

The extraordinary efficacy of platelet rich fibrin membrane on fungal infections of nails in a human model

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Abstract

Background: Fungal infections of nail can occur in people with brittle and dry skin. This condition can lead to nail damage and infection that spread beyond your feet if you have a suppressed immune system due to medication, diabetes or other conditions. If the immune system is suppressed due to medication, diabetes or other conditions, they expand. Some patients do not respond appropriately to common treatments. The use of platelet rich fibrin membrane (PRF M) has been suggested as an alternative method for fungal infection of nail treatment due to their potential to release many kinds of growth factors and antifungal efficacy.

Materials and Methods: The PRF M sample was obtained from the patient with fungal nail infection. PRF M was harvested from peripheral blood by centrifuging immediately. Moreover, PRF M was expanded over the damaged area in flat form five times for three days. Pre-treatment and post-treatment were then analyzed by observation of fungal infection.

Results: Visual observation showed the positive effect of this technique on the patient's recovery. Hence, it can be deduced that autologous PRF M is a promising safe therapy for drug-resistant fungal infections.

Conclusion: The present clinical case report demonstrated that PRF M may be able to remove fungal infections in human.

Keywords: Platelet rich fibrin membranes, Fungal infection of nail, Antifungal efficacy, Regeneration

1. Introduction

Fungal infections of the nails appear with a white or yellow spot under the fingernail or toenail tips. At any age, many people become infected with the fungus that this process can accelerate with the nail ages, artificial nails, diabetes, and skin injury around the nail, moist fingers or toes for an extended time, closed-toe shoes, such as tennis shoes or boots, reduced blood circulation, and weakened immune system. It leads to broken nails and the entry of fungi. Nail fungus can damage part of the nail, the entire nail, or several nails. Common signs of nail fungus are including distorted nail, odor coming from the infected nail and brittle or thickened nail (1).

Bioactive factors have an important role in regenerative medicine and Platelet-rich fibrin (PRF) is one of them (2,3). It is determined as the second generation of blood derived products. This kind of platelet concentrates (PCs) derived from the patient's own blood is prepared in the form of fibrin membrane that it contains platelets and growth factors (GFs) (4). These active factors are able to accelerate healing process, angiogenesis and tissue repair despite of moderate inflammation, and an immune response (5). As well, it has an effective role in producing of chemotactic gradients and led to stimulating cell migration, differentiation and regeneration (6). PRF membrane is considered as a novel bio-factors which are processed without the use of additional ingredients

(7). Although, PRF is as a biological tool for regenerative medicine but there is not much documentary about their antibacterial and antifungal effects. In this case, the patient developed a fungal infection due to the use of artificial nails (ANs). Hence, the purpose of this study was to evaluate the performance of PRF on fungal infections.

Case study

A 35- years old woman was considered as a volunteer for this study. She referred for treatment while she had previously done all the common treatments and suffered from pain and unattractive appearance.

2. Materials and Methods

2.1. Preparation of platelet rich fibrin membrane

This practice was confirmed by the ethics committee of the academic center for education, culture, and research, Qom branch (No. 03-312). PRF preparation was performed according to previous protocols by Choukroun et al. (5). At the first step, informed consent was obtained from the patient. The PRF membrane preparation was isolated from the patient's peripheral blood in 2 test tubes (9 ml) without anticoagulant or other additives. They were immediately centrifuged at 2700 rpm for 15 minutes. The PRF clot was exited using surgical forceps from tubes and separated from the RBC layer using scissors and transferred on sterile medical gas. Finally, the PRF membrane is prepared by pressure with a spatula (Figure 1).

