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Efficacy of ankle bracing in top-level volleyball players

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トップレベルバレーボール選手における足関節装具装着時の効果

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要　旨

医療機関のみでなく，一般スポーツ店でも足関節装具を購入できるようになり，多くのバレーボール選手が足関節装具を装着するようになってきた。しかし，足関節装具を装着しているにもかかわらず，捻挫する選手を少なからず認める。このため，装具の有用性を疑問視する指導者の声も聞かれる。

本研究では日本選抜女子中学・高校生選手112名を対象として，足関節捻挫やその後の治療と足関節装具との関わりについてアンケートを行い検討した。

その結果，対象の112名のうち，調査時に装具を装着していたのは52例であった。装具を装着していた52例中，装具装着時に捻挫したことのある選手は17例（A群；32.7%）であった。その17例中15例（88.2%）は2回以上の捻挫を繰り返していて，初回捻挫時の病院受診率は装具を装着中には捻挫したことのない選手が60.0%であるのに対して47.1%と低かった。一方，装具を装着していない時に捻挫したことのある選手は110例中86例（78.2%；装具を装着するようになる以前に捻挫した50例を含む）で装具装着時に捻挫したA群（32.7%）に比べ捻挫率は高かった。したがって，装具を装着することにより捻挫する率が下がった。また，装具を装着していない時に捻挫したことがない選手は110例中24例（21.8%）で，装具を装着中に捻挫したことがない選手は52例中35例（67.3%）に比べて低かった。したがって，装具を装着しなければ捻挫する率が上がった。以上装具装着，非装着その時に捻挫したか，してないかを集計し，カイ2乗検定を行った結果，危険率5％未満で人数の偏りが有意であり，足関節装具の捻挫予防効果を認める結果となった。したがって，A群は装具装着時でさえ捻挫した原因は装具の効果に問題があるのではなく，それを装着している選手側になんらかの要因があると考えられた。その要因として様々なものが考えられるが，今回調査した限られた情報では言及することはできない。しかし，A群は病院受診率が低く，医師に勧められた治療より軽度の固定を行っていたことから，病院を受診して，医師に勧められた治療を行うことが望ましいと考えられる。また，装具の有用性が示唆されたことから，捻挫の可能性が高いと考えられる試合や試合形式の練習時には予防的に足関節装具を装着することが推奨される。

キーワード：足関節捻挫，バレーボール，足関節装具，スポーツ傷害

Abstract

Recently, ankle braces became available not only at hospitals but also at retail sports shops and are now used by many volleyball players. Nevertheless, the incidence of ankle sprain is not very low, even when the players wear braces. Therefore the effectiveness of ankle braces has sometimes been questioned by coaches. In this study the cause of ankle sprains were examined when the players were wearing braces.

The subjects were 112 female top-level volleyball players in Japanese high school. Fifty-two subjects were wearing ankle braces. Of these 52 subjects, 17 (32.7%; group A) have sprained their ankles while wearing the ankle braces. Of these 52 subjects, 35 (67.3%) have not sprained their ankles while wearing the braces. One hundred and ten subjects were not wearing ankle braces. Of these 110 subjects, 86 (78.2%) have sprained their ankles while not wearing ankle braces. Of these 110 subjects, 24 (21.8%) have not sprained while not wearing braces.

Sprain protective efficacy of ankle braces was analyzed using chi-square test. The deviation of the number was significant($\chi^2 = 31.6$ $p<0.05$, df=1), which showed ankle braces protect ankles effectively under the level of significance 5%.

Of 88 subjects with history of ankle sprain, 36 had repeated sprains. In group A, 15 out of 17 subjects had repeated sprains. It is statistically significantly higher number of repeated sprains than group B by chi-square analysis ($p<0.01$). As for the cause that some players sprained even at the time of wearing them, ankle braces was not enough effective to prevent players from spraining but there were some factors in the players who were wearing them.

In group A, the rate of medical consultation for the first injury was low, and even when they had medical consultation, some of them received lighter treatments. So, it is recommended that the players should take medical consultations and receive treatments that were recommended by the doctors when they sprained them and players should be educated on this topic. Above all, it is recommended to wear ankle braces in appropriate

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way for prevention of ankle sprains only at the time of a match form preventively for all volleyball players.

