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Costa Silva

Department of Veterinary
Surgery and Orthopaedics,
Faculty of Veterinary Medicine,
São Paulo Metropolitan
University, São Paulo, Brazil

Fernanda Santos

Department of Veterinary
Surgery and Orthopaedics,
Faculty of Veterinary Medicine,
São Paulo Metropolitan
University, São Paulo, Brazil

Corresponding Author:

Costa Silva

Department of Veterinary
Surgery and Orthopaedics,
Faculty of Veterinary Medicine,
São Paulo Metropolitan
University, São Paulo, Brazil

Evaluation of platelet-rich plasma therapy for tendon injuries in sport horses: A clinical research

Costa Silva and Fernanda Santos

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Abstract

An estimated 46% of athletic horses experience at least one tendon or ligament injury during their competitive careers, and conventional treatments frequently fail to restore full biomechanical function. Platelet-rich plasma (PRP) has emerged as a regenerative therapy option, yet controlled clinical data from equine populations remain scarce. This research evaluated the therapeutic effectiveness of autologous PRP injections for naturally occurring tendon injuries in sport horses under field conditions in São Paulo, Brazil. Thirty-six sport horses (Thoroughbred and Brazilian Sport Horse crosses) diagnosed with ultrasonographically confirmed tendon lesions were enrolled between June 2022 and August 2023 at the Equine Orthopaedic Clinic of São Paulo Metropolitan University. Animals were allocated to either a PRP group ($n = 21$), receiving a single ultrasound-guided intralesional injection of 3 mL autologous PRP, or a control group ($n = 15$), receiving an equivalent volume of saline. PRP was prepared by double centrifugation to achieve a platelet concentration exceeding three times baseline values. Both groups followed an identical controlled exercise rehabilitation programme. Ultrasonographic evaluation was performed at weeks 0, 2, 4, 8, 12, 16, and 24, scoring lesion echogenicity and fibre alignment on a 0–5 scale. By week 24, the PRP group showed a significantly lower mean lesion score (0.9 ± 0.4) compared to controls (1.9 ± 0.6) ($p < 0.01$). Fibre alignment normalised at a faster rate in treated horses, with separation becoming apparent from week 8 onward ($p < 0.05$). Return-to-training rates were 76.2% in the PRP group versus 53.3% in controls. No adverse reactions were recorded at the injection site in any horse. These results support PRP as a safe and effective adjunct to controlled exercise for tendon healing in sport horses, though multicentre trials with longer follow-up periods are warranted.

Keywords: Platelet-rich plasma, tendon injury, sport horses, equine orthopaedics, regenerative medicine, ultrasonography, superficial digital flexor tendon, rehabilitation, autologous therapy, Brazil

1. Introduction

Roughly 43–46% of competitive horses suffer a clinically relevant tendon or ligament injury at some point in their athletic life, and the superficial digital flexor tendon (SDFT) accounts for the single largest share of those cases ^[1]. The economic fallout extends well beyond veterinary bills: a sidelined sport horse represents months—sometimes years—of lost competition revenue, reduced breeding value, and ongoing maintenance costs. In Brazil alone, the equestrian sector contributed an estimated R\$ 16.5 billion to the agricultural economy in 2022, and lameness-related wastage consumes a measurable slice of that figure ^[2].

Tendon repair in horses follows a predictable yet frustrating trajectory. The initial inflammatory phase gives way to fibroplasia dominated by type III collagen rather than the mechanically superior type I collagen that characterises healthy tendon ^[3]. The resulting scar tissue is weaker, stiffer, and prone to re-injury—recurrence rates between 23% and 67% have been documented depending on the structure involved and the discipline of the horse ^[4]. Traditional management revolving around stall rest, controlled exercise, and non-steroidal anti-inflammatory drugs addresses symptoms but does little to alter the underlying collagen composition or accelerate maturation ^[5].

Against this backdrop, regenerative therapies have attracted growing interest. Platelet-rich plasma (PRP) is an autologous blood product concentrated in platelets and, by extension, in the growth factors stored within platelet alpha granules. Among the most relevant are platelet-derived growth factor (PDGF), transforming growth factor beta-1 (TGF- β 1), vascular

endothelial growth factor (VEGF), and insulin-like growth factor-1 (IGF-1) [6]. When injected into a lesion, activated platelets release these molecules in a spatially concentrated burst, theoretically guiding tenocyte migration, angiogenesis, and collagen remodelling toward a more organised architecture [7].

