

Preservation of the ulnar periosteum during ulnar shortening procedure: A comparison with conventional techniques

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Introduction

Ulnar shortening osteotomy (USO) is a widely accepted procedure for triangular fibrocartilage complex (TFCC) tear and ulnocarpal abutment syndrome. USO yields good outcomes; however, non-union or delayed union remains one of the complications. Except for bone union rate, transverse osteotomy is relatively easy for surgeons to perform without any operative failures. Therefore, an additional method, which involves a transverse cut as a resolution for non-union or delayed union, has been looked into.

The periosteum is a fibrous membrane around the bone, containing osteogenic cells and vessels that promote bone healing. Thus, we adopted a method of preserving the periosteum as a "tube" and restoring it on the osteotomy site after osteotomy. The purpose of this study was to assess the effects of preserving the periosteum on bone healing after USO.

Subjects and Methods

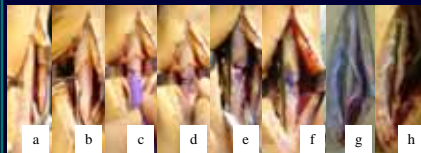
Subjects

- 85 patients (90 wrists) were treated by USO at our hospital between 2003 and 2009.
- Right-left: 50/40 wrists (5 bilateral cases)
- Sex (male/female): 56/29
- Age: 15-73 years (mean, 41.3 years)
- Follow-up period: 276-2755 days (mean, 1184 days)
- Patient categories:

- 1) Group A: 45 wrists, treated using a conventional method
- 2) Group B: 45 wrists, treated using the newly introduced method of preserving the periosteum

Operation

- The shortening length was decided to be ulnar null variance for the ulnocarpal abutment syndrome and 3 mm for the isolated TFCC tear of the null variance for both groups.
- The newly introduced method is as follows (Fig. 1):



- Longitudinal excision of the periosteum (Pe) approximately 15mm.
- Stripping Pe around with marginal continuity
- Marking the 2 osteotomy lines and etching for correct rotational alignment
- Clamping a plate on the Pe
- Fitting the plate in compression mode
- Overlapping the Pe all over the ulna

Fig. 1 The newly introduced method of preserving the periosteum in group B.

- Indication: TFCC tears detected using arthrography, magnetic resonance imaging, arthroscopy and positive results of physical test, such as TFCC stress test and TFCC tenderness test.
- Preoperative chief complaints: Pain in the ulnar aspect of the wrist on resting or during motion, and limitation of pronation and supination range in some wrists.

Evaluation

- (i) Bone healing time and (ii) pattern were evaluated every month after the operation by using radiography.

Results

i) Bone healing time

- Group A indicated 4 non-union cases (Fig. 2-1).
- Mean bone healing time: group A, 179.0 days (60-481 days); group B, 149.5 days (29-402 days); $p = 0.12$ (Fig. 2-2).

ii) Bone healing pattern

- Wrists were classified based on callus formation and bone absorption:
 - Type 1: (1-1) No callus formation; (1-2) no callus formation, with slight bone absorption
 - Type 2: Some callus formation
 - Type 3: (3-1) Obvious bone absorption at the osteotomy site; (3-2) non-union cases (Fig. 3-1).
- The distribution of wrist types 1, 2, and 3 in each group is shown in Fig. 3-2.
- The incidence of type 1 wrists was significantly higher in group B than in group A ($p = 0.01$; χ^2 test).

Case	Disease	Age (yr)	Sex	Plate hole	Background
1	TFCC tear	69	F	4	None
2	UCAS	69	F	5	None
3	TFCC tear	73	F	5	None
4	TFCC tear	53	M	5	Heavy smoker

TFCC, triangular fibrocartilage complex; UCAS, ulnocarpal abutment syndrome

Fig. 2-1 Non-union cases in group A

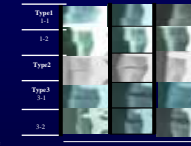


Fig. 3-1 Bone healing pattern observed in groups A and B

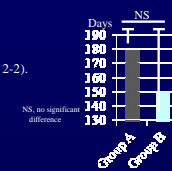


Fig. 2-1 Bone healing time in groups A and B

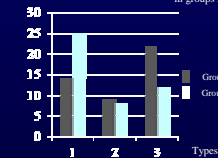


Fig. 3-2 The distribution of wrist types (types 1, 2, and 3) in each group

Discussion

According to the literature, the non-union rate in USO is 4.3-15%.^{1,3} Development of oblique or step-cut osteotomy has decreased the number of non-union cases; however, these techniques are technically demanding. In this study, the non-union rate improved from 8.9% (4/45) to 0% (0/45) because of the introduction of a method for preserving the periosteum at the osteotomy site. Type 1 wrists, which were more observed in the group B than in group A, seemed to undergo direct bone healing. Osteoprogenitor cells and vessels are inherent in the periosteum. They promote the direct bone healing pattern, resulting in the shortening of bone healing time and prevention of non-union. Of the non-union cases included in this study, patients 1-3 were relatively older and patient 4 was a heavy smoker, this might have adversely affected the outcome.

Conclusions

Preserving the periosteum during USO is recommended because it effectively prevents the complication of non-union after USO; moreover, it is not technically demanding and does not need specific devices.

References

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