Keywords: Ankle sprains, volleyball, ankle braces, sports injury

Introduction

Ankle sprains in volleyball used to occur sometimes during practice when a player stepped on a ball. This type of injury, however, is significantly decreasing due to effective installation of protective devices, such as a guard net which prevent balls from getting into spike areas on practicing spikes. Yet, the incidence of ankle sprains at the net has been on the rise; such injuries occur when a player is landing on the foot of another player after forward "long-jump" spikes or quick blocks, which are increasingly used as the speed, techniques and the complexity of combination spikes are progressively advancing. Unlike stepping on a ball, which are a lot softer than the foot, the inversion and eversion forces when landing on the foot after a jump as long as one meter are considerably large and may cause severe injuries.

Recently, ankle braces became available not only at hospitals but also at retail sports shops and are now used by many volleyball players. Many volleyball players use ankle braces for preventing inversion and eversion are often found. Nevertheless, the incidence of ankle sprain is not very low, even when the players wear braces. As such, the effectiveness of ankle braces has sometimes been questioned by coaches.

In this study, ankle sprains in top-level volleyball players who wore ankle braces were examined to evaluate the cause of injury and the efficacy of ankle bracing.

Subjects and Methods

One hundred and twelve Japanese junior and senior high school female volleyball players selected for the national camp training were studied. Their age ranged from 14 to 17 years old (mean ± SD: 16.1 ± 0.94 years), and the mean weight and height were 60.3 ± 6.3 kg and 172.4 ± 6.3 cm, respectively. A questionnaire is designated to collect data on ankle sprains, such as first sprain age, number of sprains, whether they have sprained their ankles using ankle braces and other information. Most of ankle braces which volleyball players use have a flexible plate made by plastic, which prevent inversion and eversion.

Statistical Analysis has been done by t-test and chi-square analysis. A level of significance was set at p=0.05.

Results

Of 112 subjects, 88 (78.6%) had previous ankle sprains. Fifty-two subjects were wearing ankle braces at the time of investigation. Of these 52 subjects, 17 (32.7 % ; group A) have sprained their ankles while wearing ankle braces. Of these 52 subjects, 35 (67.3 % ; group B) have not sprained their ankles while wearing the braces.

One hundred and ten subjects were not wearing ankle braces at their first ankle sprains. Of these 110 subjects, 86 (78.2 % ; group C include 50 subjects who started to wear ankle braces because of their ankle sprains in group A and B.) have sprained their ankles while not wearing ankle braces. Of these 110 subjects, 24 (21.8 % ; group D) have not sprained them while not wearing braces. Two subjects without any history of ankle sprain sprained them while wearing braces for the prevention of their ankle sprains. Fifty subjects started

Table 1-a　Age, body height, and body weight in each group

	Group A	Group B
Number	17	35
Age	16.4 ± 0.8	15.9 ± 1.0
Height	169.0 ± 5.8	174.3 ± 5.7
Weight	58.9 ± 5.2	60.7 ± 7.1

n.s.　mean ± SD

Fifty-two subjects who were wearing ankle braces at the time of investigation.
Group A ; Of these 52 subjects, 17 (32.7 %) have sprained their ankles while wearing ankle braces.
Group B ; Of these 52 subjects, 35 (67.3%) have not sprained their ankles while wearing the braces.

Table 1-b　Age, body height, and body weight in each group

	Group C	Group D
Number	86	24
Age	16.9 ± 1.0	16.7 ± 0.8
Height	172.9 ± 6.7	170.5 ± 5.1
Weight	60.4 ± 6.6	60.0 ± 5.5

n.s.　mean ± SD

One hundred and ten subjects who were not wearing ankle braces at their first ankle sprains.
Group C ; Of these 110 subjects, 86 (78.2 % .) have sprained their ankles while not wearing ankle braces.
Group D ;　Of these 110 subjects, 24 (21.8 % ;) have not sprained them while not wearing braces.

Table 2　Relationship between ankle sprains and ankle braces

	with ankle braces	without ankle braces
ankle sprains	17(32.7%)	86(78.2%)
no ankle sprains	35(67.3%)	24(21.8%)
Total	52	110

($\chi^2 = 31.6$ $p<0.05$,df=1)

Table 3　Number of sprains

	Group A	Group B
Once	2(11.8%)	25(71.4%)
More than twice	15(88.2%)	10(28.6%)
Total	17	35

($\chi^2 = 16.3$ $p<0.01$,df=1)

In group A, 15 out of 17 players had repeated sprains.
Subjects in group A had sprained their ankles while wearing the ankle braces.
Subjects in group B didn't have ankle sprains while wearing the braces.

Table 4　Medical consultation

	Group A	Group B
Medical consultation	8(47.1%)	21(60.0%)
No medical consultation	9(52.9%)	14(40.0%)
Total	17	35

In group A, the rate of medical consultation for the first injury was low.

