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# Bone lengthening of the radius with temporary external fixation of the wrist for mild radial club hand

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## KEYWORDS

Bone lengthening;  
External fixation;  
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Healing index

**Summary** *Background:* We report the utility of a surgical approach to treat mild (Bayne type I or II) radial club hand with a combination of radial bone lengthening and temporary external fixation between the ulna and the metacarpals.

*Methods:* We evaluated five radial club hands that received a new procedure involving radius lengthening with external fixation to support the radial side of the wrist. The evaluation included an assessment of radial deficiency deformity recurrence from the anteroposterior radiographs and a measurement of the passive range of wrist motion with the use of a goniometer before surgery and at the time of the final follow-up. We recorded complications such as infection and nerve palsy.

*Results:* The healing index of the radius was from 72.2 to 298.9 day/cm (mean, 176.8 day/cm). The mean radial/ulnar deviation was 84.0/−14.0° before surgery and 37.0/13.0° at the time of the final follow-up. No correction loss was detected during the follow-up. All patients were able to hold and bring an object to the mouth after surgery. No patient had a postoperative infection and there were no cases of nerve palsy.

*Conclusions:* All cases demonstrated a better range of motion despite a poor healing index in the present series. Our novel technique can be performed for cases with mild radial deficiency and with mild radius deficiency including growth plate injuries.

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## Introduction

The goals in the treatment of radial deficiency are to correct the wrist deformity, to maintain the corrected position, to provide wrist-like mobility, and to preserve the maximal forearm longitudinal growth capacity as well as to achieve an acceptable cosmetic result.<sup>1</sup> However, it is difficult to acquire alignment as well as mobility. Matsuno et al. developed a new approach with a combination of radius bone lengthening and soft-tissue traction between the ulna and third metacarpal.<sup>2</sup> This device distracted the ulnar side of the wrist, although it is important to distract soft tissue at the radial side of the wrist for radial deficiency. In fact, severe radial deviation of the wrist recurred with this procedure.<sup>2</sup>

To solve the recurrence, we first applied soft-tissue release at the radial side of the wrist for mild (Bayne type I, short distal radius, or II, hypoplastic radius<sup>3</sup>) radial deficiency, because the radius in severe cases of radial deficiency (Bayne III, partial absence of the radius, or IV, total absence) cannot be attached to the external fixator to extend the bone. After that, we applied an approach of treating with a combination of radius bone lengthening and temporary external fixation between the ulna and the metacarpals to support the radial side of the wrist and avoid the loss of correction.

## Materials and methods

### Patients

Five radial deficiencies were treated with radius lengthening and external fixation to support the radial side of the wrist. All hands were Bayne type I (short distal radius) or II (hypoplastic radius). No cases demonstrated limited range of elbow motions. The age range of the patients at the time of operation was from 21 to 59 months (mean, 36.0 months). There were three boys and two girls included in the series. Two patients had TAR (thrombocytopenia with absent radius) syndrome and useful thumbs were present. Pollicization was performed for an absent thumb in two cases 1 year after the wrist procedure. The follow-up period was from 25 to 55 months (mean, 38.4 months). Four affected hands were classified as type II and one as type I in the categories defined by Bayne<sup>3</sup> (Table 1). The institutional review board at our institute approved the study.

### Surgical procedure

The procedure was performed under general anesthesia by senior surgeons who had been practicing at least 10 years and were highly experienced with the treatment of congenital anomalies. An arm tourniquet was applied during the procedure and deflated before closure for improved visualization.

A zigzag incision was made along the radial side of the wrist (Figure 1). Care was taken to avoid damage to the sensory branches of the radial nerve (Figure 2).

Table 1 Data on the patients.

Case	Bayne's classification	Gender	Affected side	Age at the time of operation (months)	Follow-up period (months)	Pre		Post		Extended length of the radius (mm)	External fixator duration (days)	Healing index (day/cm)
						Radial deviation	Ulnar deviation	Radial deviation	Ulnar deviation			
Case 1	I	M	R	21	44	40	20	70	0	5.1	72	142.0
Case 2	II	F	R	37	55	60	0	90	-10	5.3	134	252.8
Case 3	II	F	R	22	37	30	30	110	-10	16.8	198	118.2
Case 4	II	M	L	59	25	40	0	80	-40	15.2	110	72.2
Case 5	II	M	R	41	31	15	15	70	-10	5.6	168	298.9
Mean				36.0	38.4	37.0	13.0	84.0	-14.0	9.6	136.4	176.8

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