Clinical Research

ENT Updates 2019;9(1): 53-58
DOI: 10.32448/entupdates.541153

ENT updates
www.entupdates.org

Application Of Platelet Rich Fibrin Matrix (PRFM) In Septorhinoplasty

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Abstract

Objective: In our study, we aimed to investigate the success of Platelett-rich fibrin matrix (PRFM) septorhinoplasty cartilage graft applications obtained from the patient's own blood easily and cheaply.

Methods: Four patients who presented at the Otorhinolaryngology Clinic of Ankara Numune Training and Research Hospital underwent open technical septorhinoplasty. Preoperative 10 cc venous blood was taken into two separate biochemistry tubes and centrifuged at 3000 rpm for 12 minutes. PRFM was prepared. The cartilages taken from the septum were divided into 0.3-0.5 cm in average. Cartilages were divided into PRFM and dorsal irregularity and type were applied.

Results: 2 patients were implanted PRFM-wrapped cartilage graft to the type 2 region of the other 2 patients who were implanted in the dorsal region PRFM split cartilage graft.

Conclusion: Although our findings were short-term in our study, considering the problems in other grafting methods used in routine, it can be a grafting method that can be used safely in PRFM-wrapped cartilage graft septorhinoplasty.

Key Words: Septorhinoplasty, Split cartilage graft, Platen rich fibrin matrix

INTRODUCTION

Autologous cartilage grafts have been widely in cosmetic surgery and rhinoplasties (1, 2). The foreign body reaction and infection are the most important factors that can be observed during the usage of autologous cartilage grafts (2-4). In particular, the resorption of cartilage grafts in time is the major problem of application of these grafts in aesthetic procedures. The use of cartilage grafts wrapped in Surgicel (Turkish Delight) was first developed and then developed by Erol to prevent resorption of cartilage (5). Even though it has been commonly used, the long-term clinical reports show that the cartilage grafts wrapped in Surgicel are absorbed by human body (6-8).

The biological component grafts have been specially investigated to prevent the complications such as foreign body reaction and absorption. Firstly, the split cartilage graft was wrapped in temporal muscle fascia and so the problems associated with Surgicel was solved (9, 10). By the investigation of biological components, the incidence of foreign body reaction and resorption of grafts significantly decreased. However, the need for a second incision and the complications asociated with donor site such as scar formation, hematoma and infection and prolonged operation times are the disadvantages of harvesting temporalis fascia. Later, Alloderm, adecellularised homograft obtained from human skin, was introduced as an alternative to the use of temporalis fascia. Nevertheless, these grafts are relatively

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Received: October 23, 2018; **Accepted:** January 15, 2019

Online available at:
www.entupdates.org

expensive compared to other graft materials and there is a potential risk of immunological reaction around the surgical field (11).

In the literature, there is no consensus on which material is best to wrap the split cartilage. An ideal wrap material should be biocompatible, cost-effective, easy to apply and obtain. It should keep the graft material without resorption and have low risk of infection.

The fibrin glue, a polymerized fibrinogen obtained by the addition of thrombin and calcium, was first introduced by Matras in 1970s (12). Fibrin glue has been used innumerous surgical procedure by cosmetic surgeons including including face lift, abdominoplasty, mammoplasty (13).

Platelet-rich plasma (PRP); is the plasma fraction obtained from the autologous line containing the platelets above the reference line (14). Platelet rich plasma contains such growth factors and acts as a growth factor agonists. PRP has been used for about 30 years. It was first used by Ferrari et al. In 1987 to reduce the transfusion of homologous blood products following open heart surgery (15). Today, PRP is most commonly used in surgical procedures including orthopedic procedures, dental and oral procedures, traumatic surgical procedures (maxillofacial surgery, spinal surgery, cardiac bypass surgery, angiogenesis procedures, rotation and transposition of flaps, macular lesions, corneal epithelial defects (16). The use of PRP in orthopedic and traumatic surgeries including bone, cartilage and tissue defects is considered to be a promising technique. Later, the ability of use of platelet-rich fibrin matrix (PRFM) in rhinoplasty surgery as cartilage grafts has been proposed (17-19). Briefly describing the physiological importance of platelets (platelets) and the duration of wound healing before entering the plasma-rich fibrin matrix topic will provide the understanding of the application.