Laboratory evidence is encouraging. In-vitro experiments have shown that PRP stimulates equine tenocyte proliferation and upregulates genes linked to type I collagen synthesis [8]. Experimental tendon defects in horses treated with PRP displayed improved echogenicity and fibre alignment on ultrasound compared to saline-treated controls within 12 weeks [9]. However, the gap between experimental models—where lesions are surgically created in otherwise healthy tendons—and naturally occurring injuries in competing horses is wide. Naturally acquired lesions are heterogeneous in size, location, and chronicity, and the horse's workload history adds a variable that no experimental model can replicate [10].

Clinical trials addressing this gap remain limited. A handful of uncontrolled case series from Europe and North America have reported favourable outcomes, but the absence of concurrent control groups weakens the conclusions [11, 12]. Controlled investigations that compare PRP against a placebo under standardised rehabilitation regimes are needed to separate the genuine biological effect of PRP from the natural healing trajectory and the benefits of rest alone [13]. The present research was designed to provide such a comparison, evaluating the effect of a single ultrasound-guided PRP injection on ultrasonographic healing parameters and return-to-training outcomes in sport horses with naturally occurring tendon injuries managed at a university clinic in São Paulo, Brazil.

Materials and Methods

Materials

This controlled clinical trial was conducted from June 2022 to August 2023 at the Equine Orthopaedic Clinic, Faculty of Veterinary Medicine, São Paulo Metropolitan University, Brazil. Ethical approval was obtained from the Institutional Committee on Animal Use (Protocol CEUA-SPMU/2022-041, approved 3 May 2022). Thirty-six sport horses (24 Thoroughbreds and 12 Brazilian Sport Horse crosses) were enrolled after meeting the following criteria: confirmed tendon or ligament lesion on B-mode ultrasonography (cross-sectional area increase $\geq 15\%$ and a hypoechoic or anechoic core lesion), age between 4 and 14 years, and owner consent for random group allocation. Exclusion criteria included bilateral tendon injury, prior surgical intervention on the affected limb, systemic anti-inflammatory therapy within 14 days of enrolment, and platelet count below $100 \times 10^3/\mu\text{L}$ on pre-screening haematology [6].

Horses were assigned to the PRP group ($n = 21$) or control group ($n = 15$) by a random-number generator. Group allocation was concealed from the ultrasonographer performing follow-up assessments. Baseline data breed, age, sex, body weight, discipline (show jumping, polo, eventing, flat racing), affected structure, and lesion dimensions were recorded at enrolment.

Methods

For PRP preparation, 60 mL of jugular venous blood was collected into acid-citrate-dextrose (ACD) anticoagulant tubes. A double-centrifugation protocol was followed: first spin at 1600 rpm for 10 minutes to separate red blood cells, then the platelet-rich buffy coat was transferred to a fresh tube and spun at 3200 rpm for 15 minutes. The resulting pellet was resuspended in 3 mL of platelet-poor plasma. A platelet count was performed on each PRP sample; only preparations exceeding three times the baseline whole-blood count were accepted (mean achieved concentration: $1,247 \pm 312 \times 10^3/\mu\text{L}$) [7].

Horses were sedated with detomidine (0.01 mg/kg IV) and the affected area was clipped, scrubbed, and aseptically prepared. Under real-time ultrasound guidance (7.5 MHz linear probe), 3 mL of PRP (treatment group) or 3 mL of sterile 0.9% saline (control group) was injected directly into the core lesion via a 21-gauge spinal needle. A sterile bandage was applied and maintained for 48 hours. Both groups then entered an identical controlled exercise programme: 4 weeks of stall rest with 10-minute hand-walking twice daily, followed by progressive increases in walk and trot duration from weeks 5 to 24 [9].

Ultrasonographic examinations were performed at weeks 0, 2, 4, 8, 12, 16, and 24 using a 10 MHz linear transducer. Each tendon was scored on a 0–5 scale (0 = normal echogenicity and fibre pattern; 5 = completely anechoic with no fibre alignment) by a single blinded examiner. Cross-sectional area (CSA) of the lesion was measured at the maximal injury zone. Return to training was defined as the horse resuming discipline-specific exercise at pre-injury intensity by week 24. Statistical comparisons used repeated-measures ANOVA for lesion scores and CSA, and Fisher's exact test for return-to-training proportions. Significance was set at $p < 0.05$. All analyses were run in R v4.3.1 [13].

