marginal bone loss was evaluated using standardized retro-alveolar radiographs and gingival covering was followed up clinically each year. The mean clinical follow-up was 2.1 years (range, 1–5 years).

In this specific series, no implant was lost and all rehabilitations were successful, whatever the implant system and the number of implants used. How-

ever, there was some minor differences between the systems; marginal bone loss was normal around 3I implants (between 0.3 and 1 mm lost during the first year of functional loading, and then 0.1 mm on average per year) but imperceptible around AstraTech and Intra-Lock implants. Moreover, with microthreaded implants and PRF membranes, the initial marginal bone loss was not even noticeable.

DISCUSSION

PRF for Gingival Healing and Esthetic Results

Choukroun's PRF is an autologous leukocyte- and platelet-rich fibrin matrix. In the first part, we described the numerous actions of such biomaterial during the bone grafting procedure. The repetitive use of PRF membranes during the implant surgery leads to another kind of beneficial effects. In these cases, PRF was used to cover the head of the implants, and thus act as a fibrin bandage between the allograft and the gingival tissue. Platelet concentrates are known to improve soft-tissue healing,²⁰ but PRF is above all a fibrin biomaterial²¹: the fibrin mesh is slowly remodeled and replaced by a strong collagen neotissue. The use of PRF thus leads to this thick gingival tissue around the implants. The repetitive use of PRF during the healing screws placement will amplify these phenomena. Considering the gingiva remodeling speed, it could be interesting to define the best period of time between the two PRF applications. In this case series, 3 months seemed very efficient considering the final gingival tissue thickness and long-term stability.

If PRF presents clear effects on gingival healing and maturation, it could play a significant role on the stability of the grafted bone surface. Indeed, in this new protocol, allografts were performed by adding a high quantity of materials onto the resorbed maxilla. When the implants were placed, this grafted bone always showed a strong density. Bleeding during drilling demonstrated the good integration of the graft, partially due to the use of PRF and metronidazole during the grafting phase. However, this bone gain must

be protected. PRF membranes allow to obtain thick gingiva, and its action on the periosteum is significant, because of the growth factors and the fibrin itself.^{22,23} The early reinforcement of the periosteum certainly explains the excellent long-term results considering the peri-implant tissues, showing a very small peri-implant bone loss even 5 years after surgery.

Influence of the Implant Design on the Treatment

In this case series, two different implant designs were used and lead to an evolution of the surgical approach. All these implant systems show modified implant surfaces (3I Osseotite, AstraTech Osseospeed, and Intra-Lock Standard or Ossean)²⁴⁻²⁶ with satisfactory osseointegration performances. In these clinical cases, the main problem was more biomechanical. Implants with a microthreaded collar offered a stronger initial stability in grafted tissues, and thus allowed to use less implant per maxillary without compromising or delaying the treatment outcome. However, no significant conclusions can be drawn from this clinical feeling and finally, all implant systems showed similar success rates.

High initial mechanical anchorage of microthreaded implants could open more opportunities for simplification in sensible implant sites. However, the influence of implant design is more obvious considering the peri-implant tissues. In this case series, the peri-implant bone loss remains always low with all implant systems, because of adequate implant positioning and repetitive covering with PRF membranes. This result is however clearly reinforced with AstraTech and Intra-Lock implants. Both feature microthreads and a prosthetic platform-switching concept.²⁷ Their design leads to an undetectable marginal bone loss, even 4 years after treatment.

We can assume that simultaneously using such implant design with PRF and metronidazole could significantly improve this protocol.

CONCLUSION

Implant rehabilitation after extensive bone grafting is always a delicate

procedure. Even after bone maturation, the protection of the grafted tissue is at stake. The stabilization of peri-implant bone and gingival tissue could be easily improved by an adequate implant design and the repetitive use of PRF membranes. Combined with maxillofacial implant reconstructive therapy, PRF represents a new opportunity to improve grafting procedures, keeping in mind that it is a healing biomaterial and not a "miracle product."

Disclosure

"The authors declare no competing financial interest."

