Kinesio taping effect on biceps brachii muscle strength

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Abstract: This work aimed at presenting the idea of inventor Dr. Kenzo Kase that kinesio tape application with proximal base leads to muscle contraction facilitation and application with distal base leads to muscle contraction inhibition. Twenty male volleyball players with the dominant shoulder girdle muscle imbalance between the ages of 25 and 30 participated in this study. There were compared two techniques which were placed on biceps brachii muscle in shoulder and elbow joint extension. Isokinetic tests flexion and extension of elbow joint with HUMAC NORM were used to quantify muscle strength before kinesio taping application (first measurement), 24 hours (second measurement) and 72 hours (third measurements) after it. Third and first measurement difference was evaluated as an increase for each parameter (peak torque, average power per best repetition, angle of peak torque). The null hypothesis was not rejected for peak torque and average power per best repetition of both kinesio tape application ways but for angle of peak torque was rejected for both application methods. Kinesio tape application with both ways has statistically significant effect on angle of peak torque. On the other hand kinesio tape application don´t influence peak torque or average power per best repetition. There is no statistically significant difference of both kinesio tape application methods.

Key words: kinesio taping, biceps brachii muscle, muscle strength, eccentric contraction

1. Introduction

In overhead athletes such as volleyball players a specific coordination between the scapula and the humerus is a key point for economical movement. Abnormal biomechanics of the shoulder blade can cause a muscle imbalance and injuries of shoulder joint too. Biceps brachii muscle is one of the muscles which connects the scapula and the glenohumeral joint. Its long caput used to be part of the rotator cuff. Biceps brachii concentric contraction is important in the end of spiking (Fig. 1C). Its eccentric contraction protects the glenohumeral joint from damage and serves as a brake of the elbow back (Fig. 1A) and close shoulder phase (Fig. 1B).

The movement is characterized with dynamic change of direction muscle pull in common life. Čápová (2009) indicates this situation as *a dynamic stabilization* of support. It is

prerequisite of human locomotion with other factors as an adequate motivation or a previous experience with the similar movement.

Contraction of a muscle where both its distal and proximal attachments approach one another is called concentric contraction. The direction of muscle pull depends on which end is stabilized. If the proximal muscle attachment is stabilized the distal end of the muscle moves towards proximal part. If the distal muscle attachment is fixed the proximal end of the muscle moves towards the distal part (Kolář, 2009). The similar situation arises for eccentric contraction. The muscle elongates while under tension due to an opposing force greater than the muscle generates. It acts to decelerate the joint at the end of a movement. This can occur involuntarily or voluntarily.

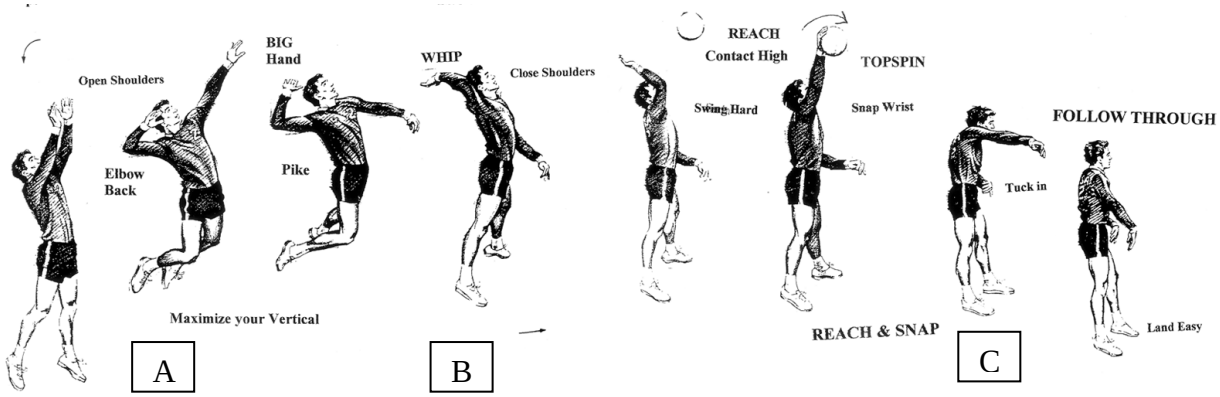

Fig. 1 Phases of Spike Approach (A – elbow back phase, B – close shoulder phase, C – track in phase)

One of the proposed methods to facilitate the control of the movement is kinesio taping. Kinesio tape is adapted in order to imitate skin characteristics as much as possible (Kase, Hashimoto, & Okane, 1996). In application of basic and corrective techniques, it is necessary to bear in mind that we apply or place our hands on an athlete (Kase, Wallis, & Kase, 2003). At present, there are a lot of modifications of the original Kase techniques. However, the difference between them has not quite been supported by many facts.

