Effects of platelet-rich plasma on the healing of tendons: animal model

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Introduction: Platelet-Rich Plasma (PRP) contains lot of growth factors which could enhance the healing process of different tissues. We aimed to determine if a single injection of PRP could improve the cicatrisation of ruptured Achilles tendons of rats.

Material and Methods: A 5mm defect was surgically made in the Achilles tendon of 120 rats. A few hours after surgery, 45 rats received a PRP or PBS injection in situ. After 5, 15 and 30 days, 20 rats of both groups were euthanized and 15 collected tendons were immediately submitted to a biomechanical tensile strength test until rupture using a "cryo-jaw" device. After, theses samples were used for transcriptomic analyses (type III collagen, MMP-9, tenomodulin). Histological and immunohistological analyses were performed on the five remained tendons in each group.

Results: Tendons in the PRP group were more resistant to rupture at 15 and 30 days than those in the control group (Fig. 1). The transverse area of tendons in the PRP group was significantly higher at day 5 and 15. The constraint was significantly increased in tendons of the PRP group in the late phase of the healing (day 30). Histological and immunohistological analysis showed an increased staining for fibrillar collagen at day 5 confirmed by a biochemical analysis showing an increased collagen concentration in the callus (Fig. 2 and 3). The expression of tenomodulin, a tenocyte differentiation marker, was significantly higher in the PRP-treated tendons at day 5 (Fig. 3). No significant difference in terms of mRNA for type III collagen and matrix metalloproteinase 9 was observed at any time between the 2 groups (Fig. 4).

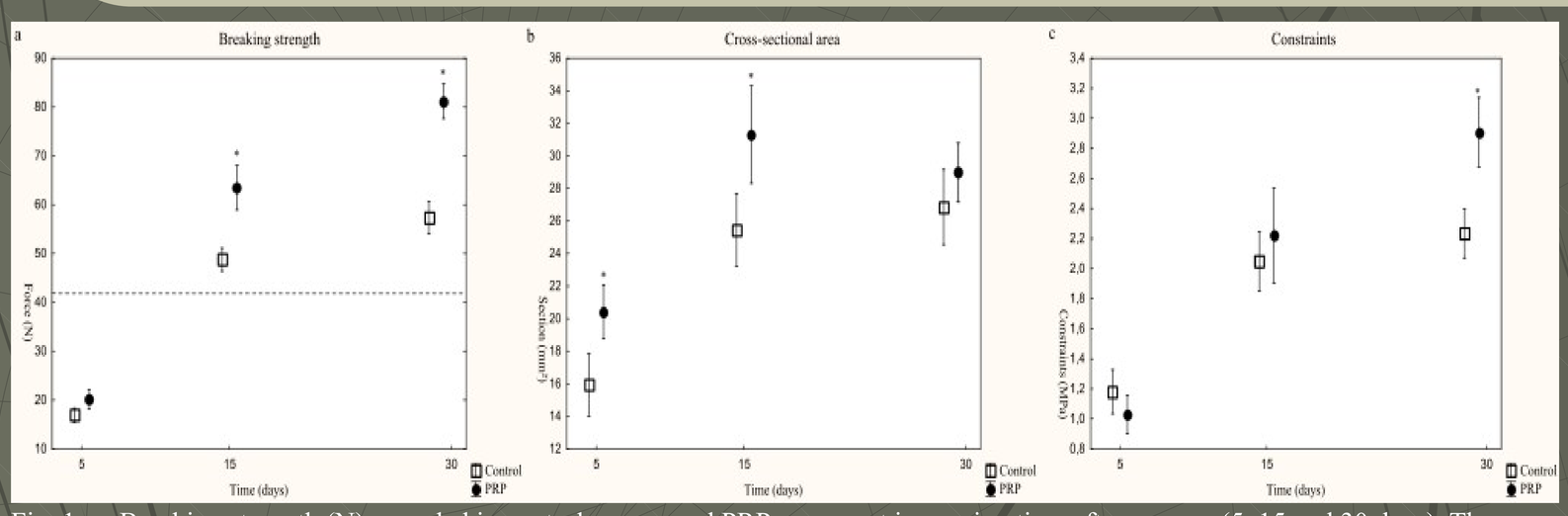


Fig. 1: a- Breaking strength (N) recorded in control groups and PRP groups at increasing time after surgery (5, 15 and 30 days). The dotted line represents the mean value measuring for healthy Achilles tendons of rats (42N, n=10). * p-value < 0.05. b- Evolution of the transverse area of the tendons (mm²) with time. c- Calculated constraints (MPa) at the three time points.

