Platelet-Rich Fibrin Plays a Role on Healing of Acute-Traumatic Ear Drum Perforation

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Objective: Our objective was to demonstrate the effects of platelet-rich fibrin (PRF) for the healing of acute ear drum perforation.

Methods: Thirty-two patients with acute traumatic ear drum perforations were randomly separated into 2 groups. In group 1 (n = 14), PRF was used for the repair of ear drum perforation; in group 2 (n = 18), we did not make any intervention.

Results: At initial inspection, perforation sizes were measured as 10.93 ± 3.58 mm^2 in group 1 and 10.05 ± 4.02 mm^2 in group 2. After 1 month, perforation sizes were 1.35 ± 2.53 mm^2 in group 1 and 4.44 ± 3.34 mm^2 in group 2 ($P < 0.01$). In the study group, the rate of ear drum closure was 64.3% and in the control group it was 22.2% ($P < 0.05$).

Conclusion: Here we found that PRF is a biomaterial that quickens the healing of ear drum which is autogenous and simply prepared.

Key Words: Platelet-rich fibrin, ear drum perforation

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Myringoplasty has still been accepted to be a valuable technique, but the need of an operating room, anesthesia, and experience are the restrictions of the procedure.[1,2] Thus, easy and cheap procedures are necessary which could be used in an outpatient clinic.

There are some minimally invasive procedures such as paper-patch, fat, and cartilage myringoplasty procedures that are easy and quick to perform in a clinic.[3,4]

There are some studies about the acceleration of the closure of ear drum perforation by the use of hyaluronic acid, pentoxifylline, and fibroblast growth factors.[5,6]

Nowadays, platelet-rich fibrin (PRF) is also used for wound and graft healing because it contains growth factor in large amount.[7]

Here, our aim was to reveal the possible impact of PRF on the acceleration of closure ratio of ear drum perforation without a need for a surgical manipulation.

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MATERIALS AND METHODS

Setting

The paper was approved by the Umraniye Training and Research Hospital Ethical Committee. This prospective and controlled study was organized in this clinic between April and December 2011.

Participants

Thirty-two cases with traumatic ear drum perforations were enrolled in the study. Cases were accepted as 2 groups. In 14 cases, PRF was used to quicken recovery of ear drum perforations (group 1). Eighteen patients were accepted as control group (group 2) and we did not make any intervention. Exclusion criteria were subtotal perforation, millimetric perforation of the ear drum, greater than 1 day of period of trauma, previous ontological illnesses, and any other illnesses.

Study Design

All cases had otomicroscopic examination. A blinded operator measured short and long axis of perforation size subjectively and an approximative area of the perforations was measured for all cases. Patients were followed up, and after a month otomicroscopic examinations were evaluated and perforation sizes were measured again subjectively by another operator. At the end, the data were compared between the groups for statistical analysis.

Measurement of the Approximative Size of Perforation

Two axes of the perforation were calculated (long: a, short: b) otomicroscopically (Fig. 1). Then the estimated perforation areas in cases were noted by the following formula:

$$\text{Approximative size of perforation} = \frac{(\pi) \times (a) \times (b)}{4}$$

To Obtain and Perform PRF

We obtained 8 to 10 mL of blood from patients and pulled into 10-mL tubes which did not contain heparin and immediately

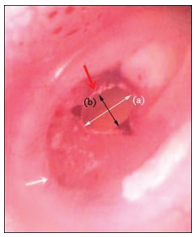

FIGURE 1. Assessment of long and short axis of ear drum perforations.

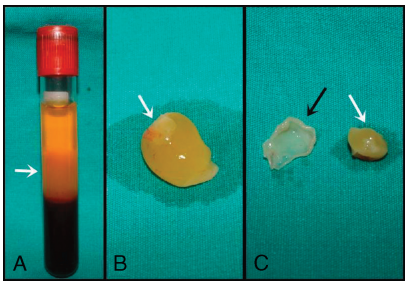

FIGURE 2. Platelet-rich fibrin was signed with arrows in *A–C*; platelet-rich membrane was signed with left arrow in *C*.

centrifuged for 12 min at 2700 rpm. The occurring material consisted of these 3 layers: at the top serum, in the middle PRF clot, and red cellular component at the lowermost. Between 2 sponges, the PRF could be given form as a fine membrane (Fig. 2).

At first, perforation was obliterated by a piece of PRF, under local anesthesia. Then the remaining piece of PRF was placed overlaying the ear drum as a thin membrane without de-epithelialization of the perforation edges (Fig. 3). Antibiotic treatment was given to cases for 7 days.

