Piotr Jakubów[1], Anna Kuryliszyn-Moskal[2], Marcin Przegaliński[2], Agnieszka Dakowicz[2], Paweł Konarzewski[2], Andrzej Niewiński[2], Katarzyna Krystyna Snarska[3], Anna Ślifirczyk[4]

[1]Departament of Clinical Pharmacology, Medical University of Bialystok
[1]Zakład Farmakologii Klinicznej Uniwersytetu Medycznego w Białymstoku
[2]Departament of Rehabilitation, University Hospital in Bialystok
[2]Klinika Rehabilitacji Uniwersyteckiego Szpitala Klinicznego w Białymstoku
[3]Medical University of Bialystok
[3]Uniwersytet Medyczny w Białymstoku
[4]Institute of Health, Pope John Paul II State School of Higher Education in Biala Podlaska
[4]Instytut Zdrowia, Państwowej Szkoły Wyższej im. Papieża Jana Pawła II w Białej Podlaskiej

Efficiency of shock wave therapy in patients with "tennis elbow" - preliminary study

Ocena skuteczności fali uderzeniowej u pacjentów z „łokciem tenisisty" - doniesienie wstępne

Summary
The increase in the number of patients with chronic pain of lateral elbow region ("tennis elbow") has been observed in recent years. The aim of the study was to evaluate the efficiency of extracorporeal shock wave therapy in treatment of patients with "tennis elbow". The examination embraced 10 patients with recognized "tennis elbow" who underwent clinical evaluation including the level of pain intensity according to visual analogue scale (VAS), functional tests and Mayo Elbow Performance Score (MEPS).
Conducted examinations proved that application of shock wave therapy leads to the reduction of pain estimated by VAS, improvement of functional tests results and progress in efficiency of elbow joint estimated by MEPS.
Basing on conducted examinations, it may be stated that application of extracorporeal shock wave therapy is an effective, non-invasive method of treatment of pain connected with "tennis elbow".

Key words: extracorporeal shock wave therapy, tennis elbow

Streszczenie
W ostatnich latach obserwowany jest wzrost pacjentów z przewlekłą bolesnością bocznego przedziału stawu łokciowego czyli tzw. „łokciem tenisisty". Celem pracy była ocena skuteczności zastosowania zogniskowanej fali uderzeniowej (ESWT) w leczeniu chorych z „łokciem tenisisty". Badaniem objęto 10 pacjentów z rozpoznaniem łokcia tenisisty, u których przeprowadzono ocenę kliniczną, obejmującą stopień nasilenia bólu według skali VAS, testy funkcjonalne oraz kwestionariusz wydajności stawu łokciowego (MEPS).
Przeprowadzone badania wykazały, że zastosowanie fali uderzeniowej powoduje zmniejszenie dolegliwości bólowych ocenianych w skali VAS, wykazano poprawę wyników testów funkcjonalnych oraz poprawę wydajności stawu łokciowego, ocenianego kwestionariuszem MEPS.

Na podstawie przeprowadzonych badań można stwierdzić, że zastosowanie zogniskowanej fali uderzeniowej jest skuteczną, nieinwazyjną metodą w leczeniu dolegliwości bólowych występujących w przebiegu „łokcia tenisisty".

Słowa kluczowe: zogniskowana fala uderzeniowa, łokieć tenisisty

Introduction

Lateral epicondylitis ("tennis elbow") includes disorders of ulnar extensor muscle of wrist in the area of its proximal attachment to the lateral epicondyle of humerus. The area of the most visible disorders is the proximal attachment of radial extensor muscle of the wrist. Overloads and recurrent injuries of this area may lead to fibroses and micro-tears of exposed tissues (Gaździk 2000, Veneziano et al. 2006).

The disease occurs in 1 patient per every 200 while the proportion of women and men with this problem is 5:4. The most frequently, tennis elbow syndrome occurs in middle-aged patients (approximately 35-45 years old) (Platssman, Kokosz 1997, Veneziano et al. 2007).

According to Krushnaar and Nirschl, as a result of overload, cells which do not develop in the direction of healthy tendon create large amount of fibroblasts, what is more, vascular hypertrophy occurs and disorganized collagen causes angiofibroblastic hypertrophy (Krushaara, Nirschl 1999). It has been proved that it is a physiological result of the rupture in collagen structure. Pathological changes are observed on the sterile area of inflammation and edema which occur after defragmentation of single fibers of the tendon. After a longer period of time edema develops on scars and exostoses. Patient suffers from the pain of tendons which became less solid (Wittek 1999). The pain may radiate to the humerus or wrist and may be experienced at the moment of resisting the contact and pressure from the physician. What is more, impairment of muscle strength and gradual limitation of upper limb functions occur (Gaździk 2000; Duk, Szykuła 1997). The pain of lateral elbow region may be caused by many different factors including enthesopathy of extensor muscles of wrist and fingers, brachioradial joint bursitis, fibrosis and pain of annular ligament, posttraumatic synovitis of cubital joint with hemorrhage to the articular cavity, hypertrophy of synovial bursa between the head of radial bone and the head of humeral bone, calcium deposits in the area of extensor muscles of wrist and fingers, neuropathies of posterior musculospinal nerve, periostitis, tendinitis, inflammatory states of ligaments and joint capsule as well as brachioradial joint degenerations (Tylman, Dziak 1986).

