

Platelet Rich Fibrin for the Repair of Tympanic Membrane

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ABSTRACT

Objective: The aim of our study is to investigate the effect of the Choukroun's platelet-rich fibrin (PRF) on the acute tympanic membrane perforations due to trauma without application of any classic tympanoplasty procedure.

Methods: This prospective controlled study was conducted at Umraniye Hospital, between April-December 2011. 32 subjects with acute tympanic membrane perforations due to trauma were divided randomly into two groups (study:14, control:18) In the study group, PRF was used to repair tympanic membrane perforations. In the control group, no manipulation was performed.

Results: Mean area of perforation was $10,93\pm 3,58$ mm² in the study group and $10,05\pm 4,02$ mm² in the control group in the first examination. At the end of 1st month the mean area of the perforation was $1,35\pm 2,53$ mm² in the study group and $4,44\pm 3,34$ mm² in the control group ($P<0,01$). Total closure rate of the tympanic rates was 64,3 % for the study group, and 22,2% for the control group ($P<0,05$) at the end of 1st month. At the end of 2nd month, number of patients with a perforation was one for the study group, 4 for the control group ($P>0,05$).

Conclusion: PRF application in otologic interventions is a new subject and little information is currently available about its use in otology. Our study has shown that PRF is an autogenous, useful and easy to prepare biomaterial which accelerates the healing of the tympanic membrane.

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1. INTRODUCTION

Although, myringoplasty has still been proved to be an effective method, it has some limitations such as the necessity of equipment in an operating room setting sometimes general anesthesia and experience of the surgeon (1,2). Therefore, simpler and cost-effective techniques are required that could be used in an office setting.

There were techniques described without elevating the annulus and entering the middle ear for myringoplasty. Paper-patch, fat, and perichondrium myringoplasty techniques which are simple, quick, and minimally invasive procedures, that can be performed easily in an office setting (3,4).

Also in recent years, some agents have been tried experimentally for healing of tympanic membrane (TM) perforations, such as hyaluronic acid, pentoxifylline (Trental), and epidermal and fibroblast growth factors (5,6).

Platelet rich fibrin (PRF) which is also called as second generation platelet rich plasma, due to high amount of growth factor consistency; could be used as sealant, graft material or membrane (7).

In this study we aimed to investigate the effect of the PRF on the acute tympanic membrane perforations due to trauma without application of any classic tympanoplasty procedure.

2. METHODS AND MATERIALS

2.1. Patients

This prospective controlled study was conducted at Umraniye Hospital, between April-December 2011. The study was consisted of 32 patients with acute tympanic membrane perforations due to trauma. Subjects were randomly divided into two groups. PRF was used to repair tympanic membrane perforations in 14 patients. In the control group (18 patients), no manipulation was performed. Patients with total perforation, less than 2 mm perforation of the tympanic membrane, trauma to the ear more than 24 hours, patients with previous ear disorders and systemic diseases were excluded from the study.

Microscopic examination of the ear was performed in all patients. Short and long axis of perforation size were measured by a blinded senior surgeon. Then, an estimated area of the perforation were calculated for each patient. All patients were followed up for two months. At the end of the first month and second months microscopic examination of ear were repeated and size of the perforations were recalculated. Finally, comparison of the data between the groups were made for statistical analysis.

2.2. Preparation and application of Choukroun's platelet-rich fibrin: 8-10 cc blood was obtained and drawn into 10-ml test tubes without an anticoagulant; and centrifuged without a delay for 12 min at 2.700 rpm. The resultant material consisted of the following three layers: Superficial layer consisting of acellular serum, PRF clot in the middle and red blood cell at the bottom. This PRF clot could be shaped out as a thin membrane between two sterile sponges (Figure-1).

Under local anesthesia, a small piece of PRF clot bigger than the perforation size was inserted into the perforation in a dumbbell fashion and than the thin PRF membrane was also spread overlay (Figure-2). Patients were under wide-spectrum antibiotic treatment for 1 week.