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Abstract Translations

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Die Bedeutung des Thrombozytreichen Fibrins von Choukroun (PRF) und Metronizadol bei komplexen Wiederherstellungsbehandlungen im Oberkiefer unter Anwendung von Knochenallotransplantat. Teil II: Implantationschirurgie, Prothetik und Überlebenschancen von Implantaten

ZUSAMMENFASSUNG: Weitreichende Knochengewebs-transplantation bleibt nach wie vor schwierig, da das transplantierte Material sich nur langsam und unter Schwierigkeiten in die physiologische Gesamtarchitektur eingliedert. Die neuartige Verwendung von Thrombozytkonzentraten zielt darauf ab, diesen Integrationsprozess durch die Beschleunigung der Heilung von Knochengewebe und Schleimhaut zu verbessern. Bei Choukrouns Thrombozytreichem Fibrin (TRF) handelt es sich um ein heilendes Biomaterial in einem Konzentrat einer einzelnen autologen Fibrinmembran, den meisten Thrombozyten, Leukozyten und Zytokinen aus einer 10 ml Blutprobe ohne künstliche biochemische Veränderung, d.h. keine Antikoagulantien oder Rinderthrombin. In diesem zweiten Teil beschreiben wir die Implantat- und Prothesestadien bei einer komplexen Wiederherstellungsbehandlung im Oberkiefer, bei der eine Knochen transplantation mittels Alotransplantat, Choukroun-PRF-Membranen sowie Metroni-

zadol der tatsächlichen Implantierung vorgeschaltet war. Insgesamt zwanzig Patienten wurden mit dieser neuen Methode behandelt und durchschnittlich 2,1 Jahre nach der Behandlung nach verfolgt (1 bis 5 Jahre). Schlussendlich wurden 184 Zahnimplantate eingepflanzt, darunter auch 54 klassische Schraubimplantate (3I, Palm Beach Gardens, USA) sowie 130 Implantate mit Kragen mit Mikrogewinde (46 von AstraTech, Mölndal, Schweden; 84 von Intra-Lock, Boca Raton, USA). Kein einziges Implantat bzw. Transplantat ging im Verlauf des Versuchs verloren, wodurch die Gültigkeit dieses rekonstruktiven Protokolls bekräftigt wird. Allerdings war die Anzahl an Implantaten, die pro Oberkieferwiederherstellung verwendet wurden, bei den einfachen Schraubimplantaten immer höher als bei den Implantaten mit Mikrogewinde, wobei die letzteren eine größere Anfangsstabilität des Implantats aufweisen. Abschließend erweisen sich die TRF-Membranen als besonders hilfreich bei Heilung und Reifung des Periost im Verlauf von komplexen Wiederherstellungsbehandlungen unter Einbeziehung von Implantaten. Der dicke Zahnfleischbereich um das Implantat herum hängt mit verschiedenen Heilungsphasen bei einer TRF-Membranbeschichtung ab und könnte den geringen marginalen Knochengewebverlust erklären, der während der Versuchsreihe zu beobachten war. Ein Konzept unter Einbeziehung eines Kragens mit Mikrogewinde sowie von Plattformwechsel verbesserte das Ergebnis weiterhin. Vielfachheilung bei TRF-Membranen scheint eine neue Möglichkeit zur Verbesserung des abschließenden ästhetischen Ergebnisses zu sein.

SCHLÜSSELWÖRTER: Fibrin, gefriergetrocknetes Knochenalotransplantat (FDBA), Implantat, Thrombozytkonzentrat, Thrombozytreiches Fibrin (TRF), Thrombozytreiches Plasma (TRP)

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La relevancia de la fibrina rica en plaquetas (PRF) de Choukroun y metronidazola durante la rehabilitación compleja de maxilares usando aloinjertos de hueso. Parte II: cirugía de implante; prostodóntica y supervivencia

ABSTRACTO: Un injerto extenso de hueso sigue siendo un procedimiento delicado debido a la lenta y dificultosa integración del material injertado en la arquitectura fisiológica. El uso reciente de concentrados de plaquetas trata de mejorar este proceso de integración al acelerar la curación del hueso y la mucosa. La fibrina rica en plaquetas (PRF) de Choukroun es un biomaterial de curación que concentra en una sola membrana de fibrina autóloga, la mayoría de plaquetas, leu-

