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BMC Complement Altern Med. 2016 Aug 18;16:293. doi: 10.1186/s12906-016-1261-3.

Effects of the pulsed electromagnetic field PST® on human tendon stem cells: a controlled laboratory study.

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Abstract

BACKGROUND:

Current clinical procedures for rotator cuff tears need to be improved, as a high rate of failure is still observed. Therefore, new approaches have been attempted to stimulate self-regeneration, including biophysical stimulation modalities, such as low-frequency pulsed electromagnetic fields, which are alternative and non-invasive methods that seem to produce satisfying therapeutic effects. While little is known about their mechanism of action, it has been speculated that they may act on resident stem cells. Thus, the purpose of this study was to evaluate the effects of a pulsed electromagnetic field (PST®) on human tendon stem cells (hTSCs) in order to elucidate the possible mechanism of the observed therapeutic effects.

METHODS:

hTSCs from the rotator cuff were isolated from tendon biopsies and cultured in vitro. Then, cells were exposed to a 1-h PST® treatment and compared to control untreated cells in terms of cell morphology, proliferation, viability, migration, and stem cell marker expression.

RESULTS:

Exposure of hTSCs to PST® did not cause any significant changes in proliferation, viability, migration, and morphology. Instead, while stem cell marker expression significantly decreased in control cells during cell culturing, PST®-treated cells did not have a significant reduction of the same markers.

CONCLUSIONS:

While PST® did not have significant effects on hTSCs proliferation, the treatment had beneficial effects on stem cell marker expression, as treated cells maintained a higher expression of these markers during culturing. These results support the notion that PST® treatment may increase the patient stem cell regenerative potential.

KEYWORDS:

Pulsed electromagnetic fields; Pulsed signal therapy; Rotator cuff; Tendon stem cells

PMID:
27538432
PMCID:
PMC4989537
DOI:
10.1186/s12906-016-1261-3
[PubMed - in process]
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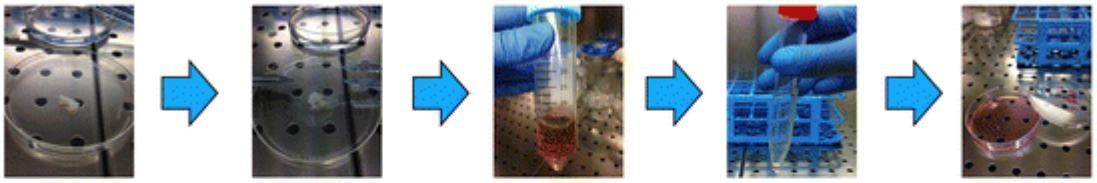
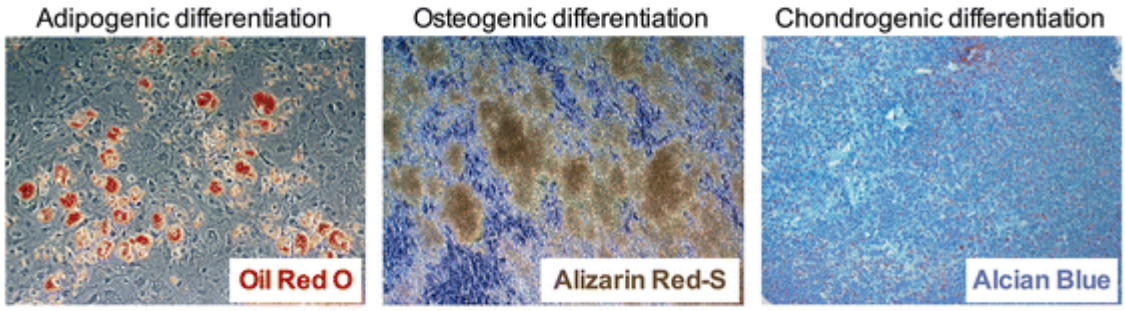
PST Pulsed Signal Therapy Technology