2.3 Statistical investigations: Statistical analysis was performed with the use of NCSS (Number Cruncher Statistical System) 2007 & PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA). Mann Whitney U-test was used in the descriptive statistics of the data (the mean and standard deviation) as well as in the comparisons. Fisher's Exact test were used for comparisons of quantitative data. P values of less than 0.05 were considered statistically significant.

Table-1: Comparison of closure area After first month examination.

	The study group N (14)	The control group N (14)	P
	Mean area of perforation	Mean area of perforation	
First examination	10,93±3,58 mm ²	10,05±4,02 mm ²	0,493
After first month examination	1,35±2,53 mm ²	4,44±3,34 mm ²	<0,01
Closure ratio	9,57±3,93 mm ²	5,61±3,74 mm ²	<0,05

Mann Whitney U test *p<0.05 **p<0.01

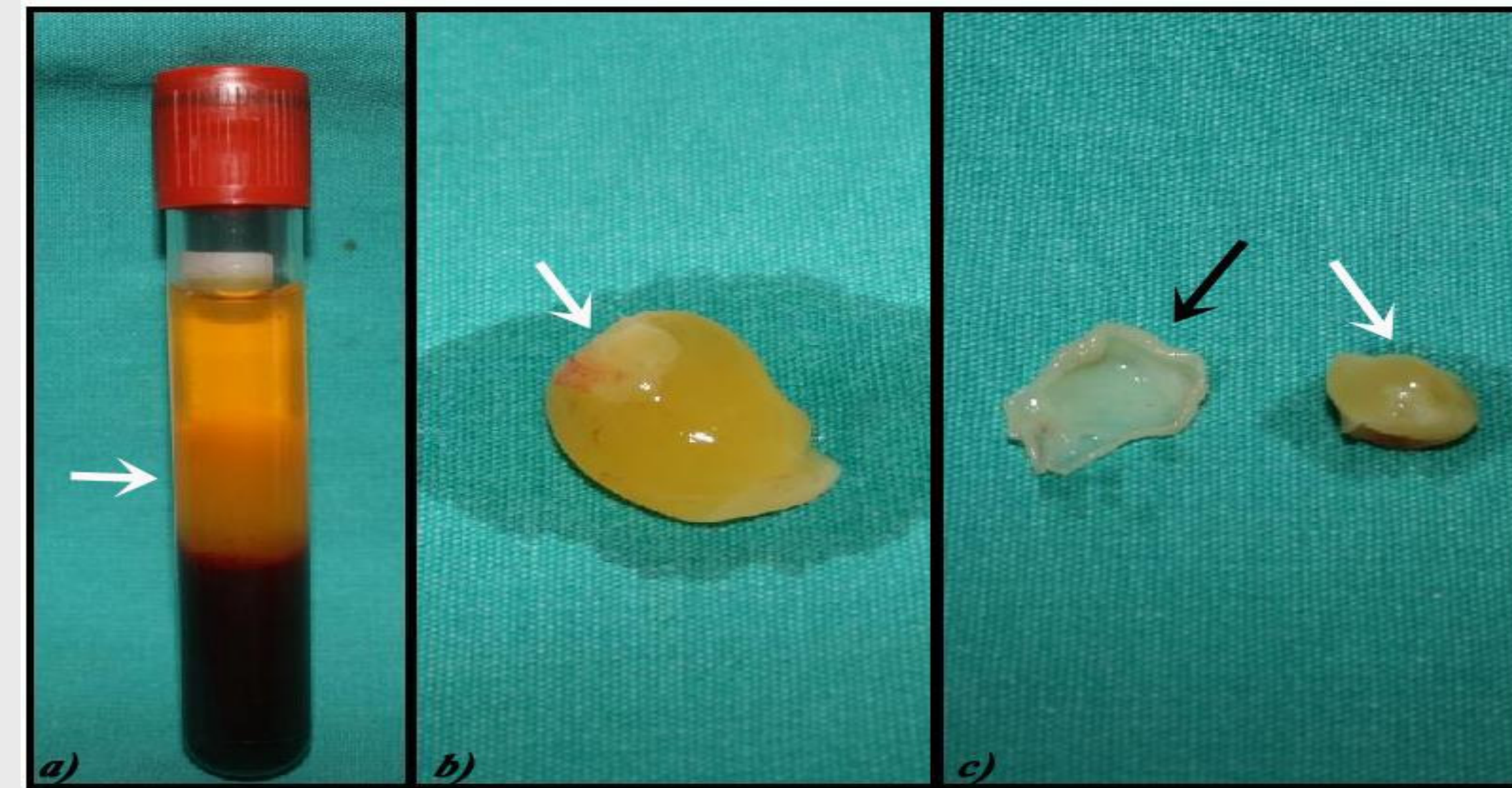


Figure-1: Platelet rich fibrin marked with white arrow in a),b),c); Also platelet rich membrane marked with black arrow in c).

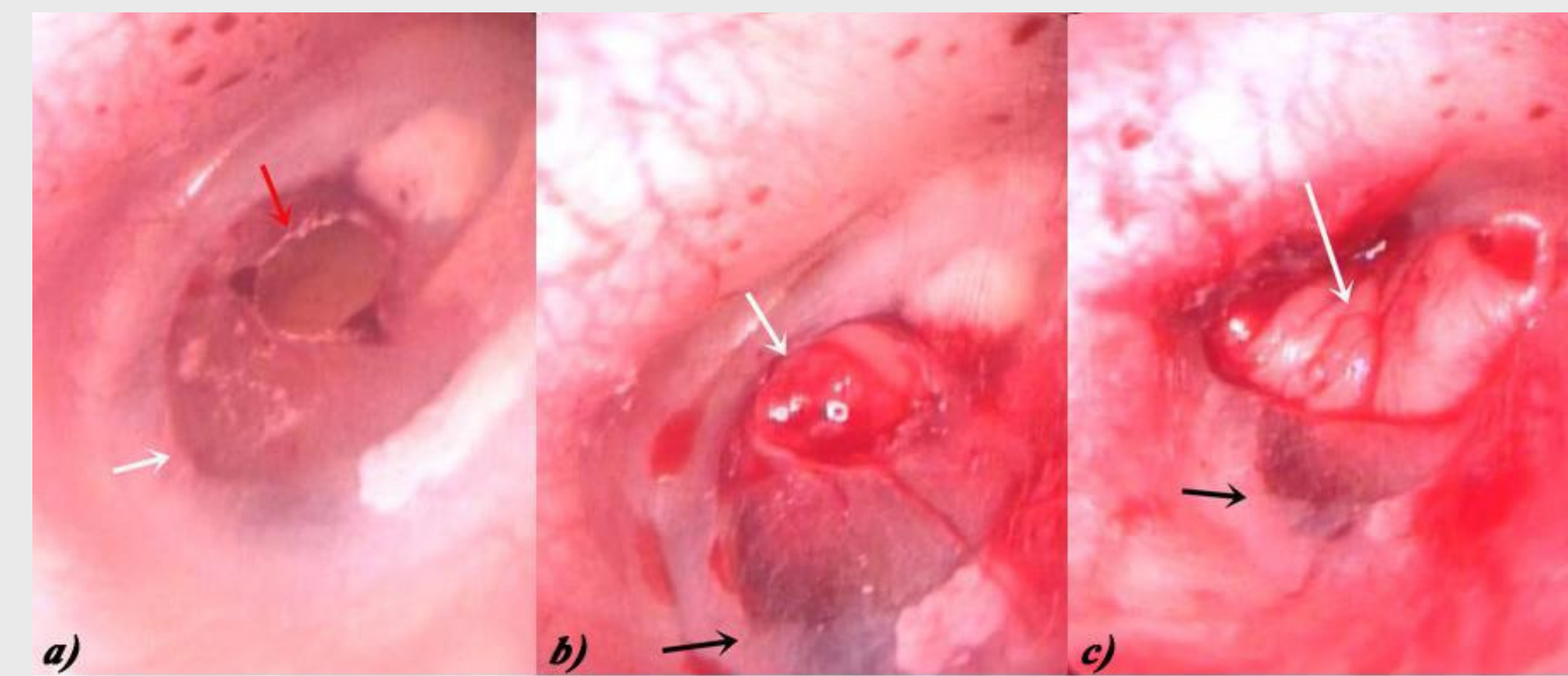


Figure-2: Application of platelet rich fibrin and membrane.

