



ORIGINAL RESEARCH

The Effect of Kinesio Taping Versus Splint Techniques on Pain and Functional Scores in Children with Hand PIP Joint Sprain

Sancar Serbest¹, Uğur Tiftikci¹ , Erdoğan Durgut¹, Özge Vergili²  and Cem Yalın Kılınç³ 

¹Faculty of Medicine, Department of Orthopaedics and Traumatology, Kırıkkale University, Kırıkkale, Turkey; ²Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Kırıkkale University, Kırıkkale, Turkey; ³Faculty of Medicine, Department of Orthopaedics and Traumatology, Muğla Sıtkı Kocman University, Muğla, Turkey

ABSTRACT

Introduction: Due to the continual increase in the number of children engaging in sports today, physicians encounter finger injuries at an increasing frequency. This study sought to investigate the effectiveness of the method of Kinesio taping versus classic finger splint technique on pediatric patients with PIP (proximal interphalangeal) joint sprains of the fingers. **Method:** This is a retrospective cohort study. Forty-nine pediatric patients with PIP joint sprains were included in the study. The patients were divided into two groups, Group 1 being those treated with Kinesio taping and Group 2, those treated with splints. The area around the PIP joint was measured before and after treatment. Visual analog scale (VAS) evaluation: nighttime pain, numbness, pain at rest, and pain during activity were each separately evaluated before and after treatment. Also, flexion was measured at rest and in active motion before and after treatment. **Results:** The patients' periarticular measurements of the affected joint were statistically significant in both groups after treatment ($p < 0.001$). In the comparison between the groups, it was found that the group treated with Kinesio taping displayed a better outcome ($p < 0.021$). According to the VAS for PIP joint pain, it was observed that in both groups, pain at rest, pain during activity, nighttime pain, and numbness were statistically significant after treatment ($p < 0.001$). In the comparison of the groups, it was seen that the difference was statistically significant only in terms of nighttime pain ($p < 0.013$). **Conclusions:** The study conducted supported the literature that Kinesio taping method does not restrict the function of the extremity to which it is applied and also does not produce the complications reported in other treatment techniques. Kinesio taping was found to have a higher patient compliance and the outcomes were better in terms of edema and joint range of motion as well as night time pain when compared to the group treated with splint.

Keywords: Kinesio taping; splint; pain; sprain; PIP

INTRODUCTION

Finger traumas are frequently observed in schoolchildren who play sports such as basketball, handball, volleyball, and football in which the hands are used. In particular, interphalangeal joint injuries are the most common to be encountered among children playing these games [1]. Finger splints for fixation, buddy taping, and especially manufactured thermoplastic

apparatus are used in the treatment of such joint injuries [2]. The aim of treatment is to correct the movement of the injured joint. For this, an effort must be made in the initial evaluation to determine which structures have been injured and to determine which method of treatment would be most appropriate [1–3]. The healing of these injuries may take a surprisingly long period of time. Especially the swelling around the joint and restricted motion may linger for some time [1–5].

Received 10 July 2018; accepted 5 September 2018.

Address correspondence to Sancar Serbest, Faculty of Medicine, Department of Orthopaedics and Traumatology, Kırıkkale University, Kırıkkale, Turkey. E-mail: dr.sancarserbest@hotmail.com

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/iivs.