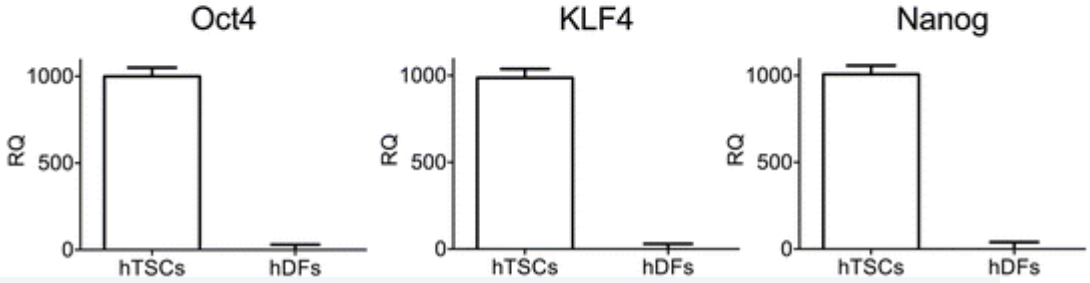
A hTSCs isolation procedure

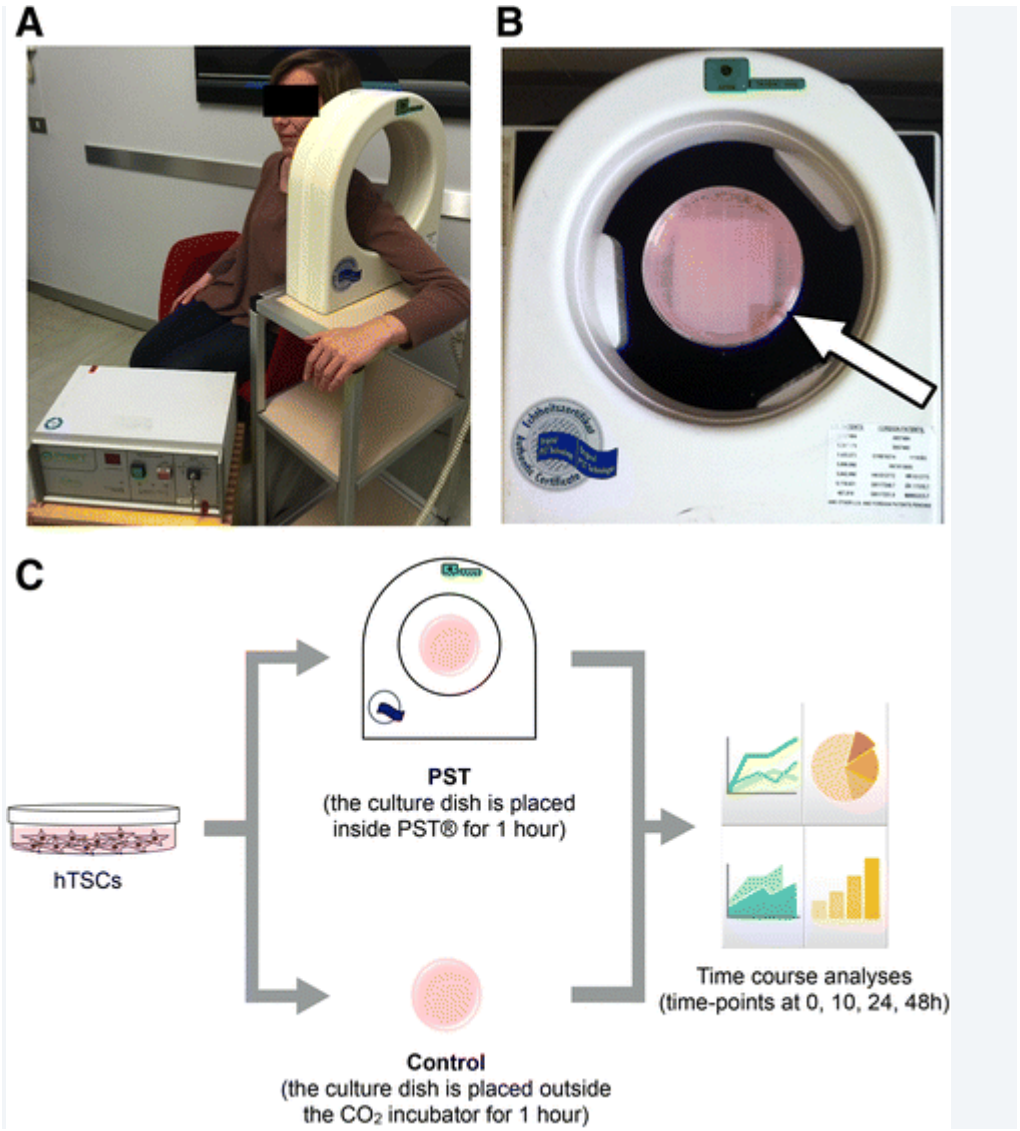


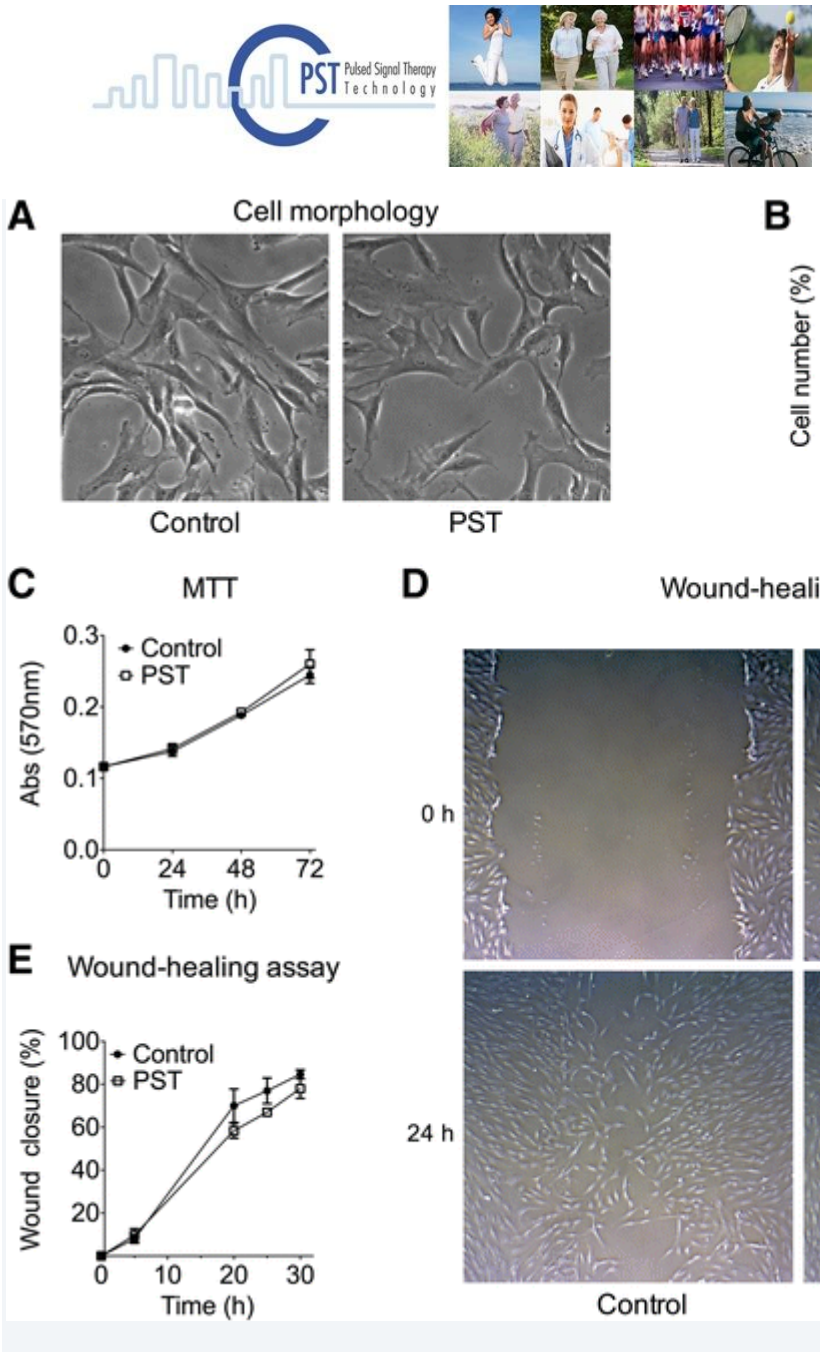
B hTSCs differentiation