3. RESULTS

Mean area of the perforation was $10,93\pm 3,58$ mm² in the study group and $10,05\pm 4,02$ mm² in the control group in the first examination ($p>0,05$). At the end of the first month; the mean area of the perforation was $1,35\pm 2,53$ mm² in the study group and $4,44\pm 3,34$ mm² in the control group ($P<0,01$) (Table-1). Tympanic membrane repair ratio was $9,57\pm 3,93$ mm² in the study group and $5,61\pm 3,74$ in the control group ($P<0,05$). In study group, 64,3 % of patients had total closure of their tympanic membranes, but in control group, only 22,2% patients had total closure at this time ($P<0,05$). At the end of the second month, 7,1% of patients in the study group had unclosure of the tympanic membrane, 22,2% patients in group-2 had unclosure of their tympanic membrane ($P>0,05$).

Table-2: Comparison of closure ratio at the en of second month.

	The Study Group (n=14)	The Control Group (n=18)	P
	n(%)	n(%)	
Non closure of perforation at the en of first month	5 (35.7%)	14 (77.8%)	<0,05
Non closure of perforation at the en of second month	1 (7.14%)	4 (22.2%)	>0,05

Fisher's exact test *p<0.05 **p>0.05

DISCUSSION

Although the TM has a great ability for regeneration and spontaneous healing, some perforations may require repair. In the literature, there are many materials that can be used with different surgical procedures for the repair of TM perforation. Larger perforations may need a microsurgical procedure usually under general anesthesia, but smaller perforations may heal with conservative techniques with minimal cost, surgical risks, and hospitalization period (8).

In an attempt to develop a simpler, more cost-effective technique that could be used in an office setting, Blake introduced in 1887 the paper-patch graft (9). In this method, the paper-patch guides the migrating epithelium as a scaffold from the borders of the perforation. This technique is still practiced for acute and traumatic perforations (10). First reported in 1962 (11), fat graft myringoplasty has been used and described as a cost-effective and safe procedure for closure of small TM perforations (12).

Recently, agents such as hyaluronic acid, pentoxifylline (Trental), and epidermal and fibroblast growth factors, were also tried experimentally as an alternative method to promote the healing of TM perforations (5,6).

PRF is a blood clot which is an autologous inexpensive material, can easily be prepared. PRF which is a source of many growth and healing factors, has been shown to accelerate wound healing (13,14). Also these growth factors may lead tissue regeneration (15).

Navarrete Alvaro ML et al, in their pilot study, evaluated 3 patients with inactive central tympanic membrane perforation. They used PRP for the closure of their TM perforation without elevating annulus and entering middle ear. According to their results, PRP lead to the successful closure of TM perforation in these patients (16).

Erkilet E. et al created traumatic TM perforation in 44 rats, and they founded that PRP was effective in accelerating tympanic membrane perforation healing. Therefore, they claimed that PRP might be effective in human subjects, particularly as it is an autologous material (17).

In our study, we studied the effect of PRF on the healing of traumatic tympanic membrane perforation. In 9 of 14 patients with use of PRF, there were total closure of their TM perforation at the end of 1.month. But, in control group, there were total closure of the TM perforation in only 4 of 18 patients. In study group, at the end of the 1.month $9,57\pm 3,93$ mm² closure area of TM were calculated, but in control group, only $5,61\pm 3,74$ mm² closure area of TM were calculated ($P<0,05$). However, at the end of second month, there was no significant difference between study and control group when we compared the ratio of closure of TM perforation ($P>0,05$).

Although, there has been limited researches in otolaryngology literature about this issue, results of our study were similar to the results of few previous studies, showing that PRF had a positive effect on TM perforation healing especially in early period.

4. REFERENCES

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