Several studies have supported the efficacy of kinesio taping technique for addressing acute injury inflammation, promoting a faster return to activity, enhancing proprioception training, reducing pain, promoting neurological function postinjury and reducing muscle imbalances (Aktas & Baltaci, 2011; Halseth, McChesney, & Lien, 2004; Murray & Husk, 2001; Fu, Wang, & Lin, 2008).

This work aimed at presenting the idea of inventor Dr. Kenzo Kase that kinesio tape application with proximal base leads to muscle contraction facilitation and application with distal base leads to muscle contraction inhibition.

2. Methods

Subjects

Twenty male volleyball players between the ages of 25 and 30 (mean age: 27 ± 2,3 yrs) participated in this study. The dominant upper limb in which there was a predisposition towards muscular imbalance in the area of the shoulder girdle was tested. Through a self-reported health history check, participants identified no known shoulder girdle or elbow pathology or upper extremity injuries. Other exclusion criteria used in this study were a history of previous shoulder surgery and a report of past skin reaction on kinesio taping material. Previous undertaking of only a conservative treatment was a prerequisition.

These participants came to our laboratory because of examination. Then we did the test on HUMAC NORM isokinetics dynamometry and applied kinesio tape two I strips on biceps brachii muscle in shoulder and elbow joint extension. The strip was led from proximal ends of biceps brachii muscle with 10% stretch to the distal end. Participants came again after one and three days and repeated the test on HUMAC NORM. We repeated this whole cycle after one month. Only difference was in application of kinesio tape Y strip. It was applied from distal part to proximal with the 10% stretch.

Kinesio taping

The skin was cleaned with alcohol before kinesio tape application on biceps brachii muscle. It was chosen according to the kinesio taping guidelines (Kase, Wallis, & Kase, 2003). There were compared two muscle techniques which were placed on biceps brachii muscle in shoulder and elbow joint extension. First one was led from proximal ends of biceps brachii muscle with 10% stretch to the distal end and second one was applied from distal part to proximal with the 10% stretch (Fig. 2).

Kinesio taping was conducted by the same physiotherapist each time in standardized form (Kase, Wallis, & Kase, 2003). After taping, the participants were asked to move with upper extremity only in functional range of movement to observe if there were any vascular problems. All the tests were explained to them before every test initiation.

Fig. 2 Kinesio tape muscle technique. The tape is applied from distal part to proximal with the 10% stretch

Biceps brachii muscle strength

Isokinetic tests flexion and extension of elbow joint with HUMAC NORM (Fig. 3) were used to quantify muscle strength before kinesio tape application (first measurement), 24 hours (second measurement) and 72 hours (third measurements) after it. Each subject completed a standard warm up with a Thera-Band before testing. It tooks from 5 to 10 minutes. Isokinetic testing was carried out with 5 repetitions at 60°/s, a break of 1 minute rest, and 3 repetitions at 60°/s. This medium joint speeds was recommended because of the test type which includes measurement concentric and eccentric contraction of the same muscle (Brown, 2000). Each repetition consists of concentric and eccentric biceps brachii contraction.

We evaluated peak torque, average power per best repetition and an angle of peak torque during eccentric biceps brachii contraction. *Peak torque* parameter was evaluated for comparison of concentric and eccentric figures. The eccentric figures should be 30% higher than the concentric figures (Brown, 2000). On the other hand peak concentric force will decrease with increasing speeds, whilst, peak eccentric force will rise initially with increasing speed then plateau and eventually decrease. Using this knowledge it is possible to work out how strong a subject is related to speed and plot this on a graph (known as a force velocity curve). Measurements of *power* can highlight differences between elite performers when peak torque figures appear fruitless (Kannus, 1994). Key parameter was *angle of peak torque*.

According to Kannus and Jarvinen (1990), weaker muscles probably due to neuromuscular facilitation show peak torque later in range.