cocitos y citocinas de una cosecha de sangre de 10 mL, sin modificación bioquímica artificial (sin anticoagulante, sin trombina de bovinos). En esta segunda parte, describimos las fases del implante y prótesis de una rehabilitación compleja de un maxilar, luego del injerto de hueso preimplante usando un aloinjerto, membranas de PRF de Choukroun y metronidazol. Se trataron a veinte pacientes usando esta nueva técnica con seguimiento durante 2,1 años (1 a 5 años). Por último, se colocaron 184 implantes dentales, incluyendo 54 implantes clásicos con tornillos (3I, Palm Beach Gardens, EE.UU.) y 130 implantes con cuello de rosca microscópica (46 de AstraTech, Mölndal, Suecia; 84 de Intra-Lock, Boca Raton, EE.UU.). No se perdieron implantes ni injertos en esta serie de casos, lo que confirma la validez de este protocolo de reconstrucción. Sin embargo, el número de implantes usados por rehabilitación maxilar fue siempre más alto con implantes simples de tornillos que con los implantes de roscas microscópicas, ya que este último presentó una estabilidad inicial del implante más sólida. Por último, durante complejas rehabilitaciones que usan implantes, las membranas PRF son muy útiles para la curación y maduración del periostio. La encía espesa perimplante se relaciona a varias fases de la curación en una capa de la membrana PRF y podría explicar la baja pérdida marginal del hueso que se observó en esta serie. El concepto del cuello con roscas microscópicas y el cambio de plataforma mejoraron este resultado. La múltiple curación de las membranas de PRF parece ser una nueva oportunidad para mejorar el resultado estético final.

PALABRAS CLAVES: fibrina, aloinjerto de hueso liofilizado (FDBA por sus siglas en inglés), implante, concentrado de plaquetas, fibrina rica en plaquetas (PRF), plasma rico en plaquetas (PRP)

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A relevância da Fibrina Rica em Plaquetas (PRF) de Choukroun e metronidazol durante reabilitações maxilares complexas usando enxerto aloplástico de osso. Parte II: cirurgia de implante, prostodontia e sobrevivência

RESUMO: O enxertamento extensivo de osso permanece um procedimento delicado, devido à lenta e difícil integração do material enxertado na arquitetura fisiológica. O uso recente de concentrados de plaquetas visa melhorar este processo de integração acelerando a cura do osso e mucosal. A Fibrina

Rica em Plaquetas (PRF) de Choukroun é um biomaterial de cura que concentra numa única membrana de fibrina autóloga, a maior parte plaquetas, leucócitos e citocinas de uma coleta de 10 mL de sangue, sem modificação bioquímica artificial (nenhum anticoagulante, nenhuma trombina bovina). Nesta segunda parte, descrevemos as fases de implante e protética de uma reabilitação maxilar complexa, após o enxertamento de osso pré-implante usando enxerto aloplástico, membranas PRF de Choukroun e metronidazol. Vinte pacientes foram tratados usando esta nova técnica e acompanhados durante 2,1 anos (1 a 5 anos). Finalmente, 184 implantes dentários foram colocados, incluindo 54 implantes clássicos com parafuso (31, Palm Beach Gardens, EUA) e 130 implantes com colarinho microrrosqueado (46 from AstraTech, Mölndal, Sweden; 84 de Intra-Lock, Boca Raton, EUA). Nenhum implante ou enxerto foi perdido nesta série de casos, confirmando a validade deste protocolo reconstrutivo. Contudo, o número de implantes usados por reabilitação maxilar foi sempre mais alto com implantes simples com parafuso do que com implantes microrrosqueados, os últimos apresentando uma estabilidade de implante inicial mais forte. Finalmente, durante reabilitações de implantes complexos, as membranas PRF são particularmente úteis para cura do perioste e maturação. A grossa gengiva de peri-implante está relacionada a várias fases de cura numa camada de membrana PRF e poderia explicar a baixa perda de osso marginal observada nesta série. O colarinho microrrosqueado e o conceito de mudança de plataforma até melhoraram este resultado. A cura múltipla em membranas PRF parece uma nova oportunidade de melhorar o resultado estético final.

PALAVRAS-CHAVE: fibrina, enxerto aloplástico de osso seco por congelamento (FDBA), implante, concentrado de plaquetas, Fibrina Rica em Plaquetas (PRF), Plasma Rico em Plaquetas (PRP)

RUSSIAN / РУССКИЙ

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Обоснованность применения богатого тромбоцитами фибрина (PRF) по методу Шукруна и метронидазола при проведении комплексного восстановления верхней челюсти с применением костного аллотрансплантата. Часть II: имплан-