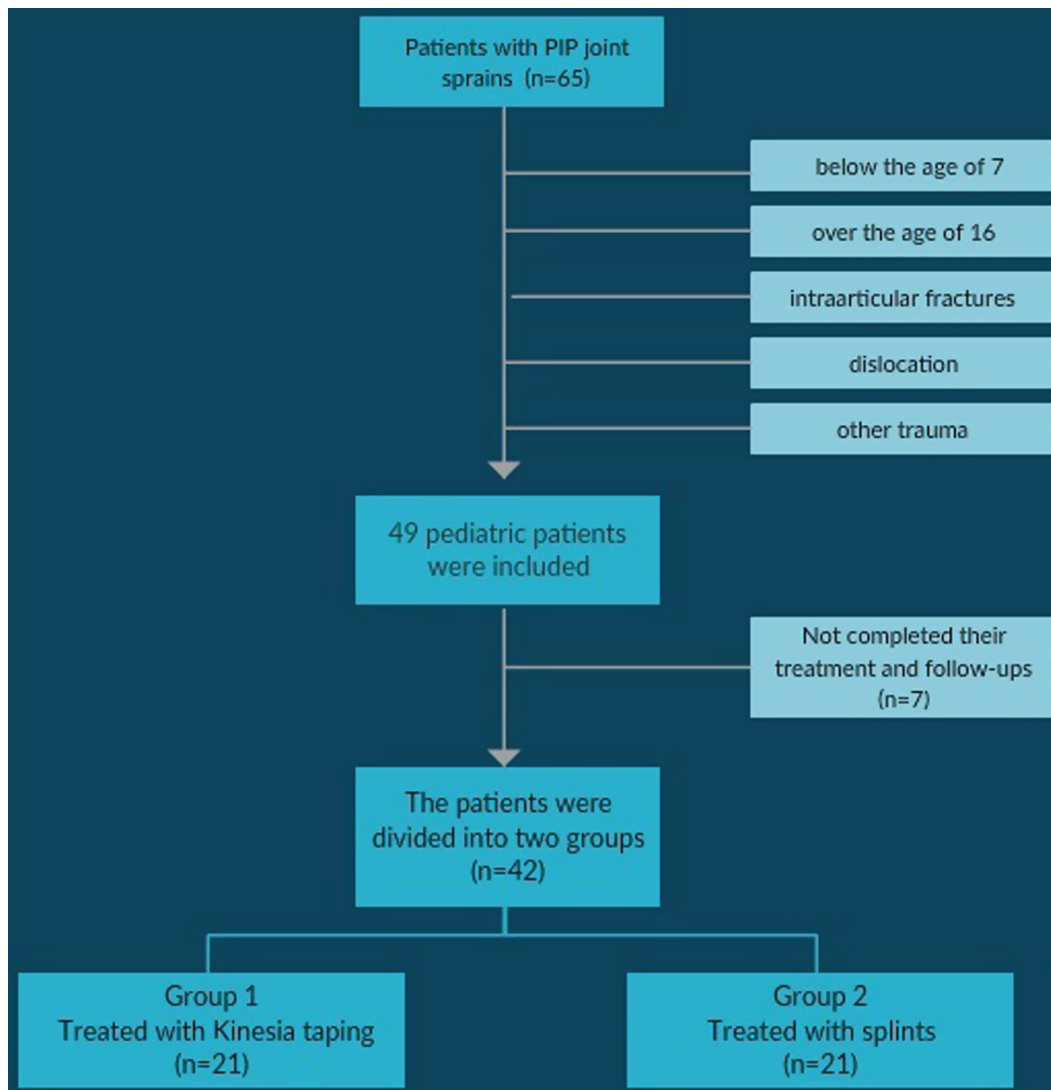


FIGURE 1. Flow diagram of exclusion criteria.

Kenzo Kase developed the Kinesio taping technique in the 1970s. Since that, numerous clinical trials have been performed examining its effects on human body function on various clinical conditions. It has been shown in clinical studies that local circulation is increased in the application area following Kinesio taping [6] and that proprioception is enhanced *via* cutaneous stimulation of mechanoreceptors [7]. The applied tape increases circulation and helps to reduce pain. It is frequently used in the treatment and evaluation of musculoskeletal disorders and sports injuries [6,7].

There is no study in the literature related to the treatment of PIP (proximal interphalangeal) joint injuries with Kinesio taping. The aim of this study, therefore, was to evaluate the results of treatment of pediatric patients with PIP joint sprains of the fingers comparing the effectiveness of the method of Kinesio taping versus the classic finger splint technique on both pain and function of the finger.