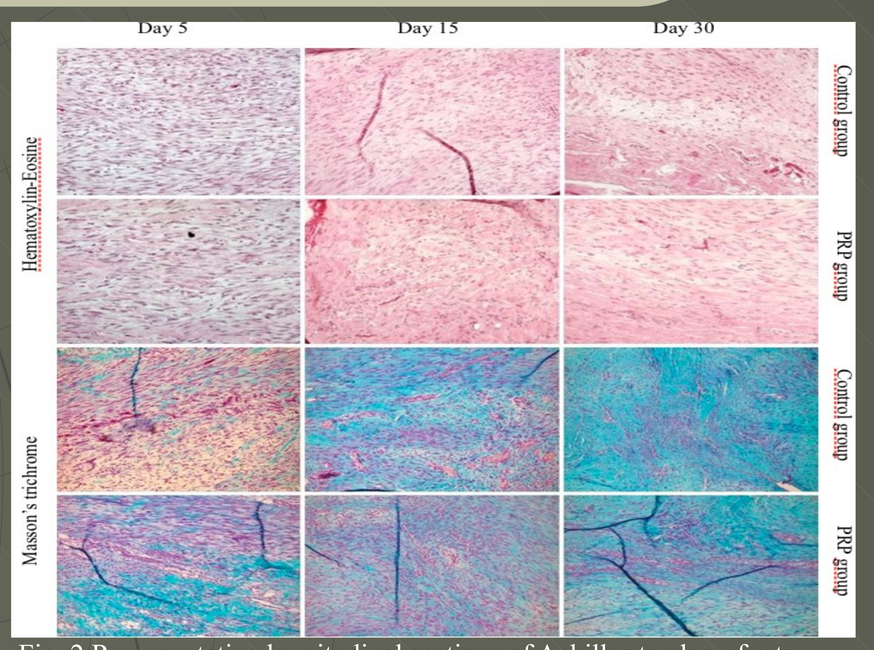
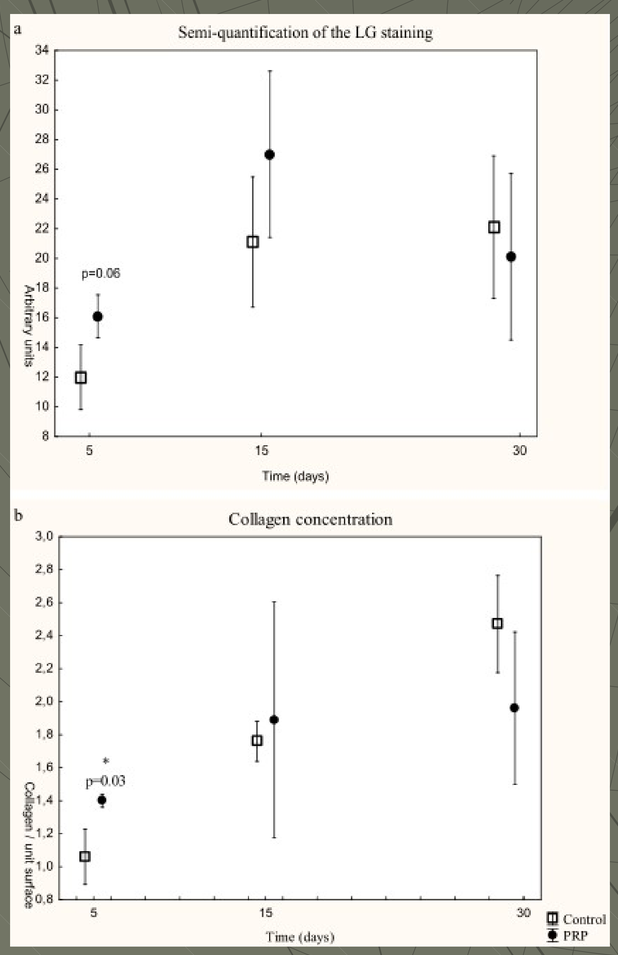


Fig. 2 Representative longitudinal sections of Achilles tendon of rats from control (C) and PRP groups (x20), stained with HE and MT.



