Injury, Int. J. Care Injured 45 (2014) 970–973

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

The outcomes of peritendon tissue free-grafted on the tendon surface

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ARTICLE INFO

Article history:
Accepted 8 February 2014

Keywords:
Peritendon tissue
Free graft
Tendon
Histology

ABSTRACT

Objective: The objective of this study is to observe the gross and histological changes of free-grafted peritendon tissue.
Methods: The incisions were made in the bilateral Achilles tendon sites in six healthy rabbits weighing 2.0–2.5 kg. The peritendon tissue flaps of about 2.0 cm × 0.5 cm size were harvested and free-grafted into the contralateral donor sites. After 3 weeks, three animals were sacrificed, and after 6 weeks the remaining three animals were sacrificed. The peritendon tissue specimens were sampled for gross observation and histological observation.
Results: Gross observation after 3 weeks: the peritendon tissue became thick, there was tissue proliferation, and the deep surface was smooth. Histological observation after 3 weeks: inflammatory cells in the peritendon tissue were observed, many fibroblasts proliferated in the superficial surface, and some neovascularization was observed. Tissue growth could be seen in the suture site. Gross observation after 6 weeks: the peritendon tissue looked thick and the deep surface was smooth. Histological observation after 6 weeks: inflammatory cells in the peritendon tissue were significantly reduced and there were still more fibroblasts in the tissues. Neovascularization was obvious and the suture site was firmly healed. No signs of necrosis were found at the two time points, and the structure of the free-grafted peritendon tissue was almost the same as the structure of the peripheral tissue.
Conclusion: The peritendon tissue can survive well after being free-grafted into the tendon surface and the structure shows no obvious changes.

Restoration of digital function after flexor tendon injuries remains a clinical challenge and decreasing postoperative flexor tendon adhesions is one of those challenges. The goals of flexor tendon repair are to promote intrinsic tendon healing and minimize extrinsic scarring in order to optimize tendon gliding and range of motion [1–4]. Using a variety of barrier materials to prevent extrinsic scarring is the research focus in this field. However, currently, there is no material that can fully meet the clinical requirements. The peritendon tissue transplantation has a role to play in preventing postoperative tendon adhesions because of the following advantages: it uses autologous materials, causes no immune rejection, has a similar structure, and is available adequately and easily. In the clinical setting, some scholars used peritendon tissue transplantation of the palmaris longus to prevent postoperative adhesions of flexor tendon ruptures and achieved some positive results [5,6]. However, the outcome of the grafted peritendon tissue was rarely reported. In this experiment, the gross and histological changes of the grafted peritendon tissue were observed in rabbits, which provide evidence and theoretical support for the application of the peritendon tissue graft.

Materials and methods

Materials

Six healthy adult white rabbits weighing 2.0–2.5 kg and of either gender were provided by the Experimental Animal Center of Dalian University. All protocols were conducted in accordance with the *Guidance Suggestions for the Care and Use of Laboratory Animals* formulated by the Ministry of Science and Technology of China [7].

Animal model and grouping

After being fed adaptively for 1 week, the animals were anesthetized with 10% chloral hydrate (3 ml/kg) by intraperitoneal injection. The anesthetized animals were fixed on the operating

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http://dx.doi.org/10.1016/j.injury.2014.02.019
0020–1383/

table in the prone position, and the conventional surgery area was shaved, disinfected, and covered with a sterile cloth. Longitudinal incisions of about 3.0 cm size in the bilateral Achilles tendon sites were made and the peritendon tissue of the Achilles tendon was exposed. The bilateral peritendon tissue flaps of about 2.0 cm × 0.5 cm size were harvested and cross-grafted into the contralateral donor site (Fig. 1). After hemostasis, the incisions were sutured. Postoperative animals were caged singly and fed ad libitum. Penicillin (800,000 IU) was intramuscularly injected for 3 successive days to prevent infection. The animals were randomly divided into 3-week group and 6-week group in accordance with the sampling time.

Outcome measures

After 3 weeks, three animals were sacrificed, and after 6 weeks the remaining three animals were sacrificed. Gross observation was carried out. The peritendon tissue specimens were sampled for histopathological observation with haematoxylin and eosin staining.

Results

General situations of the postoperative animals

All the rabbits regained consciousness in 1–2 h and all rabbits survived, exhibiting normal eating habits and activities. The incisions healed 7–10 days after surgery and no infections occurred.

Gross observation

Three weeks postoperatively, the free-grafted peritendon tissues thickened. No obvious signs of degeneration and necrosis were found and the peritendon tissue survived well. The deep surface was smooth and there were tissue connections between the transplanted peritendon tissues and the surrounding tissues (Fig. 2). Six weeks postoperatively, the transplanted peritendon tissues thickened and no signs of degeneration and necrosis were found. The deep surface was smooth and there was firm healing between the peritendon tissues and the peripheral tissues (Fig. 3).