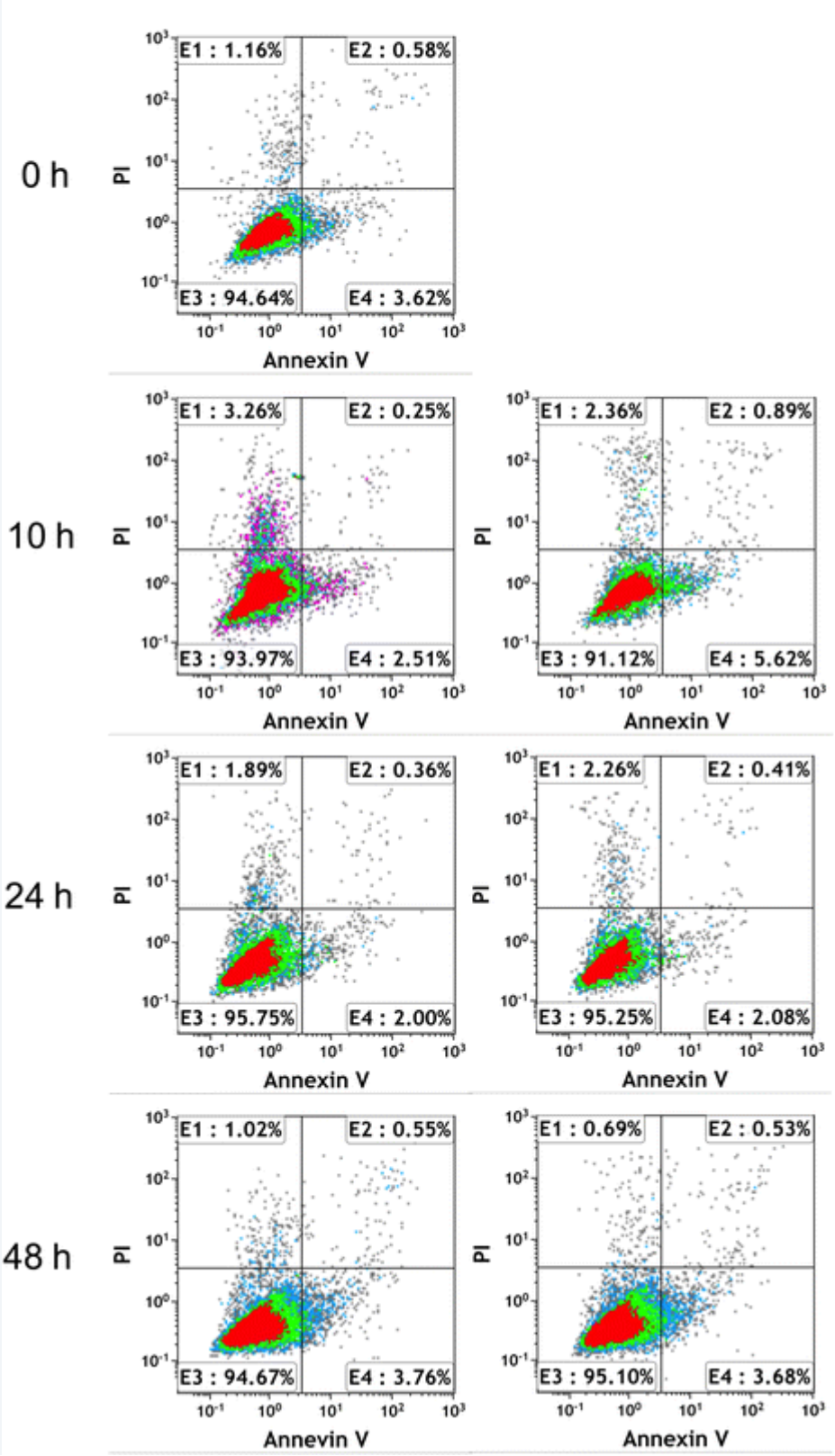
C Stem cell marker expression by Real-Time PCR