тационная хирургия, ортопедическая стоматология и срок жизнеспособности

РЕЗЮМЕ. Обширная костная трансплантация остается деликатной процедурой по причине медленной и трудной интеграции трансплантационного материала в физиологическую архитектуру. Внедряемая в последнее время практика использования тромбоцитарной массы преследует цель улучшить данный процесс интеграции посредством ускорения регенерации костной и мышечной ткани. Богатый тромбоцитами фибрин (PRF) по Шукруну – это регенерационный биоматериал на одинарной аутогенной фибриновой мембране. Большую часть тромбоцитов, лейкоцитов и цитокинов получают из забора пробы крови объемом 10 мл, без искусственной биохимической модификации (без антикоагулянта и бычьего тромбина). Во второй части данной статьи мы описываем этапы имплантации и протезирования в рамках процедуры комплексного восстановления верхней челюсти после предимплантационной трансплантации костной ткани с применением костного аллотрансплантата, богатого тромбоцитами фибрина (PRF) по методу Шукруна и метронидазола. Данная методика применялась при лечении двадцати пациентов, и результаты ее применения изучались в течение 2,1 года (от 1 до 5 лет). В итоге, были установлены 184 зубных имплантата, в том числе 54 классических винтовых имплантата (31, г. Палм-Бич-Гарден, США) и 130 имплантатов с микрорезьбой на шейке (46 производства компании AstraTech, г. Мильндаль, Швеция; 84 производства компании Intra-Lock, г. Бока-Ратон, США). В данной серии случаев все имплантаты и трансплантаты прижились, что подтверждает обоснованность и правильность данного протокола реконструкции. количество имплантатов, использованных в расчете на одну процедуру восстановления верхней челюсти, всегда было выше при применении обычных винтовых трансплантатов, чем при применении имплантатов с микрорезьбой, что свидетельствует о большей первоначальной стабильности последних. В заключение следует отметить, что мембраны с богатым тромбоцитами фибрином (PRF) очень помогают при регенерации и созревании надкостницы. Утолщенная периимплантная десна является результатом нескольких этапов регенерации на слое мембраны с богатым тромбоцитами фибрином и может свидетельствовать о незначительной потере костной массы костной массы в данной серии случаев. Микрорезьба на шейке и концепция смены платформ способствуют достижению еще лучших результатов. Многоэтапная регенерация на мембранах с богатым тромбоцитами фибрином представляется новой возможностью улучшить конечный эстетический результат.

КЛЮЧЕВЫЕ СЛОВА: фибрин, лиофилизированный костный трансплантат (FDDB), имплантат, тромбоцитарная масса, богатый тромбоцитами фибрин (PRF), богатая тромбоцитами плазма (PRP)

TURKISH / TÜRKÇE

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Kemik allogrefti kullanan kompleks maksiller rehabilitasyonlarda Choukroun'un Trombositten Zengin Fibrininin (TZF) ve metronidazolun uygunluğu. II. Bölüm: İmplant cerrahisi, prostodontik ve sağkalım

ÖZET: Greft materyalinin fizyolojik mimariye yavaş ve zor entegrasyonu nedeniyle büyük çapta kemik greftleme nazik bir prosedür olma niteliğini sürdürmektedir. Kemik ve mukoza iyileşmesini hızlandırarak bu entegrasyon sürecinin düzeltilmesi amacıyla yakın zamanda trombosit konsantratlari kullanılmaya başlanmıştır. Choukroun'un Trombositten Zengin Fibrini (TZF), tek bir otolog fibrin membranında 10 mililitrelik bir kan hasatından elde edilen çoğu trombosit, lökosit ve sitokini, yapay bir biyokimyasal değişiklik yapılmadan (antikoagülan veya bovin trombin olmadan) yoğunla-

ştırılan iyileştirici bir biyomateryaldir. Bu ikinci bölümde, kompleks maksiller rehabilitasyonlarda implanttan önce allogreft, Choukroun'un TZF'i ve metronidazol kullanarak kemik greftlemeden sonra gerçekleştirilen implant ve protez evreleri tarif edilmektedir. Bu yeni yöntem kullanılarak 20 hasta tedavi edilmiş ve hastalar 2,1 yıl boyunca (1 ila 5 yıl) takip edilmiştir. Toplam 184 dental implant yerleştirilmiş olup, bunların 54'ü klasik vida implant (3I, Palm Beach Gardens, ABD) ve 130 adedi de mikro yivli halkalı implant idi (46 adedi AstraTech, Mölndal, İsveç'ten ve 84'ü de Intra-Lock, Boca Raton, ABD'den). Bu olgu serisinde hiçbir implant veya greft kaybedilmemiş olup, bu sonuç bu rekonstrüktif protokolün geçerliliğini teyit etmektedir. Ancak, her bir maksiller rehabilitasyon için kullanılan basit vida implant sayısı, daima maksiller rehabilitasyon başına kullanılan mikro yivli implant sayısından daha fazlaydı. Mikro yivli implantlar başlangıçta daha güçlü implant stabilitesi sağlar. TZF membranları, kompleks implant rehabilitasyonu esnasında periosteumda iyileşme ve olgunlaşma açısından özellikle yararlıdır. Kalın peri-implant diş eti, TZF membran tabakasında çeşitli iyileşme evresiyle bağlantılı bulunmuş olup, bu seride görülen düşük marjinal kemik kaybı buna atfedilebilir. Mikro yivli halka ve platform değiştirme kavramı, bu sonucu daha da iyileştirmiştir. TZF membranlarındaki çeşitli iyileşme evreleri, diş hekimlerine nihai estetik sonucu daha da düzeltme doğrultusunda yeni bir fırsat sunmaktadır.