Histological observation

Three weeks after operation, there was accumulation of inflammatory cells in the transplanted peritendon tissue. Many fibroblasts and some neovascularization in the peritendon tissues were observed, and the tissue connections between the transplanted peritendon tissues and the surrounding tissues could be seen. The structures of the transplanted peritendon tissues were basically the same as the structures of the surrounding host tissue (Figs. 4 and 5). Six weeks after the operation, inflammatory cells were significantly reduced around the transplanted peritendon tissues. There were still many fibroblasts and fibrous tissues in the superficial surface of the peritendon tissues and neovascularization could be seen. There was firm healing between the peritendon tissues and the peripheral tissues and the structures of the peritendon tissues and the peripheral tissues were basically the same (Figs. 6 and 7). There were no obvious signs of necrosis of the transplanted peritendon tissues at the two time points.

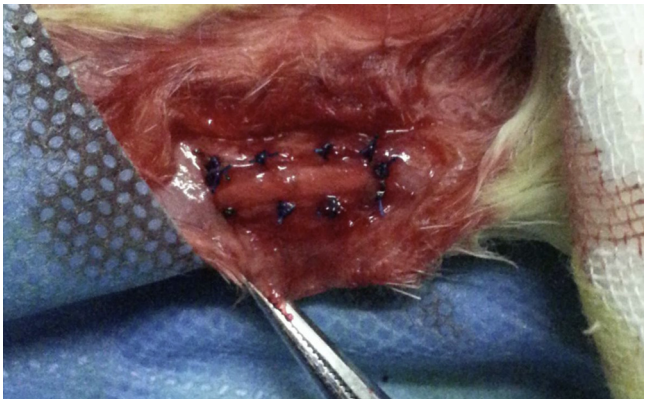

Fig. 1. The bilateral peritendon tissue flaps of about 2.0 cm× 0.5 cm size were harvested and were cross-grafted into the contralateral donor site.

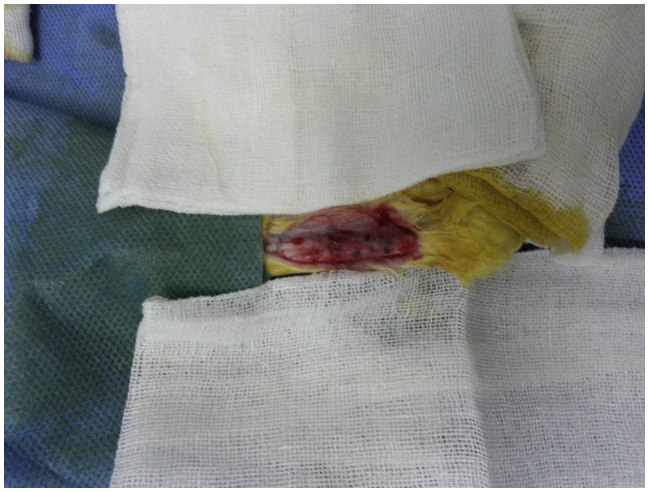

Fig. 2. Three weeks postoperatively, the free-grafted peritendon tissues survived well. No signs of degeneration and necrosis were found. There were tissue connections between the transplanted peritendon tissues and surrounding tissues.

Discussion

During extrinsic scarring, tendon adhesions can easily form after tendon rupture repair and this affects the restoration of finger function. Among the tendon injuries, the treatment and rehabilitation of the zone II flexor tendon injury is the most difficult. In the field of prevention of postoperative tendon adhesion, the variety of methods employed to obstruct the extrinsic pathway has always

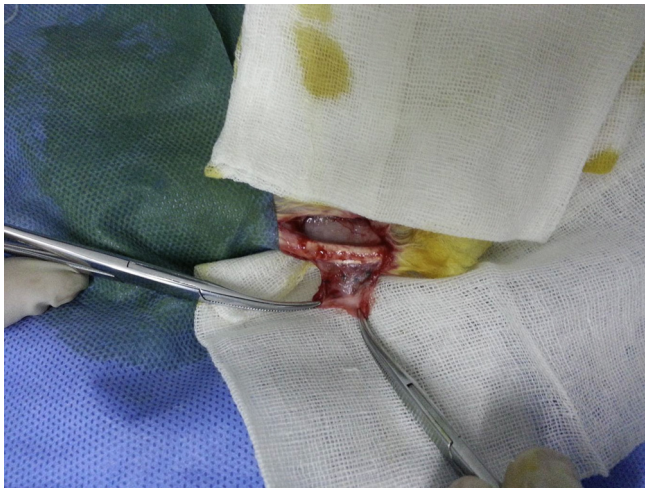

Fig. 3. Six weeks postoperatively, the transplanted peritendon tissues thickened. No signs of degeneration and necrosis were found. The deep surface was smooth. There was firm healing between the peritendon tissues and the peripheral tissues.