The most comprehensive and differentiating diagnostic method for "tennis elbow" has been described by Winkiel. He emphasized that the examination of elbow joints should be conducted according to the following order: medical interview, physical examination (palpation) and functional tests (Ryngier et al. 1999).

In the diagnostics of "tennis elbow" following imaging examinations are also applicable: roentgenography (RTG), computer tomography (CT), magnetic resonance (MR), ultrasonography (USG) and blood examination (Ryngier et al. 1999).

Available literature describes many methods of treatment of pain connected with "tennis elbow". As a first step, cooling of the elbow may bring alleviation of pain. Alternating hot and cold baths of injured joint are also recommended. Other methods of treatment are ultrasounds, iontophoresis with non-steroidal anti-inflammatory drugs

and application of low-frequency currents. Those methods are based on the analgetic, anti-inflammatory and anti-edema properties of physical stimuli (Pilecka, Hagner 2004). Cyriax transverse massage (Stasinopoulos et al. 2005) and kinesiotherapy (Walaszek et al. 2005) are also frequently recommended. Other conservative method of treatment could be the injection of glucocorticoids (Świerkot et al. 2008), however, it may lead to the atrophy of subcutaneous tissue. When conservative treatment does not bring expected results, surgical procedure is recommended (Świerkot et al. 2008).

Extracorporeal shock wave therapy brings satisfactory results in conservative treatment (Korabiewska et al. 2010; Franek et al. 2012; Król et al. 2012; McClure, Weinberger 2003; Stokłosa, 2009). Extracorporeal shock wave therapy may be applied as a three-dimensional method or on a small, specified surface with simultaneous ultrasonographic control (McClure, Weinberger 2003). In the first method, approximate localization of the change is defined using ultrasonography and radiography and the sensor is applied on the surface of the deformity without ultrasonographic control. Furthermore, the sensor embraces the larger surface than the one defined by USG or radiography. During the second examination, the sensor is placed in the same defined surface of the deformity. Along with increased dose of energy, USG control is recommended and the wave should be directed into the precise surface of the deformity according to the possibility of damage of surrounding structures of intact soft tissues (McClure, Weinberger 2003). The mechanism of analgetic properties of shock wave includes blocking of the transmission of nociceptive signal through the stimulation of nerve ends to the level allowing pain control. What is more, energetic impulses stimulate metabolism, improve blood circulation and collagen synthesis which influence significant acceleration of soft tissues regeneration. The activity of shock wave improves blood supply in tissues, has regenerative properties and may also disintegrate calcified cells of connective tissue, like for instance, fibroblasts. Muscle relaxing properties of shock wave therapy are also extremely beneficial (McClure, Weinberger 2003).

The aim of the study was to evaluate the efficiency of extracorporeal shock wave therapy in patients with "tennis elbow". In the study, the answers for following questions should be obtained:

1. Whether applied therapy influences the decrease of the level of pain estimated by visual analogue scale (VAS)?
2. Whether applied therapy influences the improvement of results of functional tests?
3. Whether applied therapy influences the improvement of functionality of elbow joint estimated by Mayo Elbow Performance Score (MEPS)?

Material and methods

Examination included 10 patients (7 women and 3 men aged 36-60) treated in the Department of Rehabilitation, University Hospital in Białystok who revealed "tennis elbow" after medical interview, physical examination and ultrasonography (USG).

Clinical evaluation regarded the level of pain intensity according to visual analogue scale (VAS). Graphic, numerical, 10cm scale has been applied where patient pointed the value of his/her actual pain. Two ends of the scale were the marginal levels of pain. "0" responded to the lack of pain and "10" was the maximum pain. Patients also completed the Mayo Elbow Performance Score (MEPS) estimating the capacity of elbow joint.

Patients defined the type of pain, the range of joint mobility, stability and dealing with everyday activities such as combing, eating, everyday hygiene, putting on clothes and shoes. The maximum score in MEPS was 100 and in such case the capacity of joint was defined as very good. Between 75 and 89 points the capacity was established as good, 60-74 points – satisfactory and less than 60 points indicated low capacity.

Physical examination of patients embraced palpation and functional tests: chair test, Cozen's test, Mill's and Maudsley's tests which confirmed the presence of tennis elbow syndrome. All examinations have been conducted before and after applied treatment.

Physical therapy program included application of EWST onto lateral epicondylitis. 4 series of the procedure have been performed once a week with 5-7 days intervals between the single procedures. Following parameters have been applied during the therapy: constant mode of activity, the pressure of 2 bars, 10Hz frequency, the amount of strokes of 2000. The therapy was initiated with application of the transducer to the most painful area with 400 strokes, 2 bars, 5Hz, afterward, the therapy was extended on surrounding tissues of the muscles of forearm with 1000 strokes. The last series consisted of 400 strokes with 10Hz frequency. Patients during the therapy have not been the subject of other therapies.