PRP is made up of blood, plasma and cells. Plasma contains protein, sugar, fat, vitamins, and hormones. Blood contains erythrocytes, leukocytes and thrombocytes cells. Thrombocytes are composed of megakaryocytes in the bone marrow. A mean life of platelets in blood circulation is about 8-10 days. They are transparent, anuclear and disc shaped. They contain many granules in their cytoplasm, such as fibrinogen, growth factors. In a healthy individual, there are about 150.000-450.000 platelets per mm3 (20, 21).

The thromboplastin is a released from activated platelets in case of a hemorrhage. Thromboplastin is converted to thrombin by the activation of prothrombin, which is produced in the liver from the precursor K vitamins. Thrombin converts the cytoplasmic fibrinogen into a fibrin network and forms a clot-plug in the bleeding region (22). The fibrin network captures circulating root cells and activates vascularization in the wound area. It has been found that the fibrin matrix directly activates angiogenesis (23). Thrombocytes also contain growth factors and cytokines that initiate wound healing as well as formation of clot (24). PRFM contains all these growth factors that should be in the wound area with increased concentrations (21, 22).

Platelet-rich fibrin (PRF) is developed and published by Choukroun in 2001 (25). It is mostly used noral surgery and dermatology, orthopedic applications. Plasma rich fibrin is a fibrin matrix which is produced by a special centrifugation technique from human venous blood. It contains biocompatible and many growth factors There are many clinical applications of PRF membranes in rhinologic procedures (19, 20).

Previous studies have shown antimicrobial and antifungal properties against E. coli, S. Aerus, C. albicans, and C. neoformans (26, 27). It is relatively cost effective compared to the other reported materials (25).

Patients And Methods

Patients who had previously referred to our center for the correction of external nasal deformity and underwent open technique septorhinoplasty were selected on a voluntary basis for a period of 6 months.

The study protocol was reviewed and approved by the local ethics committee (Ethics Committee Approval No. E-18-2019) and conducted in accordance with the ethical principles described by the Declaration of Helsinki. An informed consent was obtained from all participating subjects prior to surgery. Four patients who underwent open technique septorhinoplasty in our tertiary center were included the study. An informed consent was obtained from all participants. PRFM was prepared by as follows: 10 cc of venous blood sample was obtained from all patients and the sample was separated into two biochemical tubes (Nüve Ankara, Turkey). Tubes were centrifugated at 3000 rpm for 10 minutes *(Figure 1)*. A septal cartilage graft was harvested from cartilaginous septum and this graft material was splitted into small sizes of an average of 0.3-0.5 cm. The split cartilages were wrapped in PRFM *(Figure 2)* and applied to the dorsal irregularity and tip area. *(Figure 3)*