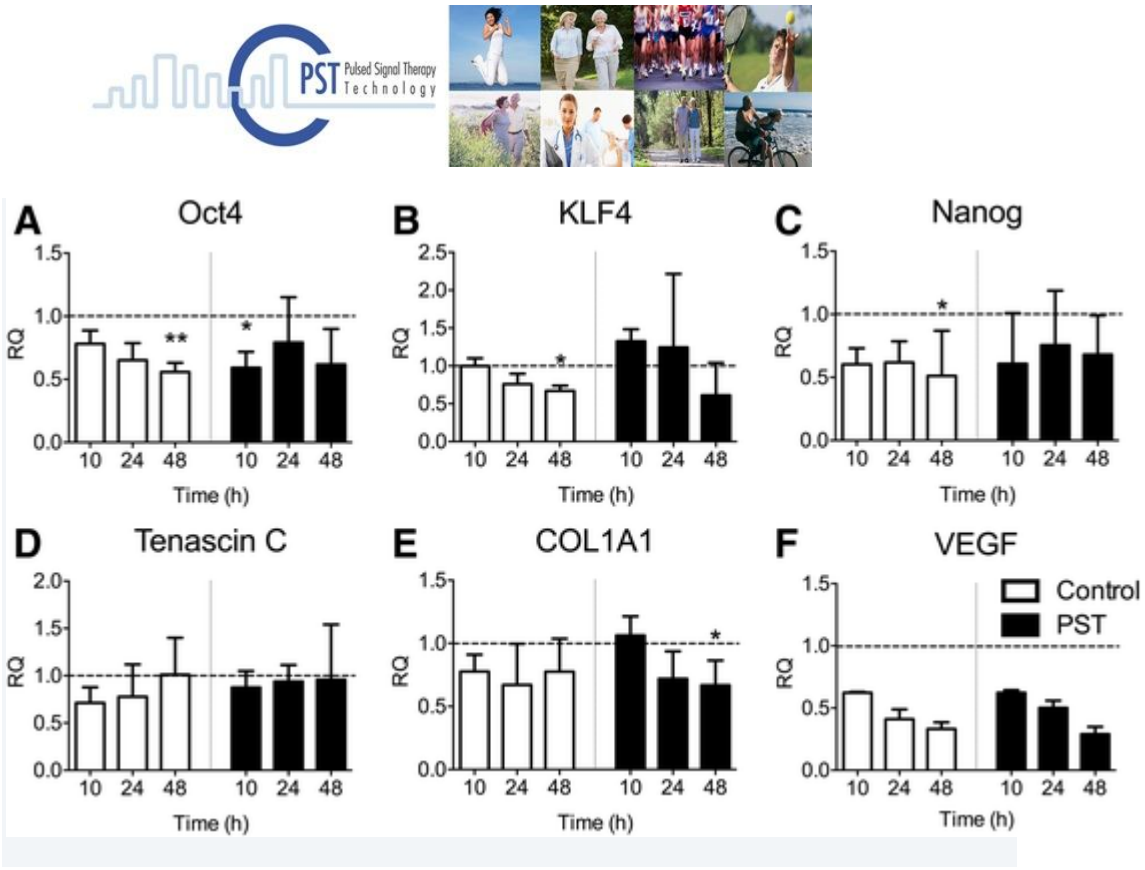



A
B
C
hTSCs
PST
(the culture dish is placed
inside PST® for 1 hour)
Control
(the culture dish is placed outside
the CO_2 incubator for 1 hour)
Time course analyses
(time-points at 0, 10, 24, 48h)


A
Cell morphology
Control
PST
B
Cell growth curve
Cell number (%)
500
400
300
200
100
0
Control
PST
0
12
24
36
48
Time (h)
C
MTT
Abs (570nm)
0.3
0.2
0.1
0.0
Control
PST
0
24
48
72
Time (h)
D
Wound-healing assay
0 h
24 h
Control
PST
E
Wound-healing assay
Wound closure (%)
100
80
60
40
20
Control
PST
0
10
20
30
Time (h)

Apoptosis/necrosis analyses with Annexin V-FITC and Propidium Iodide staining





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