

RESEARCH ARTICLE

Effects of Non-Steroidal Anti-Inflammatory Drugs on Flexor Tendon Rehabilitation after Repair

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Received: 10 July 2013

Accepted: 26 September 2013

Abstract

Background: Peritendinous adhesions after repairing an injury to the digital flexor tendons are a major problem in hand surgery. Non-steroidal anti-inflammatory drug therapy may affect tendon healing and the development of peritendinous adhesions. The aim of this study was to evaluate ibuprofen effect in patients function after flexor tendon surgical repair.

Method: Thirty-five patients, who had sharp-edge lacerations of hand-zone II requiring flexor tendons repair, participated in this randomized double-blind clinical trial study. The patients were randomly classified into two parallel and matched groups (21 patients in the intervention group and 14 patients in the control group). The groups were matched considering age, gender, and laceration size. The control group received a placebo with the same appearance and dosage. In the intervention group, ibuprofen was prescribed at a high dosage (2400 mg/day). The range of motion improvement rate of the involved fingers and the patients' performance after their follow-up period were compared.

Results: There was a statistically significant difference between the two groups for range of motion of the involved finger joints ($P=0.03$). According to the DASH score, there was a statistically significant difference between the final performance of the patients, such that it was 11 ± 2.4 and 18.4 ± 6.3 in the intervention and control groups, respectively ($P=0.01$). There was not any case of re-tear or need to re-operate in the intervention and control groups.

Conclusion: Our findings reveal that ibuprofen with an anti-inflammatory dose was effective in improving the range of motion of the involved fingers joints after flexor tendon injury.

Key words: Flexor tendon, Adhesions, Non-Steroidal Anti-Inflammatory drugs, NSAIDs, Hand surgery, Tendon repair

Introduction

The hand is a organ of the exclusive and elegance (1). The most common complications after flexor tendon repair are rupture, joint contracture, and tendon adhesion. flexor tendon healing are complications to soft tissue adhesions to the surrounding sheath (2). Adhesions between the tendon and sheath impair the gliding mechanism of the tendons and result in poor finger range of motion (ROM) (1,2). Nonsteroidal anti-inflammatory drugs (NSAIDs) are common analgesics used to treat the swelling and pain (3). NSAIDs inhibit cyclooxygenase activity so it reduces proinflammatory prostaglandin production and hyperalgesia (3). Ibuprofen is one of the most common NSAIDs used in patients to pain control (4). It is a potent cyclooxygenase inhibitor known to reduce the production of arachidonic acid metabolites (4). Ibuprofen also has been shown to improve several aspects of wound healing ranging from wound edema to adhesion formation to vas-

cular obstruction (4). The aim of this study was to evaluate the effect of NSAIDs, especially ibuprofen, on flexor tendon rehabilitation in patients who underwent flexor tendon repair.

Materials and Methods

In this double-blind clinical trial study that took place in our teaching trauma center, 35 patients with acute laceration in the volar aspect of the hand (zone 2) with flexor tendon injury according to physical examination and surgical exploration were selected. Those meeting the inclusion criteria were invited to participate in our study and they were given an informed consent form, which they signed. The excluded patients were those with a history of previous volar hand injury or laceration, previous flexor tendon disorder, patients under 18 years old and patients with a systemic disease like cardiopulmonary, diabetes, renal disease or malignancy and rhomatoid arthritis. Pa-

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tients were blindly divided into two groups and matched together according to sex, age and size or shape of laceration. Lesions were selected with a sharp edge without crush. All lesions were in volar part of the hand in zone 2. In the intervention group patients received ibuprofen with a high dose (2400 mg/day) for a month, and were compared to the control group, who only received a placebo (Zahravi Pharmacy, Tabriz, Iran).

All patients were operated on by senior author using a single technique (standard modified Strickland four strand technique with a running lock suture).

Patients range of motion was evaluated 4 and 12 weeks after operation. At the end of the follow up, both groups were evaluated with DASH score questionnaire.

Written informed consent was obtained from all of the patients. The Ethics Committee of the Tabriz Medical University approved the study. This study was registered with IRCT201301189857N2 in the Iranian Registry of Clinical Trials (IRCT).

Statistical analysis

The data are shown as Mean±SD. The repeat measure test was used to compare the range of motion change between the groups at follow up. Chi-square and Fisher's exact tests were used to determine statistical difference in qualitative variables. *P* value less than 0.05 was considered statistically significant. SPSS software (SPSS Inc., Chicago, IL) version 16.0 was used for data collection and analysis.

Results

The study was conducted on 35 patients with a mean age of 35.3±11.8, who also participated in the follow up program. The patients consisted 10 (28.5%) females and 25 (71.4%) males. Demographic findings of the patients are summarized in Table 1.

There was not any statistically significant difference between the two groups considering age, gender, and digital nerve injury. However, range of motion measurement indicated a statistically significant difference between the two

Table 1. Demographic findings between two case and control groups

variable	Intervention group	Control Group	<i>P</i> Value
	N=21	N=14	
Sex (M/F)	16:5	9:5	0.5
Age	33.4±12.5	34.2±11.2	0.8
Right Hand	13(61.9%)	10(71.4%)	0.4
Left Hand	8 (38.1%)	4(28.6%)	

groups (*P*=0.03), such that wide range of motion was seen in the intervention group. There was not any side effect resulting from ibuprofen. Evaluating patients' function three months after follow-up period indicted to statistically significant difference between two groups based on DASH score (*P*=0.01). Table 2 demonstrates the mean range of motions and DASH score.