Results

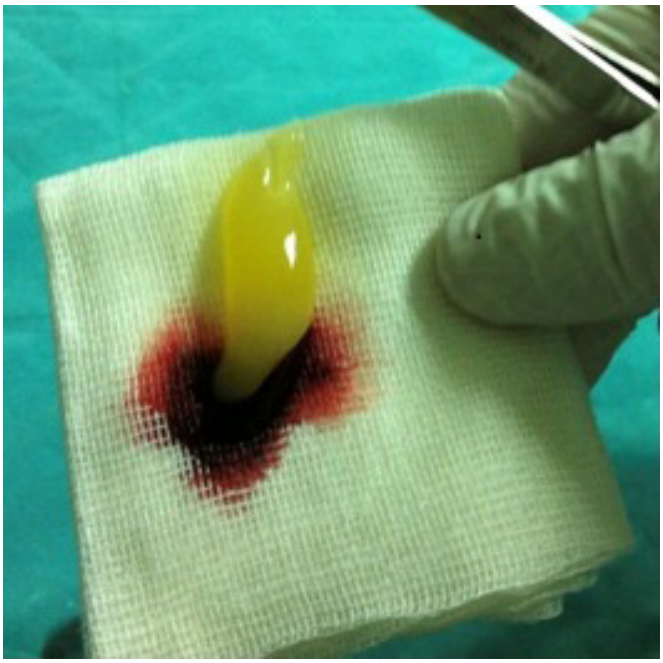

Figure 1. Platelet-rich fibrin after centrifugation

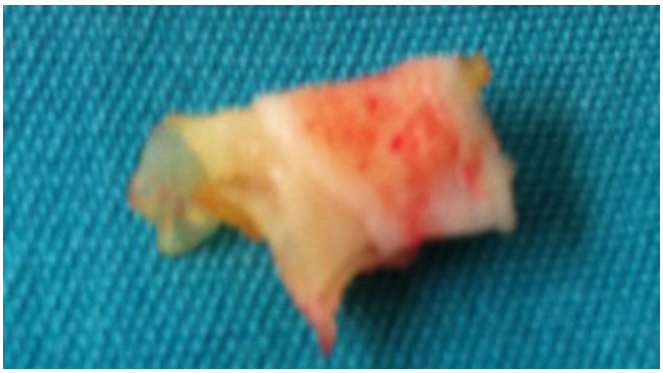

Figure 2. Preparation of diced cartilage graft wrapped in PRFM

The mean age of the patients (3 males and 1 females) was 27.9 patients. Two patients were implanted with split cartilage grafts wrapped in PRFM in dorsum region. Two other patients were implanted with split cartilage grafts wrapped in PRFM in tip area. The mean follow-up period of patients was 9 weeks (4-22 weeks). On the postoperative 5thday, all of the patients had a decrease in the ecchymosis and edema on their face. We did not observe any irregularity, nodularity or increased fibrosis formation on dorsal region or tip area during the follow-up period *(Figure 4a-b)*.

Discussion

Cartilage grafts have been used for a long time in plastic surgery and ear nose and throat surgery, especially in rhinoplasty operations for the correction of asymmetries and irregularities in dorsum and tip areas (5, 28). Following the first clinical use of cartilage grafts by Konig in 1896, cartilage grafting has been a popular method, especially in rhinoplasty procedure (29). Cartilage grafts are often obtained from nasal septum, auricula and rib (30). Cartilage grafts are increasingly used for camouflage of nasal dorsum contour and dorsal irregularities (3, 31).However, the use of block cartilage grafts for contour correction of nasal dorsum has been described as a problem by many surgeons due to recurrence of dorsal deformity by time, resorption, distortion, and external exposure of graft materials (1, 31, 32).

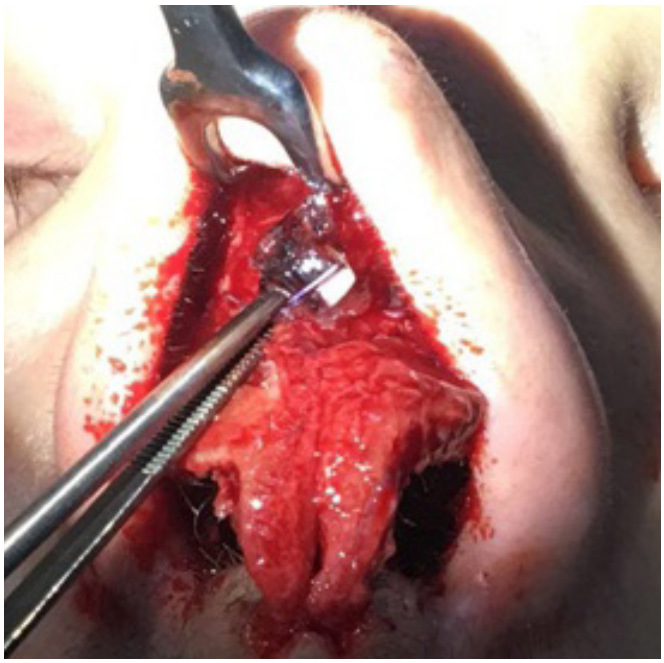

Figure 3. Operative technique: placement of diced cartilage wrapped in PRFM over dorsal irregularity area

The first experimental study with split cartilage was done by Young in 1941, and the clinical study was published by Peer in 1943 (33, 34). The priority was given to the advantage of splitting cartilage practice in terms of the forming the graft readily, but since the viability and resorption problems of the cartilage have been observed, the possibility of cartilage graft life expectancy has been considered to be increased by wrapping the split cartilage in a material before it is placed (8).