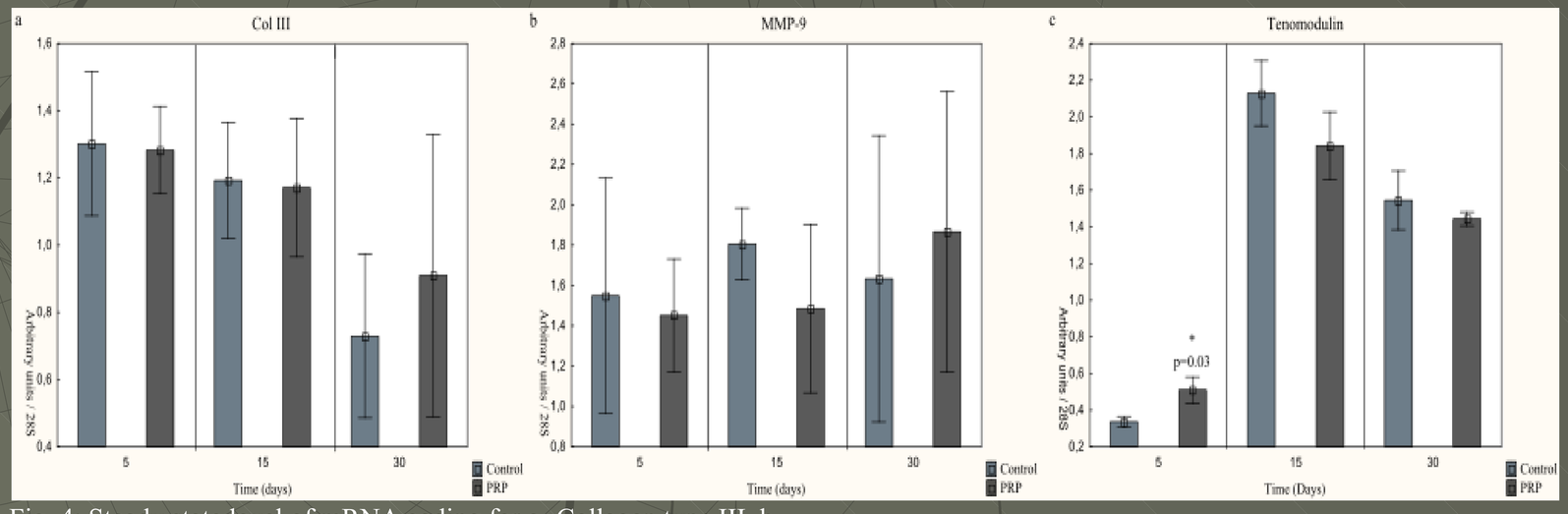


Fig. 4: Steady state level of mRNA coding for a- Collagen type III, b- MMP 9 and c- tenomodulin in tendons of the control group and the PRP group at increasing time after surgery. The results are expressed in arbitrary units per unit of 28S. * p-value < 0.05

Fig. 3: a- Semi-quantification of the LG staining on the tendons sections of control group and PRP group, at increasing time after surgery (5, 15 and 30 days). The values are expressed in arbitrary units per unit surface. b- Collagen concentration (µg) per unit surface was calculated from OHPRO measurements performed on unstained paraffin sections. * p-value < 0.05

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Conclusion: A single injection of PRP in sectioned Achilles tendon of rats few hours after surgery influences the early phase of tendons healing, resulting in an ultimate stronger mechanical resistance.