Statistical Investigations

The tests that were used for statistical analysis were NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 Statistical Software (UT, USA). To analyze descriptive statistics (mean and standard deviation) and in the comparisons, Mann-Whitney *U* test was used. For the analysis of quantitative data, Fisher exact test was used. *P* values of less than 0.05 and 0.01 were considered to be significant.

RESULTS

At initial examination, mean area of the perforation was 10.93 ± 3.58 mm^2 in group 1 and 10.05 ± 4.02 mm^2 in group 2 ($P > 0.05$). The mean area of the perforation was 1.35 ± 2.53 mm^2 in group 1 and 4.44 ± 3.34 mm^2 in group 2 at the end of the first month ($P < 0.01$) (Table 1). Ear drum repair ratio was 9.57 ± 3.93 mm^2 in group 1 and 5.61 ± 3.74 in group 2 ($P < 0.05$). The ratio of total closure of ear drum in group 1 was 64.3%, but only 22.2% of patients had total closure in group 2 at the end of the first month ($P < 0.05$) (Table 2).

DISCUSSION

Although the TM has a capability for renewal and self-repair, an additional procedure may be needed in some cases for the closure of the perforation. According to the literature, different materials for various surgical interventions were reported for the closure of the ear drum perforations. Small perforations may close with conservative techniques in clinical setting without any cost and risk. However, most of the time surgical intervention is needed with general anesthesia in bigger perforations.[8]

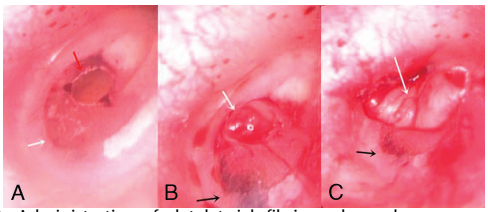

FIGURE 3. Administration of platelet-rich fibrin and membrane.

TABLE 1. Comparison of Closure Area After First Month

	Group 1 (N = 14)	Group 2 (N = 18)	
	Mean area of perforation	Mean area of perforation	*P*
First examination	10.93 ± 3.58 mm^2	10.05 ± 4.02 mm^2	*0.493*
After 1-mo 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; *$P < 0.05$, **$P < 0.01$.

In 1887, Blake introduced the paper-patch graft technique, which is easy and cheaper, that could also be applicable without hospitalization.[9] In the paper-patch method, patch acts the migrating epithelium as a guide from the perforation edges. This procedure is being used for acute and traumatic ear drum perforations.[10] Fat myringoplasty was first described in 1962,[11] which was accepted as a cheap and reliable procedure of minor ear drum perforations.[12]

Nowadays, there are molecules such as hyaluronic acid, pentoxifylline, and fibroblast growth factors which were also experimented to accelerate the healing of ear drum perforations.[5,6]

PRF is an autologous material, which is a second-generation platelet concentrate.[13] Platelet activation occurs after tissue damage and platelet plug and blood clot form. Platelet-derived growth factor, transforming growth factor, platelet factor 4, interleukin-1, vascular endothelial growth factor, platelet-derived angiogenesis factor, epidermal growth factor, insulin-like growth factor, epithelial cell growth factor, osteonectin, osteocalcin, fibrinogen, vitronectin, fibronectin, and thromboplastin are biologically active proteins, which help to begin tissue healing and are secreted from the α-granules.[14]. PRF, which contains many growth factors, has been demonstrated to facilitate wound healing.[15–17]

In the literature, Navarrate Alvaro et al used PRP for 3 patients who had ear drum perforation that did not heal spontaneously. They reported that PRP resulted in successful healing of ear drum perforation.[18]

In an animal study by Erkilet, traumatic ear drum perforation were formed in 44 rats, and they resulted in that PRP was a useful material for successful ear drum perforation closure.[19]

Here, our aim was to reveal the possible impact of PRF on the acceleration of closure ratio of ear drum perforation without a need for surgical manipulation.

After 1 month, in 9 participants in whom we used PRF, there was total healing of ear drum perforation. However, in group 2, there was total healing of the ear drum perforation in only 4 participants. In group 1, at the end of the first month, 9.57 ± 3.93 mm^2 healing area of ear drum was calculated, but in group 2, only 5.61 ± 3.74 mm^2 healing area of ear drum was calculated ($P < 0.05$).

There are few papers about this issue in the literature. In this study, our results correlate with the results of these studies about this topic. PRF may be used to accelerate healing of acute traumatic ear drum perforation particularly in early stages.

TABLE 2. Comparison of Closure Ratio at the End of First Month

	Group 1 (N = 14)	Group 2 (N = 18)	
	N (%)	N (%)	*P*
Total closure of perforation at the end of first month	9 (64.3%)	4 (22.2%)	*<0.05*

Fisher exact test; *$P < 0.05$, **$P > 0.05$.

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