The long-term results of 2365 patients were published in 2000 by Erol (5)by using split cartilage graft wrapped

in Surgicel. The authors named this technique as Turkish Delight and the technique became very popular. This technique was used for the correction of nasal contour (including dorsum, side walls and nasal type), nasal asymmetry due to antero-dorsal nasal septum, camouflage and shape of irregularities, camouflage of fragmented cartilage graft and the formation of nasal type, prevention of strut grafts become visible by time. The authors claimed that this technique allowed to give external shaping to grafts by finger during postoperative three weeks. In 2003, Elahi (35)achieved similar results with Erol in their study using cartilage grafts wrapped in Surgicel. Yilmaz et al. (6) reported that Surgicel inhibits the oxygenation of cartilage graft for at least 48 hours and that this relative hypoxia leads to the loss of regeneration potential in living chondrocytes. In another study by Çakmak (7); the authors reported that the proliferation and viability of split cartilage grafts wrapped in Sugicel was inhibited by Surgicel, and that cartilage viability was shown to be about 10%. Daniel and Calvert (8) unexpectedly observed that all of the cartilage tissue wrapped in Surgicel were resorbed even in a few months in patients underwent rhinoplasty operation.

However, due to the fact that resorption is excessive in cartilage grafts wrapped in Surgicel, this technique was modified with wrapping the cartilage tissue in biocompatible materials (10, 36). Daniel and Calvert have achieved long-term successful results when using split cartilage wrapped in autologous temporalis muscle fascia in rhinoplasty (8). Similarly, in an experimental study, Brenner et al. (36) reported that autologous temporalis fascia had no negative effect on cartilage viability and regeneration. Temporalis fascia is a permanent graft material, and it also functions as a basic structure for the graft material introduced in to fascia (37). Brenner et al. (36) suggests that temporalis fascia like perichondrium increase chondrocytes vitality, inhibit graft resorption, and retain the overall regenerative potential of cartilage fragments. However, the need for an another incision and scarring are the limitations of this fascia technique. To solve this problem, Achauer (38) used Alloderm in nasal dorsum in a limited number of cases. Later, Jackson (39) and Gryskiewicz published the original articles on the use of Alloderm in rhinoplasty (40, 41). In a study conducted by Kima et al.(42) in 2011, the authors compared split cartilage wrapped in Alloderm and split cartilage wrapped in fascia. They were reported Alloderm has a high potential for regeneration of chondrocyte, matrix colloid, metaplastic bone formation. In another study, Bateman et al. reported in their clinical study that alloplastic materials have risks of infection, tissue reaction and extrusion (11).

In a study conducted by Bullocks et al. (43) in 2011 study, 68 patients were treated with split cartilage and platelet rich plasma (PRP) for dorsal augmentation and the authors reported that dorsal augmentation performed with cartilage graft and PRP was a safe and effective method during long-term follow-up. PRP has some disadvantages such as it is in liquid or gel form, so it is not possible to wrap the split cartilage grafts into PRP, the addition of bovine thrombin and calcium, the twice-centrifugation, and the increased amount of blood obtained from patient (14, 44, 45).

There are many applications of PRFM in dermatology, dentistry, plastic surgery and otolaryngology (20). The PRFM was first described by Chouckroun in 2001(25). He stated that preparation of PRFM requires 10 ml of venous blood, anticoagulant-free tube and centrifuge at 3000 rpm and it was to easy to prepare (25). The preparation of PRP is relatively expensive due to the use of bovine thrombin and calcium chloride and need for twice-centrifugation (46, 47). PRP can not be used as a membrane because it is obtained in plasma or gel form.

PRP consists of many cytokines and growth factors such as vascular endothelial growth factor (VEGF), interleukin (IL) -1,4,6, TNF alfa and beta. The two major contents of PRP, IL-4 and Vascular Endothelial Growth Factor (VEGF), have major roles in tissue regeneration. In some studies, PRFM has been reported to promote fibroblastic proliferation and induce angiogenesis, thereby collecting circulating stem cells in blood and promoting osteoblastic activity (19). In a study by Scafani (48), PRFM was reported be successfully used as a graft material or nasolabial filler in facial aesthetic procedures .

In our study, we used PRFM in 12 patients underwent open technique septorhinoplasty and had successful results in dorsal grafting and tip area. PRFM is easy to prepare, cheap, biocompatible and ready for use. There is no need for second surgical incision and risk of infection.

Conclusion

Our results show that cartilage graft wrapped in PRFM can be safely used in septorhinoplasty. For generating more reliance data, larger sample size and longer follow-ups are needed.

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Please cite this article as: Guler I., Kum R. O., Yilmaz Y. F., Application Of Platelet Rich Fibrin Matrix (PRFM) In Septorhinoplasty. ENT Updates 2019;9(1): 53–58