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Influence of myofascial taping application on postural stability in adolescents with pain in the anterior joint of the knee

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ABSTRACT

Introduction: Regardless of the cause of pain in the anterior joint of the knee, therapeutic possibilities aside from kinesitherapy also include myofascial applications using Flexotape tape.

Aim: The aim of the research is to analyze the postural stability of the lower limbs after the application of myofascial taping (Flexotape) for pain in the knee joints.

Material and methods: Seventeen patients with pain in the anterior compartment of the knee at age 13–17 were enrolled in the study. A two-plate posturograph CQW2P-vUSB consisting of two platforms with embedded sensors was used for the measurements. The first test was performed without the application of taping. The second examination was performed directly after applying the application and the third test was half an hour after applying the taping. The Flexotape application was placed in the area of the strainer fascia of the broad, painful lower limb.

Results: The total length of the statokinesiogram (SP_EO) path counted in both axes does not change during the tests. The attached taping application does not affect the change of the statokinezjogram (SA_EO) surface area and the mean deflection of the foot pressure center in the direction of the AP axis. However, it has a statistically significant effect at the level of $\alpha = 0.01$ for the deflection of the foot pressure center in the direction of the ML axis.

Discussion: The present study shows that stretching and the selective work of muscle strengthening is not sufficient to improve the function of the lower limb with pain symptoms. The use of myofascial taping as a support in the process of rehabilitation seems to be the most justified, because its impact on the fascial system can affect the reduction of pain and improve the stability of the lower limb.

Conclusions: The Flexotype application improves the average deflection of foot pressure only in the frontal plane. The other parameters of postural stability remain unchanged. The application used in this study does not reduce the pain.

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1. INTRODUCTION

Ailments of anterior knee joint pain in adolescents relate to a significant group of patients who apply to orthopedic and rehabilitation clinics. The etiology of pain is often not conclusive. Many studies indicate a complex problem resulting from patellar patency, patellar instability, abnormalities in the lower limbs, asymmetry of the pelvis, low motor activity or excessive loads resulting from practicing sports.[1–5] Patients who have been qualified for conservative treatment after the diagnosis are being subjected to physiotherapy. The use of modern physiotherapeutic methods based on detailed diagnostics allows patients to quickly return to functioning in daily life without any ailments.[6–8] One of the methods used in this case is myofascial taping with the use of Flexotape tapes, where the goal is to regulate myofascial tone to obtain better stability within the application and to reduce pain.[9,10] In recent years, methods of supporting rehabilitation have been widely disseminated. These methods include Kinesiology Taping. The methodology is based on the use of Kinesiotape tapes, which are made of cotton and have an extensibility approximating the flexibility of the muscles. The methodology of the application depends on the patient's needs. Through appropriate applications, it can affect the skin, muscles, joints and lymphatic system.[11–13] Variations of the taping are spreading relatively quickly. Myofascial taping (flexotaping) is becoming more and more popular, the assumptions of which are derived mainly from the theory of Tensegrity, or the use of anatomical tapes. The method of gluing is based on the anatomical patterns of the muscle chains. The applications are glued on stretched myofascial structures.[9,10] The composition of the cotton adhesive tape is different and it has greater extensibility than the tapes used for kinesiotaping. So far, there are no studies that provide specific information about the effects of myofascial taping (flexotaping). Therefore, an attempt was made to analyze postural stability after applying flexotaping.

2. AIM

The aim of the study is to analyze postural stability after application of the myofascial taping (Flexotape) for knee joint ailments.

3. MATERIAL AND METHODS

Seventeen patients (aged 13–17) with pain in the anterior compartment of the knee were enrolled in the study. The methodology used a two-plate posturograph CQW2P-vUSB, which consists of two platforms with embedded sensors. The platforms were connected via a USB connection to a computer that records all data in real time. The apparatus used during the study has a specification and appropriate standards for the use of this type of equipment.[14–16] The patients were examined without shoes, in a free-standing position with the head set in a straight line and with the eyes focused at one point, and then with eyes closed. Upper limbs were laid freely along the torso. The apparatus was reset before each test (Figure 1).