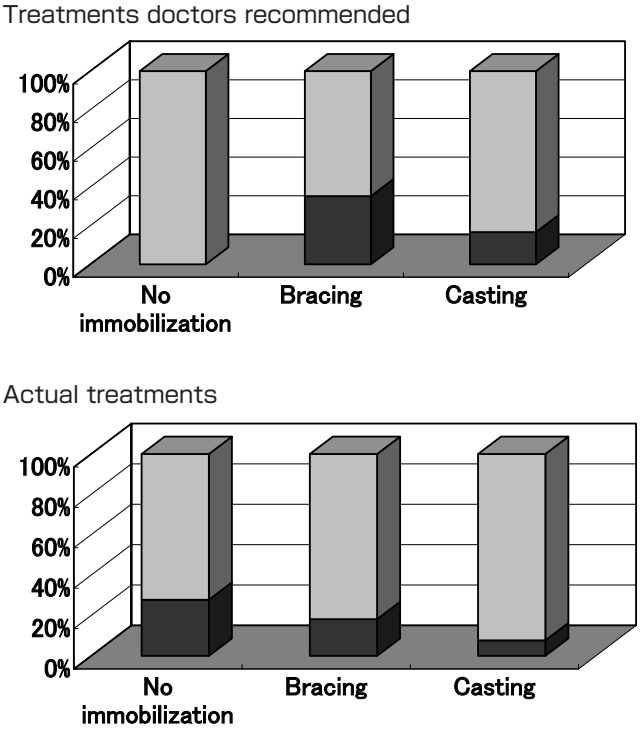

Fig.1　In group A, when they had medical consultation, some of them did not receive treatments recommended by the doctors.
The figures show group A and B percentages at each treatment.

to wear ankle braces because of their ankle sprains. There was no statistically significant difference in the age, height and weight among 4 groups (Table 1-a, b). Eighty-six subjects (78.2% ; group C include 50 subjects who started to wear ankle braces because of their ankle sprains.) had sprained them while not wearing ankle braces was large in comparison with 17 (32.7% ; group A) had sprained their ankles while wearing ankle braces. Of these 110 subjects, 24 (21.8% ; group D) have not sprained them while not wearing braces.Two subjects without any history of ankle sprain sprained them while wearing braces for the prevention of their ankle sprains. Fifty subjects started to wear ankle braces because of their ankle sprains. There was no statistically significant difference in the age, height and weight among 4 groups (Table 1-a, b). Eighty-six subjects (78.2%; group C Include 50 subjects who started to wear ankle braces because of their ankle sprains.) had sprained them while not wearing ankle braces was large in comparison with 17 (32.7% ; group A) had sprained their ankles while wearing ankle braces.

Twenty-four subjects (21.8 % ; group D) had not sprained them while not wearing braces was a few in comparison with 35 subjects (67.3 % ; group B) had not sprained them while wearing braces. Sprain protective efficacy of ankle braces was analyzed using chi-square test.

The deviation of the number was significant($\chi^2 = 31.6$ $p<0.05$, df=1), which showed ankle braces protect ankles effectively under the level of significance 5% (Table 2).

Of 88 subjects with history of ankle sprain, 36 had repeated sprains. In group A, 15 out of 17 subjects had repeated sprains. It is statistically significantly higher number of repeated sprains than group B by chi-square analysis ($p<0.01$)(Table 3).

In group A, the rate of medical consultation for the first injury was low, and even when they had medical consultation, some of them did not receive treatments recommended by the doctors but receive lighter treatments (Table 4, Fig.1). Furthermore, the subjects in group A experienced sustained pain and stronger anxiety compared to those in group B (Figs. 2 and 3).

In conclusion, the Japan Volleyball Association has long focused on injury prevention and it is hoped that this study will shed new light in this area and it is recommended that the players should take medical consultation and the treatments that were recommended by the doctors when they sprained and players should

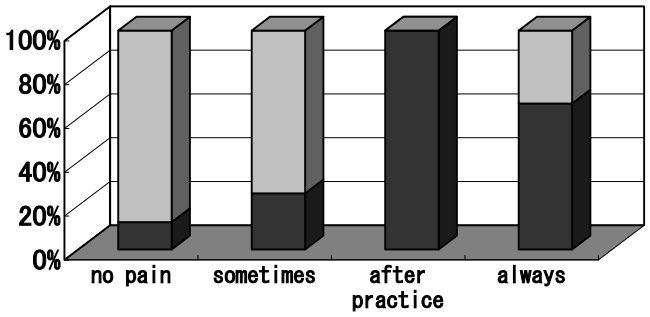

Fig.2　Pain level
The athletes in group A experienced sustained pain compared to those in group B