MATERIALS AND METHOD

Forty-nine pediatric patients who had presented to our orthopedics and traumatology polyclinic with PIP finger joint sprain injuries over the period 2014–2018 were included in the study. After a local ethics committee decision was obtained (21/07), a retrospective review of the files of the patients and subjects included in the study was carried out. Included in the study were pediatric patients between the ages of 7 and 16 with no known diseases of the muscles, tendons, or bones who had sustained PIP joint sprain injuries. Following a detailed radiological and clinical evaluation, patients over the age of 16 and below the age of 7 with intraarticular fractures, dislocation, other trauma, and those who had not completed their treatment and follow-ups were excluded from the study (Figure 1).



FIGURE 2. The Kinesio taping method (ligament correction technique).

The patients were divided into two groups, Group 1 being those treated with Kinesio taping and Group 2, those treated with splints. The symptoms (pain, swelling, bruising), gender, age, height, weight, and the side of the involved extremity of all of the patients were recorded. The circumference of the PIP joint was measured before and after treatment. Range of motion of the proximal interphalangeal (PIP) joint of the injured finger was measured using the Rolyan finger goniometer. Visual analog scale (VAS) evaluation included separate evaluation of nighttime pain, numbness, pain at rest, and pain during activity before and after treatment. Also, flexion was measured at rest and in active motion before and after treatment.

The “ligament correction technique” was used as the Kinesio taping method. Two “I” tapes were used so as to cross over the PIP joint line while the hand was in neutral position for 10 days (Figure 2). The tape was cut according to the measurement of the finger so as to provide 75–100% stretching.

In treatment with a splint, the classic method involved applying the splint to the finger (Figure 3). In the Kinesio taping technique, finger motion was not restricted and the patients were told to move their finger as much as they could tolerate. However, motion started only after 10 days in the splint group.



FIGURE 3. The splint method.

Statistical Analysis

Statistical analysis was applied using IBM SPSS version 23.0 software (IBM Corp., Armonk, NY). A confidence interval (CI) of 95% and a two-tailed $p < 0.05$ were determined to be statistically significant for all of the analyses. The numerical data were analyzed with the Shapiro–Wilk test in terms of assessing whether data were parametric. Because the numeric data were not parametric, the Mann–Whitney U test was used for comparison. Groups were compared with Pearson chi-square test for homogeneity. Wilcoxon test was used for statistical analysis of the difference in each group between pre and post-treatment scaled variables. Mann–Whitney U test was used to compare scaled variables between groups.

RESULT

The mean age of the patients ($n: 42$) was 10.71 ± 2.51 years (7–16 years). Among the patients, 26 were treated for PIP joint sprains in their dominant hand, 16 for the same type of sprain in their non-dominant hand. Injuries were caused by player-to-ball contact, that is, basketball ($n = 17$), football ($n = 15$), volleyball ($n = 7$), and handball ($n = 3$). There were not statistically significant differences between the groups in terms of age, gender, weight,

TABLE 1. The demographic characteristics of the groups

	Total (n = 42)	Group 1 (n = 21)	Group 2 (n = 21)	p
Age (mean ± SD)	10.71 ± 2.5	10.86 ± 2.61	10.57 ± 2.46	0.702
Gender M/F	25/17	13/8	12/9	0.756
Extremity side dominant/other	26/16	14/7	12/9	0.53
Height (mean ± SD)	142.14/17.12	149.14/18.87	135.31/11.90	0.62
Weight (mean ± SD)	36.1 ± 5.53	36.14 ± 6.1	36.05 ± 5.03	0.91