Discussion

The effects of NSAIDs on soft tissue healing are poorly

Table 2. Comparison of clinical findings between the case and control groups

variable	Intervention group	Control Group	<i>P</i> Value
	N=21	N=14	
TAM after 4 weeks	151.9±7.6	140.6±5.5	0.03*
TAM after 12 weeks	164.7±6.9	156.5±6.4	
Flexion contracture	16.2±2.3	28.2±1.3	0.02*
DASH score	11±2.4	18.4±6.3	0.01*

TAM: (active PIP flexion + active DIP flexion) – (flexion contracture at PIP - DIP)

understood (2). Alexander et al. found a significant reduction in rat burn wound edema with ibuprofen therapy (5). Decreased wound edema and decreased production of inflammatory mediators would presumably improve wound healing (4,5). Thus, the important role of ibuprofen in the wound healing process is reducing edema and reducing inflammatory mediators (4,5). Nonsteroidal anti-inflammatory drugs (NSAIDs) is one of the most important classes of drugs that can play a key role in inflammatory diseases (4). The formation of adhesions is an area of concern to all surgeons. In an animal study by Tan et al., ibuprofen has been shown to have a more important effect in limiting adhesion formation compared with rofecoxib after flexor tendon repair (3). Because ibuprofen inhibits both COX-1 and COX-2, whereas rofecoxib only inhibits COX-2, they suggest that ibuprofen therapy appears to offer a greater beneficial effect on tendon repair by reducing formation of adhesions (3). Another animal study has shown that dexamethasone and ibuprofen were equally effective inhibitors of the formation of significant adhesions after fallopian tube injury in rabbits (6-9). Kulick et al. showed in animal models that orally administered ibuprofen increased the gliding mechanism of flexor tendon after surgical repair (10). Our study is the first study of its kind to be performed on humans. Because there is not a similar human study, we are not able to compare our results. In this study, we tried treatment groups that were same in terms of affected variables as much as possible to achieve maximum reliability. According to our findings, the administration of high-dose ibuprofen with anti-inflammatory effects had a significant effect on range of motion improvement after operation and flexor tendon repair. Our results are in agreement with the findings of other studies in animal models. Also, no adverse reactions to the medication were observed. Another study showed that the animals treated with indomethacin had a greater tendon excursion and angular rotation of the joint than the control animals, implying a suppression of adhesions (11). It seems that non-steroidal anti-inflammatory drugs play an important role in improving flexor tendon function after repair. Studies in animal models also con-

firmed our findings.

According to findings of the present study, ibuprofen positively affects the flexor tendons repair process of hand-zone II and improvement of performance of range of motion of the involved fingers joints. Also, it plays an important role in the improvement of function and clinical outcomes of the patients following flexor tendon repair.

Acknowledgments

The authors would like to thank the Tabriz University of Medical Sciences for financially supporting this study.

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References

1. Strickland JW. Flexor tendons acute injuries. In: Green DP, Pederson WC, Hotchkiss RN, Wolfe SW. Operative Hand Surgery. 5 th ed. Philadelphia: Elsevier. 2005: 1875-7.
2. Schumacher H H, James NK. Flucloxacillin Reduces Stiffness Following Flexor Tendon Repair. *HAND*. 2008; 3:337-9.
3. Tan V, Nourbakhsh A, Capo J, Cottrell JA, Meyenhofer M, O'Connor JP. Effects of Nonsteroidal Anti-Inflammatory Drugs on Flexor Tendon Adhesion. *J Hand Surg Am*. 2010; 35(6):941-7.
4. Rockwell WB, Ehrlich HP. Ibuprofen in Acute-Care Therapy. *Ann Surg*. 1990; 34(5):45-50.
5. Alexander F, Mathieson M, Teoh KH, Huavl WV, LelcukS, Valeri CR, et al. Arachidonic acid metabolites mediate early burn edema. *J Trauma*. 1984; 24:709-12.
6. Siegler AM, Kontopoulos V, Wang CF. Prevention of postoperative adhesions in rabbits with ibuprofen, a nonsteroidal anti-inflammatory agent. *FertilSteril*. 1980; 34:46-9.
7. Nishimura K, Nakamura RM, Dizerega GS. Ibuprofen inhibition of post-surgical adhesion formation, a time and dose response biochemical evaluation in rabbits. *J Surg Res*. 1984; 36:115-24.
8. De Leon FD, Odom J, Hudkins P, Vijayakumar R, Heine MW. Orally and parenterally administered ibuprofen for postoperative adhesion prevention. *J Reprod Med*. 1986; 31:1014-6.
9. O'Brien WF, Drake TS, Bibro MC. Use of ibuprofen and dexamethasone in the prevention of postoperative adhesion formation. *Obstet Gynecol*. 1982; 60: 373-8.
10. Kulick MI, Smith S, Hadler K. Oral ibuprofen: evaluation of its effect on peritendinous adhesions and the breaking strength of a tenorrhaphy. *J Hand Surg Am*. 1986; 11(1): 110-20.
11. Szabo RM, Younger E. Effects of indomethacin on adhesion formation after repair of zone II tendon lacerations in the rabbit. *J Hand Surg Am*. 1990; 15(3): 480-3.