



## Prevention of re-fractures of both bones of the forearm in children

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**Purpose :** The aim of this study was to observe if the re-fracture rate after forearm both bones was decreased by protecting the forearm with a preventive brace for 6 months following the fracture and by ceasing all physical activities.

**Methods :** We performed a retrospective study in 75 consecutive cases of diaphyseal fracture of both bone of forearms, in 52 boys and 23 girls aged from 6 months to 11 years. It concerned a first episode of fracture in 84% of cases and a re-fracture in 17%.

**Results :** Re-fracture rate was 0% in the group where a protective brace was worn while it was 20% in the group without brace.

**Conclusions :** Both the wearing of a protective brace and absence of sport for 6 months may decrease the re-fracture rate to 0%, if the patient is compliant by wearing it and by ceasing all physical activities.

**Keywords :** forearm, re-fracture, children, elastic nailing, protective brace.

are generally treated by casting. Change in physical activities and sport in children have increased its incidence throughout the years (3). There is however a high risk of re-fracture on the same location (8,4), the first post traumatic year, related to greenstick-type fracture, residual angular deformity, younger ages and shorter periods of casting.

The aim of this study was to test if the wearing of a protective brace for 6 months following the fracture could decrease the rate of re-fractures (Figure 1).

### PATIENTS AND METHODS

We retrospectively studied 75 cases of diaphyseal fractures of the 2 bones of the forearm in children, between 2009 and 2014, using the full database available at our institution, with a minimal 1 year clinic and radiologic follow up. It concerned

### INTRODUCTION

Fast and good fracture healing is generally encountered in pediatric traumatology (10) with rare re-fractures. Diaphysis fractures of both bones of the forearm are an exception with 4-26% of re-fractures in the 6 months following the fracture (1-4,9). Diaphyseal fractures of the 2 bones in the forearm in children represent about 5% of fractures (6,7) and

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**Fig. 1.** — Typical fracture of both bones

52 boys and 23 girls, aged between 6 months and 11 years old, with an average age of 8.8 years. Of the 63 primary fractures (Table I), 6 were non-displaced fractures, and were immobilized without reduction for 8 weeks with a long arm cast for 4 weeks and a short arm cast for 4 additional weeks. For 3 patients, a surgical treatment by ESIN was directly applied due to important displacement and instability. For 54 patients, treatment consisted of fracture reduction under fluoroscopy followed by 8-week

cast immobilization (5 weeks of long arm- and 3 weeks of short arm cast). Out of these 54 patients, 2 needed secondary ESIN due to secondary displacement. The patients treated by ESIN were not immobilized by a cast. After the 8 first weeks, all patients received a removable custom-made brace, and stopped physical activity for 6 months except the patients treated by ESIN.

Of the 12 recurred fractures, 11 cases were treated by fracture reduction and cast immobilization but 5 of these needed ESIN for secondary displacement. One patient was directly treated by ESIN. Final assessment was performed both clinically and radiologically. Clinical evaluation assessed mobility (pronation or supination) at latest follow-up. A loss of more than 5° of pronation or supination compared with the opposite side was considered ab-normal. Radiological assessment evaluated remaining angulation. Any remaining diaphyseal angulation more than 5° was considered as abnormal. During the healing period of the fracture, occurrence of secondary displacement was noticed. The number of radiographs carried out within a period of 6 months of follow-up was also noted. A protective brace was worn by 70 children of the series while it was not by 5. Occurrence of re-fracture during the one-year period following the fracture was evaluated. There was also an interest in analyzing the 12 initial cases of re-fractures. We had to check if they had been protected by a brace at the time of the re-fracture, measured the initial and residual angulation of the fracture, measured the time frame between the first and second fracture. Moreover, we tried to define whether the initial fracture was complete or a "Greenstick", as it could be in relation to a higher rate of re-fractures.

Statistical analysis was performed with IBM SPSS version 20. Testing of normality of the data samples was performed by using Kolmogorov-Smirnov non parametric test. For the numerical parameters, comparison of means between the groups was performed with ANOVA and Bonferroni tests. For the categorical data, comparison was performed by using Chi-Square test. P-value less than 0.05 was considered as significant. Agreement was obtained from the local ethical committee of the institution (registration number NCT02355301;2015/26JAN/025).