TABLE 2. Functional results

Evaluation method	Treatment method						p** (between groups)	
	Group 1 (n = 21)			Group 2 (n = 21)				
	Before treatment	After treatment	p*	Before treatment	After treatment	p*	Before treatment	After treatment
Joint circumference (cm)	7.24 ± 0.54	5.88 ± 0.72	<0.001	7.03 ± 0.63	6.38 ± 0.66	<0.001	0.147	0.021
ROM at rest	12.38 ± 7.18	1.57 ± 0.8	<0.001	10.33 ± 5.94	3.57 ± 3.21	<0.001	0.277	0.026
ROM during activity	60.71 ± 25.36	106.67 ± 7.13	<0.001	53.33 ± 20.08	90.95 ± 12.71	<0.001	0.245	<0.001
VAS								
Pain at rest	3.9 ± 1.51 (2–8)	0.62 ± 0.2 (0–3)	<0.001	3.29 ± 1.55 (2–7)	1.0 ± 0.83 (0–3)	<0.001	0.99	0.89
Pain during activity	7.33 ± 1.56 (4–10)	2.52 ± 1.69 (0–5)	<0.001	6.62 ± 1.68 (4–9)	3.33 ± 1.56 (0–6)	<0.001	0.183	0.127
Nighttime pain	3 ± 1.37 (1–6)	0.1 ± 0.3 (0–1)	<0.001	2.38 ± 1.39 (0–6)	0.52 ± 0.68 (0–2)	<0.001	0.134	0.013
Numbness	2.67 ± 1.77 (0–6)	0.43 ± 0.1 (0–2)	<0.001	2.57 ± 1.74 (0–6)	0.81 ± 1.47 (0–4)	<0.001	0.828	0.579

*Wilcoxon test was used for statistical analysis.

**Mann–Whitney U test was used to compare scaled variables between groups.

Bold values were statistically significant.

or height. Seventeen of the patients (40.5%) were girls, 25 (59.5%) were boys. The mean follow-up period for the patients was 3.62 ± 1.2 (1–6) months. The demographic distribution of the groups is shown in Table 1.

The patients' periarticular measurements of the affected joint were statistically significant in both the groups after treatment ($p < 0.001$). In the comparison between the groups, it was found that the group treated with Kinesio taping displayed a better outcome ($p < 0.021$). Resting and active range of motion (ROM) measurements in both the groups were also statistically significant following the treatment ($p < 0.001$). Resting ROM ($p < 0.026$) and active ROM ($p < 0.001$) measurements in the Kinesio taping group after treatment were statistically better than measurements taken in the splint group (Table 2; Figures 4 and 5).

In the patients' responses when asked to rate their PIP joint pain on a scale of 1–10, it was observed in both groups that, according to VAS, pain at rest, pain during activity, nighttime pain, and numbness were statistically significant after treatment ($p < 0.001$). In the comparison of the groups, however, it was seen that only the difference in nighttime pain ($p < 0.013$) was statistically significant (Table 2).

DISCUSSION

Our study demonstrated that, since the Kinesio taping method does not restrict the function of the extremity to which it is applied and also does not produce the complications reported in other treatment techniques, it results in better clinical outcomes compared to the classic treatment option of the splint.

Due to the continual increase in the number of children engaging in sports today, physicians encounter these types of injuries at an increasing frequency. A sprain is an injury of the tissues surrounding and supporting a joint. This includes the ligaments as well as the joint capsule. Most cases of finger injuries are simple compaction or twisting stemming from forced hyperextension or hyperflexion of the metacarpophageal (MCP), PIP, or distal interphalangeal (DIP) joint; they do not involve fractures. The result of such injuries is swelling, sensitivity and reduced range of motion of the joint [2,3]. The treatment of PIP injuries entails the main goal of preventing a passive extension deficit in the joint [4]. Regardless of the protocol employed, all researchers recommend conservative treatment [5]. While Stage 1 ligament injuries are treated with buddy taping and early mobility, in Stage 2 injuries,

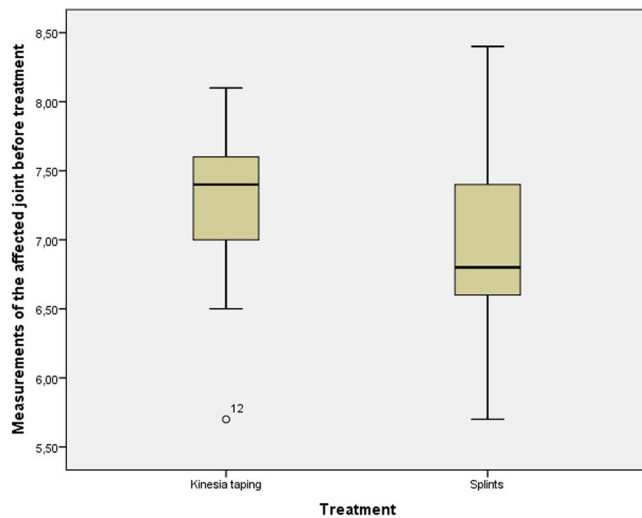


FIGURE 4. Measurements of the affected joint before treatment.