ANAHTAR KELİMELELER: fibrin, donarak kurutulmuş (freeze dried) kemik allogrefti (DKKA), implant, trombosit konsantrati, Trombositten Zengin Fibrin (TZF), Trombositten Zengin Plazma (TZP)

JAPANESE / 日本語

同種移植骨を使用した複雑な上顎骨機能再生における、コークラン多血小板繊維素成 (PRF) とメトロニタゾールの妥当性: パートII: インプラント手術、義歯補綴と存続性

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研究概要:

大規模な移植術は移植材が生理的構造へ融合するまで時間がかかり、かつ困難なために未だに微妙な処置である。最近では骨と粘膜の治癒を促進し融合プロセス改善をはかる目的で濃厚血小板製剤が使用されている。コークラン多血小板繊維素成 (PRF) は治癒力を備えたバイオマテリアルで、採血量10mLから分別した多量の血小板と白血球そしてサイトカインを、人工生化学修正 (坑凝固剤またはウシ由来トロンビン) を加えずに、1枚の同種移植繊維素成メンブレンに濃縮したものである。

パートIIではコー克蘭PRFメンブレンとメトロニタゾールを用い、インプラント術前同種異系移植で上顎骨再生後におこなった、インプラントと義歯補綴段階を説明する。20名の患者がこの新技術で治療を受け、その後2.1年（1年から5年）の期間設定で追跡調査をおこなった。結果的に合計184本のデンタルインプラントが埋入された。内訳は54本の従来型スクリューインプラント(Palm Beach Gardens, USA製31本)、そしてマイクロスレッドカラーインプラント130本 (AstraTech, Mölndal, Sweden製46本: Intra-Lock, Boca Raton, USA製84本) である。この一連のケースではインプラントまたはグラフト損失はまったく見られず、この形成術プロトコールの有効性が確認された。ただし上顎骨再生に使用したインプラントでは、常にマイクロスレッドインプラントよりもシンプルなスクリューインプラントが多数をしめ、後者の初期インプラント安定性がより優れていることを現わしている。また最終的に複雑なインプラント機能再生ではPRFメンブレンが骨膜治療と成熟に特に効果を示した。インプラント周辺歯茎の厚みはPRFメンブレン層におけるいくつかの治療段階と関連し、この一連の観察で周辺骨損失が僅かだった理由を説明することができる。マイクロスレッドカラーとプラットフォームスイッチングの概念は、この成果をさらに改善した。PRFメンブレンにおける多角的治療の特性は最終的な審美面の成果改善を目指すうえで、新たに有望視できると考えられる。

キーワード: 繊維素成(フィブリン)、ヒト冷凍乾燥骨 (FDBA)、インプラント、濃縮血小板製剤、多血小板繊維素成 (PRF)、多血小板血漿 (PRP)

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CHINESE / 中国語

使用異體骨移植進行複雑上顎復健重建期間，Choukroun 的富含血小板的纖維蛋白 (PRF) 及甲硝唑的相關性。
 第二部分：植體手術、牙科廣復與存活。

作者: Alain Simonpieri, DDS; Marco Del Corso, DDS; Gilberto Sammartino, MD, PhD; David M. Dohan Ehrenfest, DDS, MS, PhD

摘要:

大規模骨移植仍是一項棘手的手術，原因在於移植材料與生理價構的整合緩慢而困難。近期有關血小板濃縮液的使用，其目標是透過加速骨質與黏膜癒合，改善此整合流程。Choukroun 富含血小板的纖維蛋白 (PRF) 是一種具有治療功用的生物材料，可以從 10 mL 採血中凝聚單一自體纖維蛋白膜、大多數血小板、白血球與細胞激素，沒有人工生畫修改 (無抗凝血劑、無牛科動物萃取的凝血酶)。