Table I. — Types of treatment for first and recurred fractures

	Orthopedic treatment without reduction	Orthopedic treatment with reduction (and number of secondary displacement needing ESIN)	Immediate surgical treatment by ESIN	Total
First fracture	6	54 (2)	3	63
Recurred fracture	0	11 (5)	1	12
Total	6	65	4	75

Table II. — Analysis of the 12 re-fracture cases

Patient	Type of initial fracture	Residual angulation before re-fracture(degrees)	Delay before re-fracture(months)	Type of re-fracture	Brace wearing before re-fracture
1	greenstick	12	3	complete	no
2	greenstick	8	4	complete	no
3	complete	10	1	complete	no
4	greenstick	13	24	greenstick	no
5	complete	8	2	complete	no
6	complete	3	18	complete	no
7	greenstick	2	3	greenstick	no
8	complete	23	1	complete	no
9	greenstick	9	4	greenstick	no
10	complete	10	3	complete	no
11	complete	2	6	complete	no
12	greenstick	13	16	greenstick	no

Table III. — Rate of re-fracture reported in the literature

Authors	Number of patients	Number of re-fractures	%	Comparison with our series
Present study (Patients protected by the brace)	70	0	0%	
Bould et al.	768	34	4.4%	P=0.072
Cassebaum et al.	280	18	6.4%	P=0.029
Sinikumpu et al.	168	45	26%	P<0.001
Lynn et al.	174	7	4%	P=0.089
Kapel et al.	66	9	13%	P=0.001

## RESULTS

Comparing the 4 types of treatment (orthopedic treatment without reduction, orthopedic treatment with reduction, secondary ESIN and immediate ESIN), there was no significant difference con-

cerning the age at the time of fracture, the sex, the initial angulation, the final angulation, and the final mobility. Orthopedic treatment with reduction was the most used treatment in case of first fracture or recurred fracture (Table I.). Final clinical result was good in all cases. In the group of children wearing



**Fig. 2.** — Custom made brace, used for re-fracture prevention

the protective brace (70 cases) no re-fracture was observed while 1 re-fracture was observed in the 5 cases where the brace was not worn ( $p=0.02$ ). This case had been treated by ESIN after initial fracture reduction and secondary displacement.

## DISCUSSION

The analysis of the 12 cases of re-fracture, shows no difference in the incidence whether the initial fracture is a "Greenstick" or a complete fracture. There is also evidence that when the residual angulation after treatment of the initial fracture is higher than  $5^\circ$ , the rate of re-fractures increases. None of the initial cases of re-fracture was wearing a protective brace at the time (Table II.).

Re-fracture rate was 0% in the group where a protective brace was worn while it was 20% in the group without brace. Rate of re-fracture reported in the literature is summarized in Table 3. By using the brace, the rate is significantly lower than most of the other series of literature (Table III.).

## CONCLUSION

We have demonstrated that a 6-month brace wearing combined to a complete interruption of sports may decrease the re-fracture rate to 0%. The 6 months following the fracture represent the period during which the bone is still fragile. Bracing is therefore an easy and cheap way to protect the child after a both bones of the forearm fracture during the most critical period (Figure 2).

## REFERENCES

1. **Bould M, Bannister G.C.** Re-fractures of the radius and ulna in children. *Injury, Int J .Care Injured* 1999 ; 30 : 583-586.
2. **Cassebaum W.H., Hamilton R.B.** Re-fractures in children. *Am J Surg* 1953 ; 85 : 277-81.
3. **Filipe G, Dupont JY, Carlioz H.** Les fractures iteratives des deux os de l'avant-bras de l'enfant. *Chirurgie Pediatri.* 1979 ; 20 : 421-6.
4. **Holdsworth BJ, Sloan JP.** Proximal forearm fractures in children. *J Bone Joint Surg.* 1962 ; 44A : 1667-93.
5. **Lynn O, Litton M.D, Adler F.** In : *The journal of trauma : Injury, Infection and Critical Care*-Vol. 3-Issue 1; 1963 : 41.
6. **Rockwood Jr CA, Wilkins KE, King RE.** *Fractures in children.* 3<sup>rd</sup> ed .Philadelphia : Lippincott; 1984.
7. **Rodriguez-Merchan EC.** Pediatric fracture of the forearm. *Clin Orthop Relat Res.* 2005 ; 432 : 65-72.
8. **Schwartz N, Pienaar S, Sechwartz AF.** Re-fracture of the forearm in children. *J Bone Joint Surg. Br.* 1996 ; 78 :740-4.
9. **Sinikumpu J.J, Lautamo Anu, Pokka T, Serlo W.** The increasing incidence of pediatric diaphyseal both-bone forearm fractures and their internal fixation during the last decade. *Injury* 2012 ; 43 : 362-6.
10. **Weinberg A-M, Kasten P, Castellani C.** Which axial deviation results in limitations of pro-and supination following diaphyseal lower arm fracture in childhood ? *Eur J Trauma* 2001 ; 27 : 309-16.