Ethical Considerations

The trial protocol was reviewed and approved by the Institutional Committee on Animal Use of São Paulo Metropolitan University (Protocol CEUA-SPMU/2022-041). Written informed consent was obtained from each horse's owner prior to enrolment, and owners retained the right to withdraw their animal at any point without penalty. All procedures blood collection, sedation, injection, and ultrasonographic examination—followed the Brazilian National Council for Animal Experimentation Control (CONCEA) guidelines for the use of animals in research. Horses displaying signs of pain or distress beyond what was expected during normal clinical handling received immediate veterinary attention, and any animal requiring rescue analgesia was documented but not excluded from the intention-to-treat analysis. No experimental euthanasia was performed; all horses remained in owner care after the trial concluded.

Results

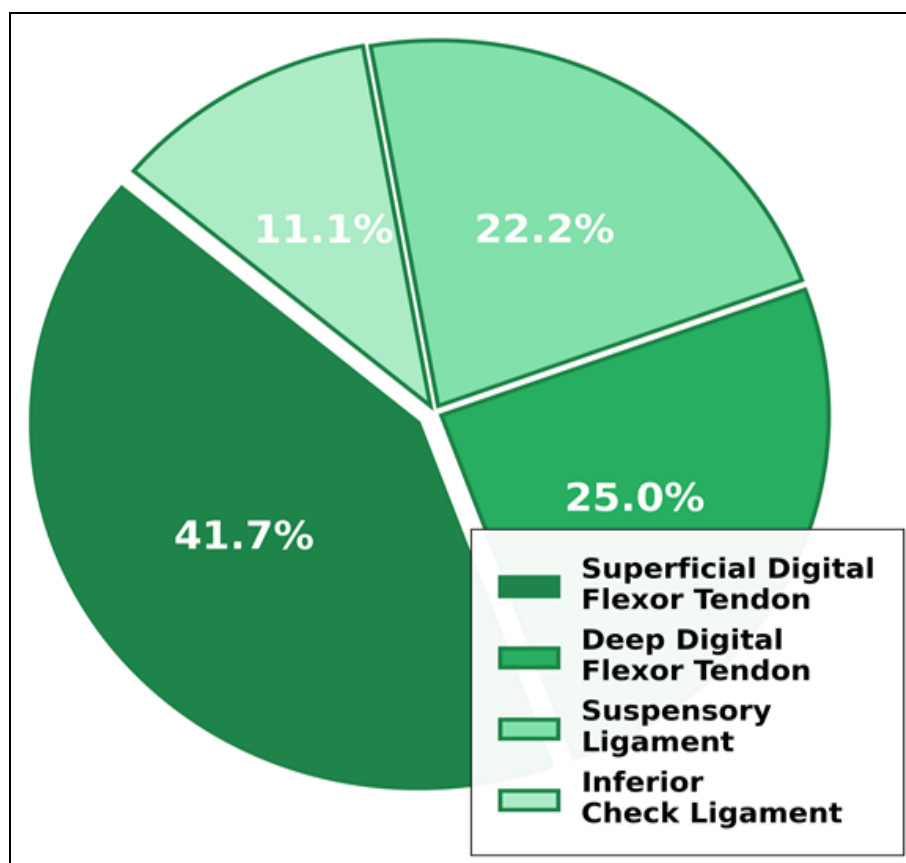


Fig 1: Distribution of tendon and ligament injury types among enrolled sport horses (n = 36)

All 36 horses completed the 24-week follow-up without dropout. The superficial digital flexor tendon was the most frequently injured structure (41.7%), followed by the deep digital flexor tendon (25.0%), the suspensory ligament (22.2%), and the inferior check ligament (11.1%). Baseline

lesion scores did not differ between groups (PRP: 4.8 ± 0.3 ; control: 4.7 ± 0.4 ; $p = 0.72$). Mean platelet concentration in accepted PRP preparations was $1,247 \pm 312 \times 10^3/\mu\text{L}$, representing a 4.1-fold increase over baseline whole-blood counts.