我們在本文第二部分描述在使用異體骨移植、Choukroun 的 PRF 膜以及甲硝唑進行種植前骨移植之後的複雜上顎重建的種植與廣復階段。使用本項新方法治療 20 名患者，然後追蹤 2.1 年 (分別追蹤 1 至 5 年)。最後，置入 184 顆牙科植體，包括 54 顆傳統螺紋植體 (美國 Palm Beach Gardens 的 3I 公司) 與 130 顆有微螺紋根頸的植體 (46 顆來自瑞典 Mölndal 的 AstraTech 公司; 84 顆來自美國 Boca Raton 的 Intra-Lock 公司)。本系列沒有流失任何植體或移植物的病例，確認本重建治療方法的有效性。不過，每個上顎重建使用的植體數，簡單螺紋植體都高於微螺紋植體，後者顯示更強的初步植體穩定性。最後，在複雜植體重建當中，PRF 膜對骨膜治療與成熟尤其有幫助。植體周圍齒齦厚與 PRF 膜層的數個治療階段有關，可能解釋本系列觀察到邊際骨質流失量低的原因。微螺紋根頸與平台轉換概念甚至改善本結果。PRF 膜上的多重治療似乎是改善最後美學結果的機會。

關鍵字 : 纖維蛋白、冷凍乾燥異體骨移植體 (FDBA)、植體、血小板濃縮液、富含血小板的纖維蛋白 (PRF)、富含血小板的血漿 (PRP)。

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KOREAN / 한국어

골 동종이식술을 이용한 복합 하악재건 시, Choukroun의 혈장풍부 섬유소(PRF)와 메트로니다졸의 관련성 .
Part II: 임플란트 수술 및 보철과 유지

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요약:

광범위한 골 이식술은 생리학적인 구조로서 이식물질이 느리고 어렵게 융합되어 여전히 어려운 시술로 인식되고 있다. 최근에는 혈장농축물을 사용하여 뼈와 점막의 치유를 가속화함으로써 이러한 융합과정을 개선시키는 중이다. Choukroun의 혈장풍부 섬유소(PRF)는 단일 동종 섬유소막과 대부분의 혈소판, 백혈구와 사이토카인의 농축물로, 인공적으로 생화학적 변경(항응고제, 소의 트롬빈을 첨가하지 않은)을 하지 않은 혈액채취물 10mL에서 채취한 치유 생체적합물질이다. 본 두 번째 파트에서는 Choukroun의 PRF막과 메트로니다졸을 이용한 예비 임플란트 골 이식 후 임플란트와 복합 상악재건술의 보철단계를 기술하고자 하였다. 20명의 환자들이 새로운 기술을 사용하여 치료를 받았고 2.1년 (1-5년)동안 추적 관찰되었다. 54개의 기본 스크류 임플란트와 130개의 microthreaded 고리 임플란트(46개는 스웨덴의AstraTech, Mölndal, 84개는 미국 Intra-Lock, Boca Raton)를 포함하여 총 184개의 임플란트가 식립되었다. 이 증례들에서 어떠한 임플란트 혹은 이식물들도 손실되지 않았으며, 따라서 이 재건술의 유효성을 확인할 수 있었다. 그러나 상악 재건술 한 건당 사용된 임플란트의 수는 Microthreaded 임플란트에서 보다 기존 스크류 임플란트에서 더 높았으며, Microthreaded 임플란트에서 안정성이 더 컸다. 결론적으로, PRF막은 복합 임플란트 재건술 동안 골막의 치유와 성숙에 특히 유용하였다. 두꺼운 임플란트의 주변 잇몸은 PRF막의 몇몇 치유 단계와 관련 있으며, 이로써 본 증례에서 관찰된 낮은 주위골 손실률이 설명될 수 있다. 또한 Microthreaded 고리와 플랫폼 전환은 이러한 결과를 더욱 개선시켰다. PRF막의 다중 치유효과는 심미적 결과를 최종적으로 개선하는데 새로운 기회가 될 수 있을 것이다.

키워드: 섬유소, 동결건조 골 이식편(FDBA), 임플란트, 혈소판 농도, 혈소판 풍부 섬유소 (PRF), 혈소판 풍부 혈장(PRP)

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