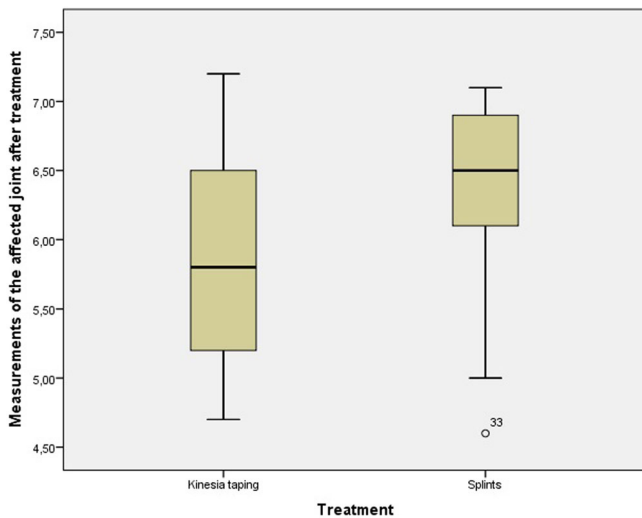


FIGURE 5. Measurements of the affected joint before treatment.

the use of a dorsal splint for 10 days is followed by buddy taping for 4–6 weeks [8,9]. In Stage 3 ligament injuries, a dorsal splint is used for 14 days and is followed by buddy taping until functional mobility is restored [10].

Typically, PIP injuries arising as a result of hyperextension are conservatively treated with early physiotherapy unless there is a complete tear of the ligament [11]. Splints are one of the components used in the acute treatment of injuries. The basic function of treatment with a splint is immobilization, ensuring support, pain reduction, distancing stressors from the injured area, and also reminding the patient of kinesthetic limitations [12].

The buddy taping system, in which a healthy finger provides the function of a splint, has been used in the treatment of fifth metacarpal fractures

and has resulted in more successful outcomes compared to plastering [13]. In a randomized study with 221 patients, it was observed that the buddy taping method produced faster and more successful outcomes in terms of edema and pain compared to the use of a splint following PIP injury [14]. In another study, it was determined that the rate of success was 98% when the buddy taping method was applied for approximately three weeks following the use of a 10-day splint application [15].

As can be seen in the results reported in the literature, both treatment with a splint and the buddy taping technique significantly limit activities of daily life and because of this, patient compliance is poor and various complications, especially skin lesions, are observed.

Kase and Willis have described many taping techniques depending upon the desired therapeutic effect [16]. Our study made use of one of these methods, the ligament correction technique, in which, as in the buddy taping method, the joint was supported, thus reducing pain and transferring stressors from this area to other areas while at the same time allowing the functionality of the hand units outside of the patient's involved segment to be preserved. It was found that patient compliance was at a higher level and the rehabilitation-indicating parameters of edema and joint range of motion as well as nighttime pain outcomes were better with the use of this technique compared to the group treated with a splint.

Although there are studies in the literature that have assessed the effects of Kinesio taping using different techniques on the grasping strength of the hand, these have been conducted on healthy groups [17–19]. There is no study in the literature related to the treatment of hand joint injuries with Kinesio taping. Our study will therefore provide guidance for future clinical studies in this respect.

Limitations of the study

This study has some limitations. First, we investigated a small patient group. A larger group of patients may provide more detailed conclusions to our findings. Second, it was a retrospective cohort study.