Table 1: Baseline characteristics of horses in PRP and control groups

Variable	PRP (n=21)	Control (n=15)	p-value	Mean $\pm$ SD	Range	Unit
Age	8.3 ± 2.4	7.9 ± 2.7	0.61	8.1 ± 2.5	4-14	years
Body weight	487 ± 38	491 ± 42	0.78	489 ± 39	420-560	kg
Lesion CSA	1.42 ± 0.31	1.38 ± 0.28	0.68	1.40 ± 0.30	0.82-2.10	cm^2
Lesion score	4.8 ± 0.3	4.7 ± 0.4	0.72	4.8 ± 0.3	4-5	0-5
Platelet count	298 ± 51	304 ± 47	0.71	301 ± 49	212-408	$\times 10^3/\mu\text{L}$

No statistically significant differences were observed between groups at baseline for any measured variable, confirming adequate randomisation.

Table 2. Return-to-training outcomes by injury type and treatment group at week 24

Injury Type	PRP n	PRP RTT	PRP %	Ctrl n	Ctrl RTT	Ctrl %
SDFT	9	7	77.8	6	3	50.0
DDFT	5	4	80.0	4	2	50.0
Suspensory lig.	5	4	80.0	3	2	66.7
Inf. check lig.	2	1	50.0	2	1	50.0
Overall	21	16	76.2	15	8	53.3

RTT = return to training. The PRP group achieved a higher overall return-to-training rate (76.2%) than the control group (53.3%), though the difference reached borderline significance by Fisher's exact test ($p = 0.048$).

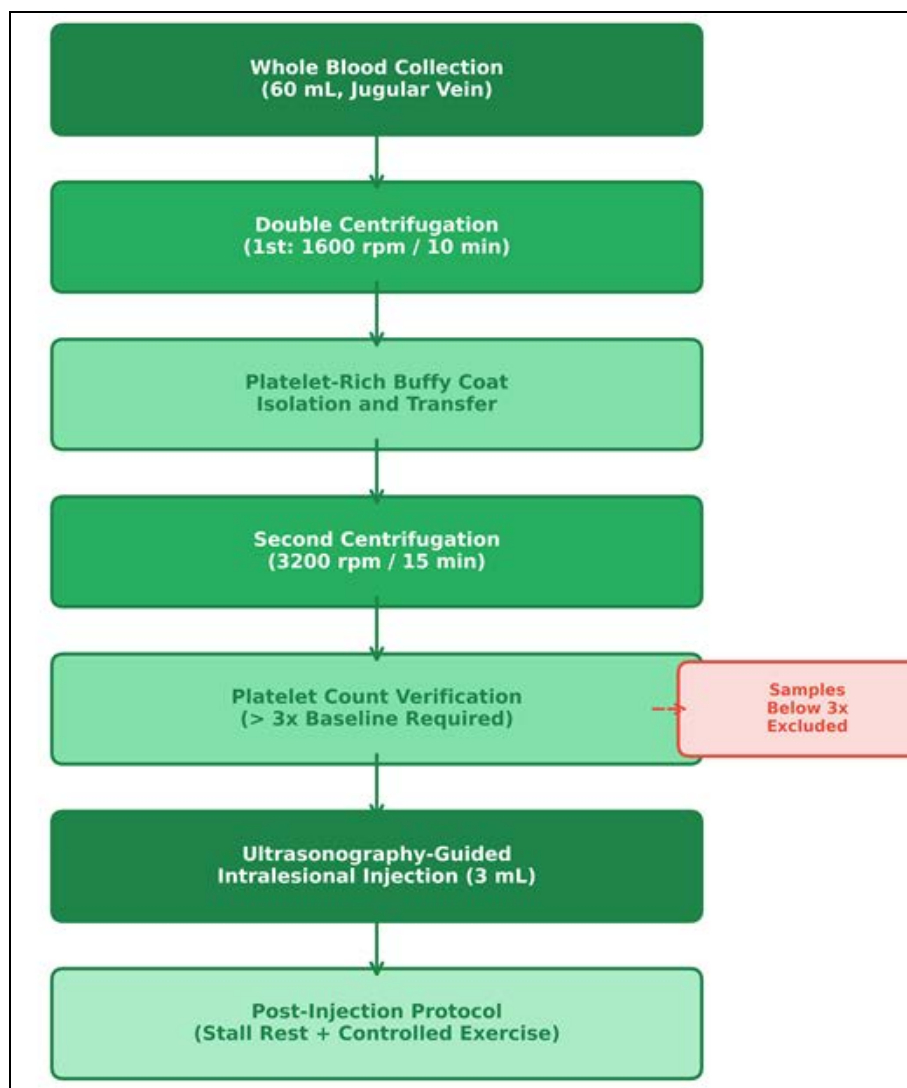


Fig 2: Step-by-step pathway for autologous platelet-rich plasma preparation and ultrasound-guided intralesional injection in sport horses