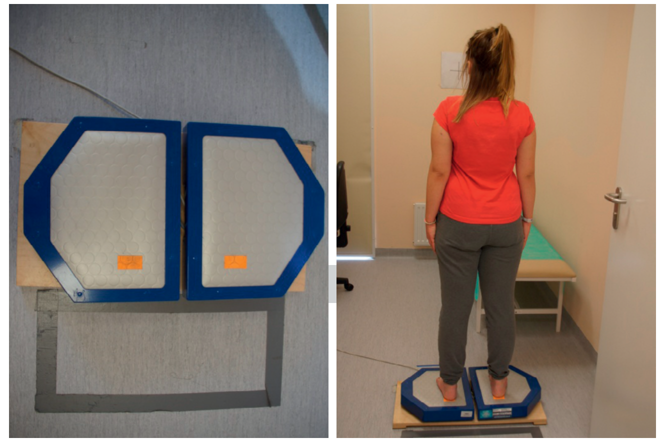

Figure 1. 2-plate posturograph and examination of the patient in a standing position.

Three parts of the study were planned for the analysis of postural stability: (1) without the flexotape application, (2) directly after the application of the Flexotapping, and (3) 30 minutes after the application of the taping. Three parts of the study were carried out with eyes opened and closed. Each part of the study was carried out using identical procedures. First entry into a 2-plate posturograph: eyes opened, 15 s of adaptation to the tested position, 30 s of proper examination, descent from 2-plate posturograph to a designated rectangle. Second entry: eyes closed from the moment of setting the feet on the platforms and repeating all activities from the first part of the test. The Flexotape application was placed in the area of the wide fascia stretcher of the painful lower limb, according to the myofascial taping methodology. To attach the tape, the patient was placed on a healthy side, positioning the painful lower limb in the abduction, bent at the hip and knee joint at a 90°. The tape was glued at a height of 5 cm from the popliteal perimeter along the ilium-tibial band towards the greater trochanter. The length of the first application was 15–20 cm with a tension of about 70%. The second tape was glued from the end of the first application laterally towards the anterior hip spine on the iliac crest with an average length of 15 cm and a stretch of 70% (Figure 2).

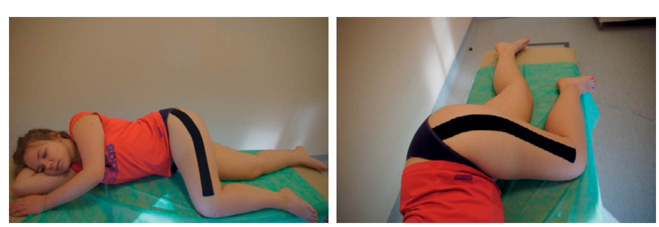

Figure 2. Application of taping to the area of the limb wide fascia stretcher affected by pain in the area of the front compartment of the knee.

In addition, the subjective pain perception of the patient was analyzed using a numerical rating scale (NRS) before application and 30 minutes after applying the taping.

