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## Original article

# Treatment of corneal ulcers with platelet rich plasma<sup>☆</sup>

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### ABSTRACT

**Objective:** To assess the efficacy of platelet rich plasma (PRP) in the treatment of extensive corneal ulcers in albino rabbits.

**Methods:** New Zealand rabbits, divided into three groups, were used for the study. Corneal ulcers of 10 mm diameter were made. Rabbits blood was extracted for the preparation of the PRP of the corresponding group. The blood was processed by differential centrifugation. The first group, named control, was treated with sterile saline every 8 h. The second group, named gel, was treated with deproteinized extract gel beef fat every 8 h, and the third group, named PRP received one PRP drop on the first and third day of monitoring. The rabbits were monitored, by taking photographs, each day for the 7 days that the study lasted.

**Results:** A better outcome was observed in the group with deproteinized extract gel beef fat (GE group), and the PRP group (PL group), in comparison with the control group (CO group) ( $P < 0.05$ ).

**Conclusion:** The PRP showed to be just as effective as the commercial product (Solcoseryl<sup>®</sup>), for the regeneration of the extensive and deep corneal ulcers. Besides, it stands out as there is no surgical procedure is required, and there is easy access, low cost and reduced doses.

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## Tratamiento de úlceras corneales con plasma rico en plaquetas

### RESUMEN

**Objetivo:** Evaluar la eficacia del plasma rico en plaquetas (PRP) en el tratamiento de úlceras corneales no infecciosas extensas en conejos albinos.

**Métodos:** Para el estudio se utilizaron conejos New Zealand, divididos en 3 grupos. Se realizaron úlceras corneales de 10 mm de diámetro. Se extrajo sangre de los conejos para la preparación del PRP del grupo correspondiente. La misma fue procesada mediante centrifugación diferencial. El primer grupo, llamado control, fue tratado con solución salina estéril cada 8 h durante 7 días; el segundo grupo, llamado gel, fue tratado con un gel extracto desproteinizado de sangre de ternera (Solcoseryl<sup>®</sup>) cada 8 h durante 7 días y el tercer grupo,

#### Palabras clave:

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llamado PRP, recibió una gota del PRP el día 1 y el día 3 de seguimiento. Los controles fueron realizados diariamente durante los 7 días que duró el tratamiento. Se llevó a cabo un registro de los mismos a través de muestras fotográficas.

**Resultado:** Se observó una mejor evolución en el grupo del gel extracto desproteinizado de sangre de ternera (grupo GE) y en el grupo de PRP (grupo PL), en comparación con el grupo control (grupo CO) ( $P < 0,05$ ).

**Conclusión:** El PRP demostró ser tan efectivo como la muestra comercial (Solcoseryl®), para la regeneración de úlceras corneales profundas y extensas. Además se destaca su fácil acceso, costo y reducida posología.

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## Introduction

A corneal ulcer is an epithelial defect, loss of stroma, stromal inflammation or a combination thereof.<sup>1</sup> The causes can be neurotrophic, chemical, self-immune or due to connective tissue disorders, traumatism or bacterial infection (more frequently found in contact lens users), virus, fungi and parasites, etc.<sup>2-8</sup>

Said entity is treated with occlusion, lubricants (gel and eyedrops), antibiotics, surgical techniques such as conjunctival covering or with amniotic membrane, including tharsorrhaphy.<sup>9-12</sup> Solcoseryl® is an ophthalmic gel that contains a deproteinized extract of veal blood, which is utilized to rebuild and re-epithelize corneal tissue due to its properties as aerobic metabolism and oxidative phosphorylation activator. This medication: (1) increases oxygen consumption and glucose transport to tissues and cells in hypoxia and metabolically weakened; (2) increases collagen synthesis, stimulates cell proliferation and migration, and (3) accelerates and qualitatively improves cicatrization of lesions.<sup>12</sup> Platelet-rich plasma (PRP) has been used as adjuvant for tissue regeneration in oral, maxillofacial, reconstructive, cardiovascular and plastic surgery and in corneal lesions that progress toward stromal ulceration.<sup>13,14</sup> It is obtained through centrifugation of non-coagulated complete blood. Its biochemical composition is serum, leukocytes, platelets and growth factors although the crucial elements are platelet-derived growth factors (PDGF), transformation growth factor-beta (TGF-BETA), insulin-like growth factor (IGF), fibroblastic growth factor (FGF), vascular endothelial growth factor (VEGF) and epidermic growth factor (EGF) which carry out to the function of regenerating the substrate.<sup>13-15</sup>

In contrast with the other treatments mentioned above, PRP began to be utilized because in addition to repairing injury it regenerates lost tissue. Tissue repair is defined as the restoration thereof without retaining its original architecture or function, which produces cicatrization. On the other hand, regeneration takes place when the restoration of said tissue features properties indistinguishable from the original ones. Scar tissue does not recover the mechanical properties of the physiological function of the damaged tissue or organ, and PRP is of interest precisely because it is able to regenerate and rebuild the form as well as restoring function.<sup>14</sup> Accordingly, therapy strategies utilizing PRP are based on the modulation and acceleration of regenerative processes by means of the growth factors present in the platelets, which are known as

universal activators of nearly all regeneration processes. It has been demonstrated that EGF is present in the basal as well as reflex lacrimal secretion in somewhat lower concentrations to those found in serum.<sup>16</sup> Its function is to enhance the migration process of epithelial cells.<sup>17,18</sup> An additional factor of significance is TGF-BETA, involved in epithelial and stromal repair processes. Its concentration in serum is nearly three times higher than that found in tears.<sup>19-22</sup> Fibronectin is an important factor in cell migration and is present in lower concentrations with respect to serum.<sup>23,24</sup>

## Objective

To assess the efficacy of PRP in the treatment of noninfectious extended corneal ulcers in New Zealand albino rabbits.

## Materials and methods

### Solcoseryl®

Gel, by RAYMOS laboratory, made up by 200 mg of deproteinized extract of veal blood, 13 mg carboxy methylcellulose, 50 mg of 70% sorbitol, 50 µg thimerosal and 1 g distilled water csp.

### Platelet rich plasma

Platelet-rich plasma was obtained by extracting blood (2.5 ml) from the marginal ear vein which was placed in 1 ml microvials containing 3.2% sodium citrate in a ratio of 9:1. Subsequently it was centrifuged at 1000 RPM during 5 min. After this procedure the plasma fraction close to red and white blood cells was withdrawn with a Pasteur pipette. This PRP aliquot (approximately 300 µl) was kept in a sterile container at ambient temperature up to application.

### Utilized population

The population utilized for this 7-day prospective experimental study were New Zealand albino rabbits weighing 2-2.5 kg ( $n = 9$ ; 18 eyes), divided into 3 groups of 3 rabbits (6 eyes) each. The animals were given food and water ad libitum in a room with controlled temperature ( $21 \pm 5^\circ\text{C}$ ). The rabbits were exposed to cycles of 12 h light and 12 h darkness. The handling procedure was in accordance with the standards of the

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