CONCLUSION

It was found that patient compliance was at a higher level and the rehabilitation-indicating parameters of edema and joint range of motion as well as nighttime pain outcomes were better with the use of this technique compared to the group treated with a splint.




DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Approval for this study was granted by the Kirikkale University Faculty of Medicine ethics committee and the study was conducted in accordance with the principles of the Declaration of Helsinki. We had all necessary consents from patients involved in the study, including consent to participate in the study.

ORCID

Uğur Tiftikci  <https://orcid.org/0000-0002-2403-071X>
 Özge Vergili  <https://orcid.org/0000-0002-5312-7684>
 Cem Yalın Kılınç  <https://orcid.org/0000-0003-2568-0500>

REFERENCES

- [1] Hong E. Hand injuries in sports medicine. *Prim Care*. 2005;32(1):91–103.
- [2] Hile D, Hile L. The emergent evaluation and treatment of hand injuries. *Emerg Med Clin North Am*. 2015;33(2):397–408.
- [3] Abzug JM, Dua K, Bauer AS. Pediatric phalanx fractures. *J Am Acad Orthop Surg*. 2016;24(11):e174–e183.
- [4] Hogan CJ, Nunley JA. Post traumatic proximal interphalangeal joint flexion contractures. *J Am Acad Orthop Surg*. 2006;14(9):524–533.
- [5] Pillukat T, Mühlendorfer-Fodor M, Schadel-Höpfner M, Windolf J, Prommersberger KJ. Verletzungen der Mittelgelenke. *Unfallchirurg*. 2014;117(4):315–326.
- [6] Kase K, Hashimoto T, Tomoki O. *Kinesio taping perfect manual: amazing taping therapy to eliminate pain and muscle disorders*. Vols. 6–10, Kinesio USA, LLC: Kinesio Taping Association; 1998: 117–118.
- [7] Murray HM. Kinesio taping, muscle strength and ROM after ACL repair. *J Orthop Sports Phys Ther*. 2000;30:A–14.
- [8] Bowers WH (ed). *The interphalangeal joints*. New York: Curchill Livingstone; 1987: 56–77.
- [9] Bowers WH. Management of small joint injuries in the hand. *Orthop Clin North Am*. 1983;14(4):793–810.
- [10] Eaton RG, Littler JW. Joint injuries and their sequelae. *Clin Plast Surg*. 1976;3(1):85–98.
- [11] Talwalkar SC. Ligament injuries of the hand. *Orthop Trauma*. 2014;28(4):225–229.
- [12] Rizzone K, Gregory A. Using casts, splints and braces in the emergency department. *Clin Pediatr Emerg Med*. 2013; 14(4):340–348.
- [13] Braakman M, Oderwald EE, Haentjens MH. Functional taping of fractures of the 5th metacarpal results in a quicker recovery. *Injury*. 1998;29(1):5–9.
- [14] Paschos NK, Abuhemoud K, Gantsos A, Mitronis GI, Georgoulis AD. Management of proximal interphalangeal joint hiperextension injuries: a randomised controlled trial. *J Hand Surg Am*. 2014;39(3):449–454.
- [15] Incavo SJ, Mogan JV, Hilfrank BC. Extension splinting of palmar plate avulsion injuries of the proximal interphalangeal joint. *J Hand Surg Am*. 1989;14(4):659–661.
- [16] Kase K, Wallis J, Kase T. *Clinical therapeutic applications of the Kinesio taping method*. 2nd ed. Tokyo: Kinesio Taping Association; 2003.
- [17] Chang HY, Chou KY, Lin JL, Lin CF, Wang CH. Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athletes. *Phys Ther Sport*. 2010;11(4):122–127.
- [18] Araujo Aguiar RSN, Silva Baschi SRM, Lazzareschi L, et al. The late effect of Kinesio taping on hand grip strength. *J Bodyw Mov Ther*. 2018;22(3):598–604.
- [19] Donec V, Varzaitytė L, Kriščiūnas A. The effect of Kinesio taping on maximal grip force and key pinch force. *Pol Ann Med*. 2012; 19(2):98–105.