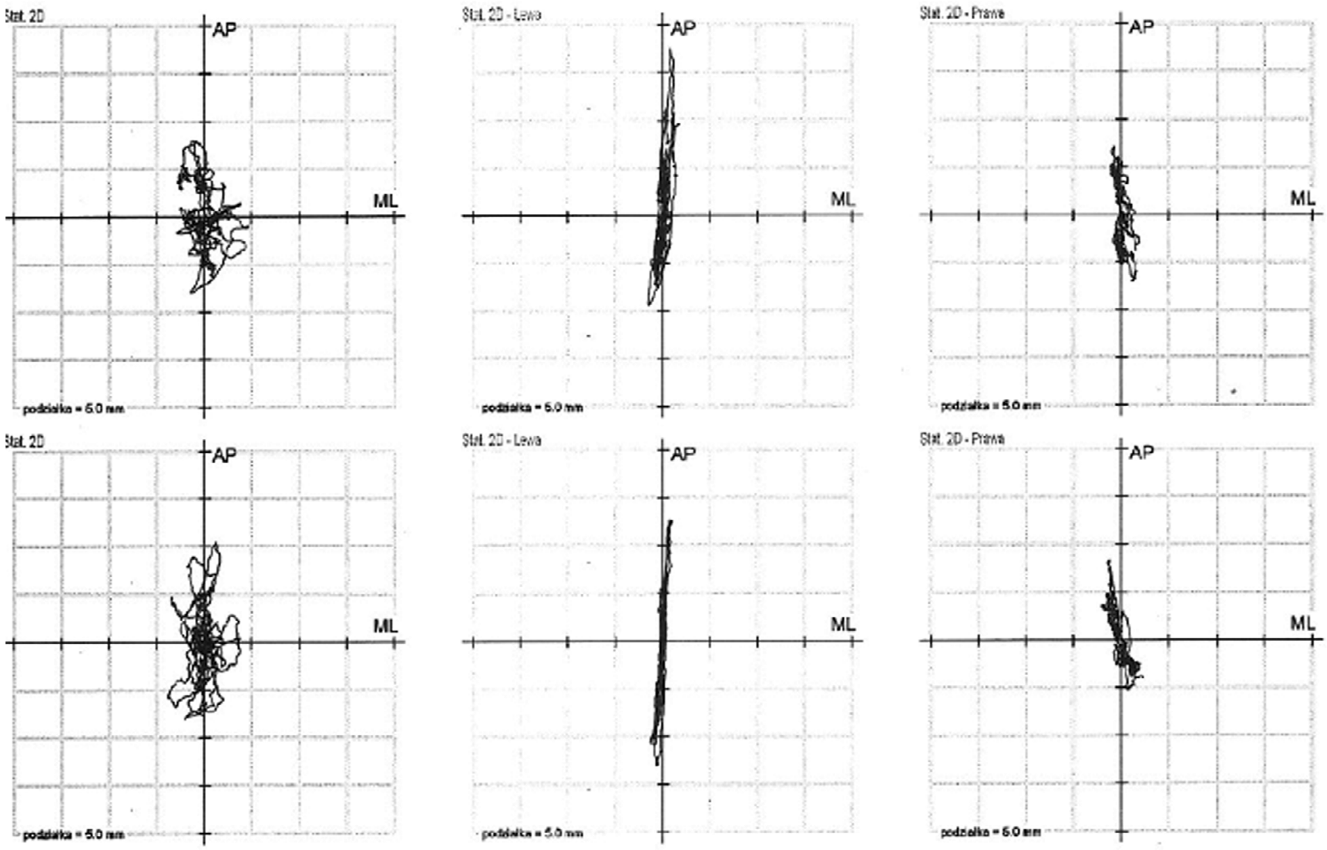

Figure 3. An exemplary graph of the 2-plate posturograph test result.

4. RESULTS

In the statistical analysis, the student's t-test was used to analyze the mean values of the total statokinesiogram path, center of pressure (CoP) surface area, mean values of the foot pressure from the point O towards the anterio-posterio axis (AP) and the medio-laterale (ML) axis (Figure 3).

In the Student's t-test, hypotheses were put forward: the average value of the analyzed feature does not change depending on the tested foot (Ho), the average value of the analyzed feature changes depending on the tested foot (H1).

The results of the tests are presented in Tables 1–5.

Table 1. The Student's *t*-test results for the total statokinesiogram track counted in both 2D axes (SP-EO).

Feature	SP-EO	Comparison between feet		
Examination number	1	2	3	Total
Degrees of freedom *df*	16	16	16	2
Empirical *t*	3.45	3.12	2.97	1.39
Tabular *t* α = 0.05	2.12	2.12	2.12	4.30
Tabular *t* α = 0.01	2.92	2.92	2.92	9.92
Conclusion based on α = 0.05	reject Ho	reject Ho	reject Ho	accept Ho
Conclusion based on α =0.01	reject Ho	reject Ho	reject Ho	accept Ho

Table 2. The Student's *t*-test results for the size of the surface area of the statokinesiogram defined by the center of gravity (SA_EO).

Feature	SA_EO	Comparison between feet		
Examination number	1	2	3	Total
Degrees of freedom *df*	16	16	16	2
Empirical *t*	1.87	1.68	2.63	1.63
Tabular *t* α = 0.05	2.12	2.12	2.12	4.30
Tabular *t* α = 0.01	2.92	2.92	2.92	9.92
Conclusion based on α = 0.05	reject Ho	reject Ho	reject Ho	accept Ho
Conclusion based on α =0.01	reject Ho	reject Ho	reject Ho	accept Ho

Table 3. The Student's t-test results for mean values of the foot pressure center (MAAP_EC) from point O in the direction of the AP axis.

Feature	MAAP_	Comparison between feet		
Examination number	1	2	3	Total
Degrees of freedom *df*	16	16	16	2
Empirical *t*	3.38	2.95	3.43	1.45
Tabular *t* α = 0.05	2.12	2.12	2.12	4.30
Tabular *t* α = 0.01	2.92	2.92	2.92	9.92
Conclusion based on α = 0.05	reject Ho	reject Ho	reject Ho	accept Ho
Conclusion based on α =0.01	reject Ho	reject Ho	reject Ho	accept Ho

Table 4. The student's t-test results for the mean values of the foot pressure center (MAML_EC) from the point O in the direction of the ML axis.