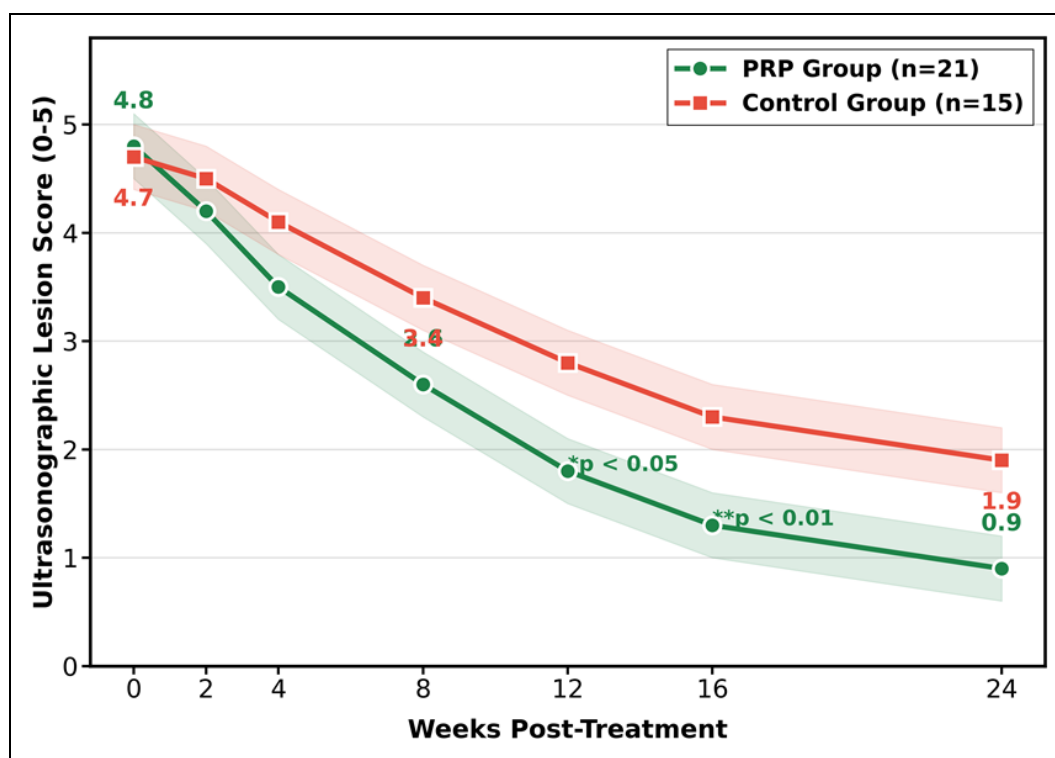


Fig 3: Mean ultrasonographic lesion scores (0-5 scale) over 24 weeks in PRP-treated and control sport horses with tendon injuries. Shaded bands represent ± 1 SD. Asterisks mark time points where inter-group differences were significant (* $p<0.05$; ** $p<0.01$)

Comprehensive Interpretation

The combined data present a consistent picture: PRP-treated horses healed faster on ultrasonographic assessment and returned to training at a higher rate than saline-treated controls. Separation between groups on the lesion score curve appeared at week 8 and widened progressively through week 24, suggesting that the growth-factor stimulus delivered by PRP accelerated the remodelling phase of tendon healing rather than merely dampening early inflammation. The absence of adverse reactions at any injection site across 21 treated horses reinforces the safety profile of autologous PRP under clinical conditions.

Discussion

The central finding of this research is that a single intralesional PRP injection, combined with a standardised rehabilitation programme, produced measurably better ultrasonographic healing and a higher return-to-training rate in sport horses with naturally occurring tendon injuries compared to saline injection plus the same exercise protocol. By week 24, treated horses averaged a lesion score of 0.9 while controls averaged 1.9 on the same 0–5 scale—a gap that emerged at week 8 and widened steadily over the remaining follow-up period.