Fig. 3 Isokinetic test flexion and extension of elbow joint with HUMAC NORM

Data analysis

Analysis of the differences between two types of kinesio tape application during eccentric biceps brachii contraction was performed using statistics software Statistica 8.0. Third and first measurement difference was evaluated as an increase for each parameter (peak torque, average power per best repetition, angle of peak torque). We got three date sets for kinesio tape application with the distal base and three date sets for proximal base. Measurements showed normal distribution.

First the null hypothesis was verified at the 5% significance level for each set separately. When the null hypothesis had been rejected we used the right-tail test at the 5% significance level. It confirmed that mean value of increase is greater than zero. Two types of kinesio tape application were compared through the paired t-test at the 5% significance level for each parameter.

3. Results

We processed results of third and first measurement difference. Results of second and first measurement difference are processed.

The null hypothesis was not rejected for peak torque and average power per best repetition of both kinesio tape application ways. There were no significant differences between measurements in time. It means that both types of kinesio tape application don´t influence peak torque or average power per best repetition. The null hypothesis was rejected for angle of peak torque of both application methods. Consequently the right-tail test confirmed that mean value of increase is greater than 0. Kinesio tape application with both ways has statistically significant effect on angle of peak torque and can support weaker muscles.

The paired t-test at the 5% significance level for each parameter compared two types of kinesio tape application. These tests confirmed that mean values of each parameter are equivalent. So there is no statistically significant difference of both kinesio tape application methods.

4. Discussion

Existing studies still include many unknowns mainly regarding process of the kinesio tape application and its influence on muscular activity. Alexander et al. have dealt with inhibition effect of the tape and kinesio tape applied along muscle fibre of trapezius and triceps surae muscle in their studies. Individual muscles were taped autonomously and it has been concluded that kinesio tape has no effect on muscular activity (Alexander, McMullan, & Harrison, 2008; Alexander, & Harrison, 2003).

Herzeele et al. (2013) evaluated kinesio tape effect through 3-dimensional scapular motion measurements during humeral elevation in the sagittal, frontal and scapular plane. The results showed that kinesio taping has moderate to large effect towards scapular posterior tilting, in all 3 planes of humeral movement and for all angles of elevation. Kinesio taping also moderately increased the scapular upward rotation at 30°, 60° and 90° of humeral abduction (Herzeele, Cingel, & Cools, 2013).

Kase et al. mention the direction of taping in their work. In case of traction from the start of the muscle to its insertion, muscle contraction is facilitated; in case of traction in the opposite direction, it is inhibited (Kase, Wallis, & Kase, 2003). However, here is an issue of whether to regard punctum fixum for the stepping forward movement aspect or for the supporting function provision. Other key point is type of contraction.

Important factor is the length of the kinesio tape application process. In order for the length of stimulation of soft tissues or the entire organism to be sufficient, it is necessary to

leave the tape on the applicable spot for three to four days. This should be followed by at least two-day´s break (Kase, Wallis, & Kase, 2003). However Slupik et al. (2007) have recorded the greatest effect of the tape in terms of increase of muscular tension 24 hours from its application and then 48 hours after its removal (application length: 24 hours).

It is also necessary to consider the extent of traction of the kinesio tape. In their studies, Kase et al. warn that less traction is sometimes more (Kase, Hashimoto, & Okane, 1996, Kase, Wallis, & Kase, 2003). Unfortunately, many studies do not state the extent of traction used. According to Vrbová et al. Itoha et al. have proven that a kinesio tape with maximum tension applied along fibres onto the lateral side of knee joint decreases latency of the hamstring stretching reflex (Itoh, Hayashi, & Kubota, 2004; Vrbová, Pavlů, & Pánek, 2011).

The condition of the organism plays a crucial role in measuring of muscular activity. The effect on a healthy organism and on an organism with a disorder resulting in muscular imbalance may be the same, but efficiency may vary or sometimes even be opposite (Aktas & Baltaci, 2011; Fu, Wang, & Lin, 2008; Vrbová, Pavlů, & Pánek, 2011).

5. Conclusions

Results of third and first measurement difference showed that kinesio tape application with both ways has statistically significant effect on angle of peak torque. On the other hand kinesio tape application don´t influence peak torque or average power per best repetition. There is no statistically significant difference of both kinesio tape application methods.

When we evaluated results of previous researches and ours we have an idea that kinesio taping influences quality of muscle tissue. Muscle strength is influenced with many factors as muscle tissue quality or motor control. Therefore, we would like to proceed in this direction.

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