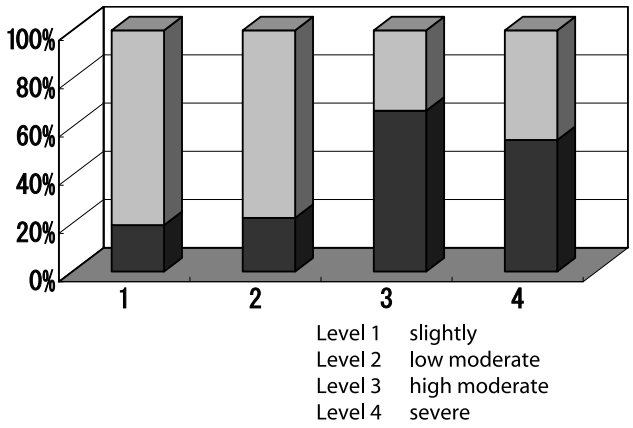

Fig.3　Anxiety Level in Instability
The players in group A experienced stronger anxiety in instability compared to those in group B.

be educated on this topic. Above all, it is recommended to wear ankle braces in appropriate way for prevention of ankle sprains only at the time of a match form preventively for all volleyball players.

Discussion

Ankle sprain is the most common sport-related injury in volleyball [5, 6]. As remarkable technical advances have been made in recent top-level volleyball, overload to the lower leg joint has become enormous as a consequence of one-footed jump spiking, an intentional abrupt change in the approach direction for time-differential spike and spiking with an improper posture.

Due to instability in the ankle during these offenses, there has been an increasing need for taping, braces and high-cut shoes that stabilize the ankles. As a result of medical checks in the national female volleyball players, it has been shown that approximately 90% of the subjects have ankle instability, and the half of them required some sort of stabilizer such as taping and ankle braces during practice or game [6]. In fact some of players who had sprained their ankles when wearing ankle braces had problems in their ankles. The interview to the national female volleyball players has further revealed that an abrupt forward movement at a receive is also the cause of ankle sprain [6]. Thus, ankle instability is a big problem for high performance. Prevention of ankle sprain is important because ankle sprain is a course of ankle instability.

Some previous studies [1-4, 7-11] have suggested that ankle braces are effective but whether ones are effective or not is still indeterminate. This study supports sprain protective efficacy of ankle braces too.

As for the cause that some players sprained even at the time of wearing them, ankle braces was not enough effective to prevent players from spraining but there were some factors in the players who were wearing ankle braces. Various things are thought about as the factor, but we can not mention it by the limited information that was investigated this time. We need further research.

References

1) Arnold BL et al: Bracing and rehabilitation--what's new. Clin Sports Med, 23 (1): 83–95, 2004
2) Boyce SH et al: Management of ankle sprains: a randomized controlled trial of the treatment of inversion injuries using an elastic support bandage or an Aircast ankle brace. Br J Sports Med, 39 (2): 91–6, 2005
3) Finestone A et al: A prospective study of the effect of foot orthosis composition and fabrication on comfort and the incidence of overuse injuries. Foot Ankle Int, 25 (7): 462–6, 2004
4) Lamb SE et al: Collaborative Ankle Support Trial research team. Related Articles, Links Clinical and cost effectiveness of mechanical support for severe ankle sprains: BMC Musculoskelet Disord, 13;6 (1): 1, 2005
5) Morikita I :A study of injuries in volleyball players : Cent Jpn J Orthop Traumat, 45:1021–2, 2002 (in Japanese)
6) Morikita I :Injuries in Top-level Volleyball Players-Results from a Questionnaire Survey-. J Orthop Sports Med, 20 (1): 18–21, 2000 (in Japanese)
7) Omori G et al: The effect of an ankle brace on the 3-dimensional kinematics and tibio-talar contact condition for lateral ankle sprains. Knee Surg Sports Traumatol Arthrosc, 12 (5): 457–62, 2004
8) Richie DH Jr et al: Functional instability of the ankle and the role of neuromuscular control: a comprehensive review.J Foot Ankle Surg, 40 (4): 240–51, 2001
9) Spaulding SJ et al: The influence of external orthotic support on the adaptive gait characteristics of individuals with chronically unstable ankles. Gait Posture, 17 (2): 152–8, 2003
10) Stasinopoulos D et al; Comparison of three preventive methods in order to reduce the incidence of ankle inversion sprains among female volleyball players. Br J Sports Med, 38 (2): 182–5, 2004
11) Ubell ML et al: The effect of ankle braces on the prevention of dynamic forced ankle inversion. Am J Sports Med, 31 (6): 935–40, 2003