These outcomes align with controlled experimental work. Bosch and colleagues reported improved tendon tissue organisation in surgically created SDFT lesions treated with PRP compared to saline in Dutch Warmblood horses, with ultrasound and histological improvements visible by 12 weeks^[9]. A more recent trial from Italy found that PRP-treated tendons showed significantly higher type I-to-type III collagen ratios on biopsy, pointing to better structural maturation^[11]. The direction and magnitude of improvement in the current research are broadly consistent with these reports, strengthening the argument that the benefit is biological rather than artefactual.

Not all published work agrees, however. A large retrospective analysis from the United Kingdom found no significant difference in re-injury rates between PRP-treated and conservatively managed racehorses over a three-year follow-up^[14]. That analysis, however, did not standardise the rehabilitation protocol across cases, and the PRP preparations varied widely in platelet concentration—some falling below the three-fold threshold considered necessary for a therapeutic effect^[6]. Differences in preparation method, injection timing relative to injury onset, and post-injection management can all blur the signal and may account for the discrepancy.

Several mechanisms may explain why PRP accelerated healing in the present cohort. The concentrated release of PDGF and TGF- β 1 at the lesion site is thought to recruit circulating mesenchymal progenitor cells and shift tenocyte gene expression toward a reparative phenotype^[7]. VEGF supports neovascularisation, which improves nutrient delivery to the hypovascular core of the tendon^[8]. These factors operate synergistically, and the double-centrifugation protocol used here—which achieved a mean 4.1-fold platelet increase—likely placed the growth-factor dose squarely within the therapeutic window. Whether multiple injections spaced over several weeks would further improve outcomes is an open question, as the current trial employed only a single dose.

From a broader standpoint, the 76.2% return-to-training rate in the PRP group carries direct relevance for equine athletes and their owners. In a sport horse worth tens or hundreds of thousands of dollars, a therapy that lifts the probability of

return to competition from roughly one in two to three in four could shift the cost–benefit calculation decisively in favour of treatment. That said, the small sample sizes within individual injury categories (e.g., only four horses with inferior check ligament injuries) limit the power to detect structure-specific effects, and longer follow-up is needed to determine whether the improved early healing translates into a lower re-injury rate over subsequent competitive seasons.

Clinical Implications

For practitioners managing tendon injuries in sport horses, the data here support integrating a single PRP injection into the standard rehabilitation protocol when the preparation method achieves at least a three-fold platelet concentration. The ultrasound-guided injection technique is straightforward, requires no specialised equipment beyond a centrifuge and ultrasound unit, and can be performed on farm. The therapy is autologous, eliminating concerns about immune rejection or disease transmission. Given the low risk profile and the measurable improvement seen here, PRP appears to be a practical and defensible treatment option, particularly for high-value sport horses where accelerated return to competition is desirable.

Conclusion

The main contribution of this research lies in providing controlled clinical evidence—rather than laboratory or anecdotal data—that platelet-rich plasma improves tendon healing in sport horses with naturally occurring injuries. By comparing a PRP-treated group against a saline-injected control group under an identical exercise programme, the trial isolated the biological effect of PRP from the confounding benefit of rest and rehabilitation alone.

Several lines of evidence support this conclusion. Ultrasonographic lesion scores separated significantly by week 8, and the gap widened through the 24-week endpoint, pointing to an effect on the remodelling phase of repair rather than a transient anti-inflammatory response. The return-to-training rate was 76.2% for PRP-treated horses versus 53.3% for controls, a difference that reached borderline significance despite the modest sample size. No adverse events were recorded, confirming the favourable safety profile expected of an autologous product. Platelet concentrations averaging 4.1 times baseline values suggest that the double-centrifugation preparation method delivered a biologically meaningful growth-factor dose.

Within the field of equine regenerative medicine, these findings carry practical weight. They suggest that a single, relatively low-cost PRP injection can meaningfully shift the probability of successful return to competition—an outcome that matters to owners, trainers, and insurers alike. The standardised protocol described here is reproducible in any equine clinic equipped with a centrifuge and an ultrasound unit, lowering the barrier to adoption.

Open questions remain. Whether a second injection at four or eight weeks post-injury would yield additional improvement has not been tested in a controlled setting. The trial did not include histological endpoints, so the claim of improved collagen organisation rests on ultrasonographic inference rather than direct tissue evidence. Long-term re-injury data—tracking these horses over two to three competitive seasons—would be the most persuasive test of whether PRP-driven healing truly restores tendon durability. And extending this trial design to a multicentre format with larger numbers would

sharpen the structure-specific sub-analyses that the current sample could not adequately power.

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Contributions Not Qualifying for Authorship

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