Feature	MAML_EC	Comparison between feet		
Examination number	1	2	3	Total
Degrees of freedom *df*	16	16	16	2
Empirical *t*	3.00	2.51	2.62	1.18
Tabular *t* $\alpha = 0.05$	2.12	2.12	2.12	4.30
Tabular *t* $\alpha = 0.01$	2.92	2.92	2.92	9.92
Conclusion based on $\alpha = 0.05$	reject Ho	reject Ho	reject Ho	accept Ho
Conclusion based on $\alpha = 0.01$	reject Ho	accept Ho	accept Ho	accept Ho

The analysis of partial variance was used to calculate the subjective pain assessment.

Table 5. Subjective pain assessment according to the NRS scale.

Groups	Number of subjects	Sum	Mean	Variance
Examination 1	17	76	4.47	5.89
Examination 2	17	52	3.06	4.18
Examination 3	17	48	2.82	3.40

Source of variance	SS	*df*	MS	*F*	*P* value	*F* test for $\alpha = 0.05$	*F* test for $\alpha = 0.01$
Between groups	26.98	2	13.49	3.00	0.06	3.19	5.07
Within groups	215.64	48	4.49				
Total	242.63	50					

5. DISCUSSION

The diagnostics and proper selection of therapeutic methods are very important factors to effectively cure patients conservatively. The dynamic development of physiotherapeutic methods allows a wide impact on the musculoskeletal system through selective strengthening exercises, stretching, functional training, and proprioceptive exercises. The modern rehabilitation program in the ailments of the frontal knee includes stretching exercises of the sciatic-tibial muscles, quadriceps, activating the broad fascia muscle, building the axiality of the lower limbs, taking into account the correct patellar track, and also strengthening the medial torso, which facilitates proper visuo-motor coordination and a more economical function of the body in space. Research shows that stretching, selective work to strengthen muscles, is not sufficient to improve the function of the lower extremity with pain symptoms.[3,17] It is important to choose the right functional training in the most common dysfunctions of the knee. Also, an important thing is to prevent injuries in adolescents practicing the most popular sport disciplines.[6,19,20] However, an incorrectly selected exercise program may adversely affect the knee joint, pelvis or lower limb functioning in the kinematic chain.[4,21] Many authors emphasize that it is important to introduce proprioceptive exercises into the rehabilitation program.[6–10] Exercises should be selected along with the adaptation of appropriate nerve fibers useful for a specific movement in space. Studies show that surface layers, not deep ones, have a denser network of mechanoreceptors and process information from the myofascial system. It is particularly important to pay attention to the areas affected by pain.[22,23] Posture control and its stability depend on many factors, including the proprioception and feedback neuromuscular reactions.[8,22] The use of myofascial taping as a support in the process of rehabilitation seems to be the most justified, because its impact on the fascial system can affect the reduction of pain and improve the stability of the lower limb.[24,25] Our research shows that the total length of the statokinesiogram (SP-EO) path counted in both axes does not change during the tests (Table 1). Attached along the wide fascia strainer application of taping has no effect on the change of the tested parameters. The results of the surface area statokinesiogram (SA-EO) measurements delineated by the COP do not change during all tests (Table 2). This means that the taped application does not affect the surface of the loaded feet. Sticky taping applications in the second and third study do not affect the mean deflection of the center of the foot pressure in the direction of the AP axis, i.e. the sagittal plane (Table 3). The application of taping in the wide fascia strainer area has a statistically significant effect at the level $\alpha = 0.01$ on the deflection of the foot pressure center in the direction of the ML axis (Table 4). This is important information about the local effects of the taping application and its impact on the frontal plane. The tested parameters do not change depending on the time of applying the application, i.e. the taping works immediately after sticking and it persists for some time after sticking. The subjective evaluation of the pain showed no statistically significant differences during the tests. This means that the intensity of the pain did not change after applying the application in the wide fascia stretcher area (Table 5). The results suggest that flexotaping should be applied to each patient individually, with consideration of the functional tests and the location of the pain reported by patients, to reduce the pain.[24–31]

6. CONCLUSIONS

1. The Flexotape application improves the average deflection of foot pressure only in the frontal plane.
2. The other parameters of postural stability remain unchanged.
3. The application used in the study does not affect pain reduction.

Conflict of interest

None declared.

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