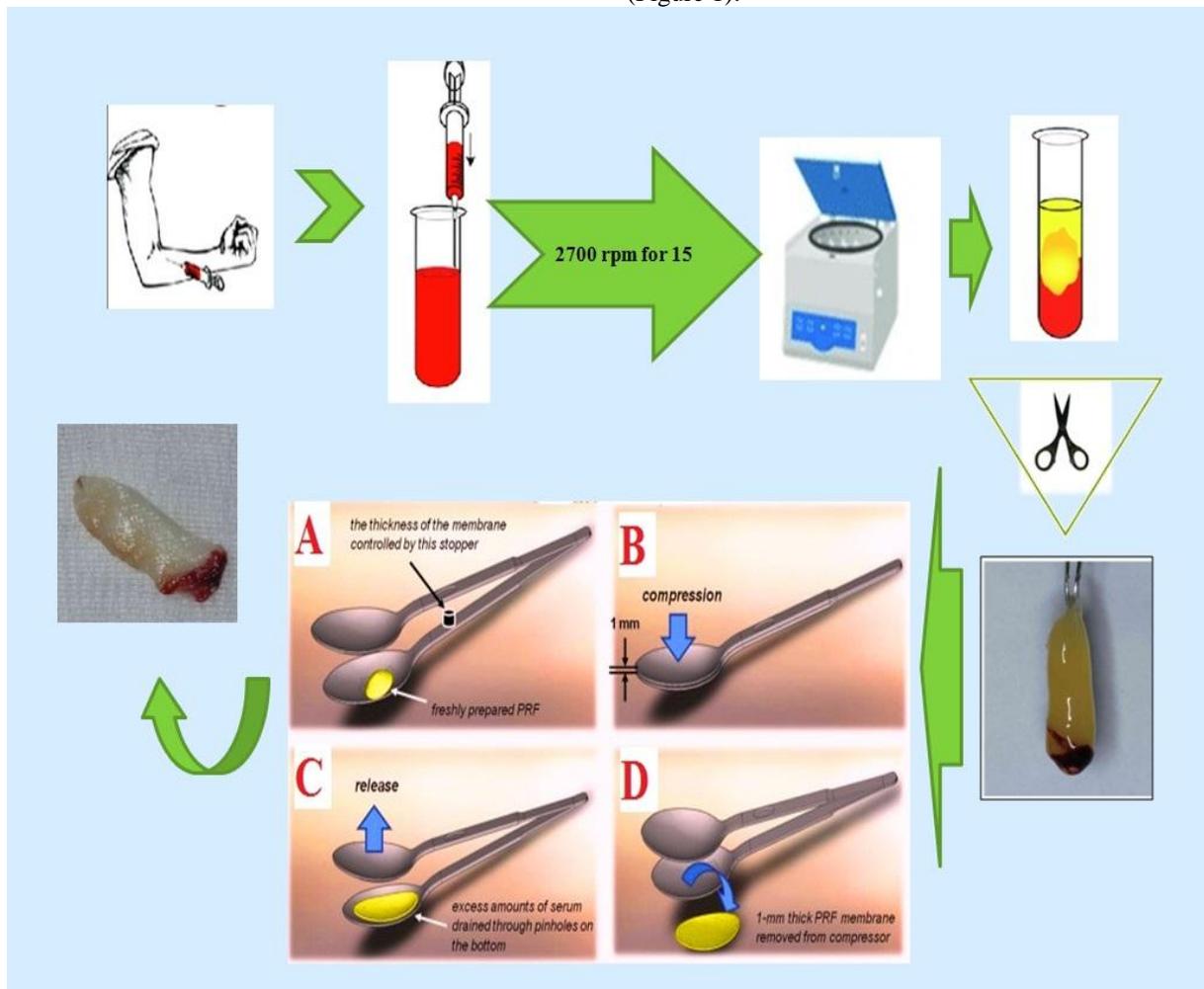


Figure 1. PRF M preparation

2.2. Transplantation of PRF membrane

The site of infection was initially rinsed with normal saline (9%). Then, the prepared membrane was placed in area of fungal nail infection. The PRF membrane was exchanged every 2 days for 5 times.

2.3. Clinical Outcome

The results were evaluated observationally during treatment. (Figure 2). It demonstrated that this method can improve the treatment process in patients with fungal infections and is effective in eliminating this type of infection.



Figure 2. A) Without treatment with PRF M, B) treatment 2 times with PRF M, C) treatment 5 times with PRF M.

3. Results and Discussion

As a common fungal disease, fungal nail infections can affect all fingers. Some cases become resistant to typical treatments. The PRF potential has been confirmed for regenerative of different tissues. Nevertheless, there are few evidences about the antimicrobial and antifungal properties of this biomaterial. Some studies have been reported antimicrobial potential of platelets (8).

Klinger and Tang shown that blood platelets can release alpha-granules consisting of bioactive peptides such as CC-chemokines and CXC-chemokines and growth factors which have an important role for stimulation of endothelial cells, smooth muscle cells and fibroblasts growth. Platelets are able to eliminate pathogens from the bloodstream. Platelets also destroy protozoal pathogens by intervening in antibody-dependent cell cytotoxicity functions and are able to kill certain bacteria and fungi dependent on microbicidal proteins (9, 10). Recent studies have shown that platelets are involved in facilitating certain processes: 1) react to microbial threats, 2) development of cell intrinsic functions, 3) adjustment of antigen presentation, 4) increasing compatible immune responses (11).

An *in vitro* study showed that rabbit platelets released different kinds of GFs and platelet microbicidal proteins from platelets which has antimicrobial potential against bacterial and fungal pathogens. Platelets have a key role in host defense against infection, when antimicrobial proteins are released locally. Because of tissue injury or microbial colonization (12), it has been shown in a study that

PRF inhibits the root canal microflora after two days during incubation (13). PRF is prepared as a matrix of autologous fibrin by centrifugation. It contains large number of platelets and leukocyte cytokines that are gradually released along with fibrin network degradation (14). The antibacterial activity of PC is due to platelets and the complex mixture of cellular component, fibrin matrix, and plasma proteins (15). The present case study determines autologous PRF membrane in patients with fungous nail infection showed an improvement according to the observational method. Therefore, it is thought that this method is considered as an alternative method in patients resistant to routine drug treatments.

Conclusion

The current research showed one of the best methods for removing fungous infection of nail by PRF membranes. PRF membranes can replace as a new treatment by producing anti-fungal and anti-microbial properties.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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