Results

Before the initiation of the therapy, positive tests results were noticed in the majority of patients: Mill's test in 90% of patients, Maudsey's in 100%, Cozen's in 90%, chair test in 100% and palpation in 100% of patients. The level of pain intensity according to VAS was determined for 6.5cm and according to MEPS for 55.5 points which indicated low capacity of elbow joint (Tab. 1).

After the termination of the treatment, 60% of patients did not experience pain during palpation. The occurrence of positive functional tests results reduced by half. The level of pain intensity according to VAS was determined for 2.6cm and according to MEPS for 79.5 points which indicated significant improvement and very good capacity of elbow joint (Tab.2). Obtained results were statistically significant.

Tab. 1 The results of clinical evaluation before physical therapy in examined group of patients

	Palpation	Mill's Test	Maudsley's Test	Cozen's Test	Chair Test	VAS
1	+	+	+	+	+	7
2	+	+	+	+	+	5
3	+	+	+	+	+	8
4	+	+	+	+	+	7
5	+	+	+	+	+	5
6	+	+	+	+	+	7
7	+	+	+	+	+	4
8	+	-	+	-	+	6
9	+	+	+	+	+	10
10	+	+	+	+	+	6

Tab. 2 The results of clinical evaluation after physical therapy in examined group of patients

	Palpation	Mill's Test	Maudsley's Test	Cozen's Test	Chair Test	VAS
1	-	-	-	-	-	2
2	+	+	+	+	+	4
3	+	-	+	+	+	3
4	+	-	-	-	-	0
5	+	-	-	-	-	1
6	+	-	-	+	+	3
7	+	+	+	+	+	2
8	+	-	-	-	+	3
9	+	+	+	+	+	8
10	+	+	+	+	+	0

Discussion

In recent years, the increase of the amount of patients with chronic pain of lateral elbow region ("tennis elbow") has been observed. It is a result of environmental and civilization changes which influence the way of aggravation of upper limbs, shoulders and the whole trunk. The crucial role in the treatment of "tennis elbow" plays conservative treatment which includes, among others, physical therapy.

The aim of the study was to evaluate the efficiency of conservative treatment with the extracorporeal shock wave therapy in patients with "tennis elbow".

Although, the mechanism of this procedure has not been fully explained it is assumed that beneficial influence of shock wave therapy on "tennis elbow" treatment is probably connected with the micro-destruction. Strokes cause micro-tears of avascular or poorly vascularized tissues with simultaneous stimulation of revascularization through the release of local growth factors and mobilization of proper stem cells (Stokłosa 2009).

The study has been conducted among 10 patients. Physical examination included basic clinical tests, evaluation of pain by visual analogue scale and Mayo Elbow Performance Score recommended by other authors (Korabiewska et al. 2010; Franek et al. 2012; Król et al. 2012; McClure, Weinberger 2003; Stokłosa 2009).

In own material, in the group of patients treated with shock wave therapy, it was observed that the level of pain according to VAS established for 6.5cm after the treatment decreased to the value of 2.6cm. It proves the fact that applied treatment reduces the pain in patients with "tennis elbow".

Similar results have been obtained by Korabiewska et al. The group of 20 patients was treated with shock wave therapy. 4 procedures have been conducted with 3-4 days intervals between them with the following parameters: constant strokes in the number of 2000 with the pressure of 2 bars and 10Hz frequency. Examined patients before the treatment suffered from pain of 2-8 degrees of intensity and after the procedure the level of pain was 0-5 degrees. Comparison of the average values of particular parameters led to the conclusion that differences in the evaluation of pain before and after the procedures were statistically significant. Differences proved the reduction of the level of pain intensity and frequency as well as the decrease of analgesics intake and reduction of limitations in physical activity after applied procedures (Korabiewska et al. 2010).

Aforementioned study remains compatible to the results obtained from own material where all examined patients noticed the improvement in everyday activities observed in high values of MEPS. Before the initiation of the therapy, patients described the functionality of elbow joint as low, however, it improved significantly after the termination of physical therapy.

In another study, Franek et al. applied shock wave therapy in 10 patients performing 3 procedures with 1 week intervals. Before the initiation of the series of procedures and directly after its termination, patients evaluated the pain and strength of muscles responsible for flexion and extension of wrist as well as flexion of fingers. After the termination of the therapy, they observed statistically significant reduction of pain. Before the treatment, VAS was established for 5.9 cm and after the treatment it was 2.7 cm (Franek et al. 2012).

Marks et al., similarly, applied shock wave therapy in the area of the strongest pain. During the first session, each patient received 500 strokes and further 2000 strokes with 3 days intervals. Before every session, the intensity of pain had been examined using VAS. Statistically significant reduction of pain intensity according to VAS has been observed after each session and remained at the same level for 6 months after the end of therapy (Marks et al. 2005).

Basing on the conducted examinations it may be stated that application of shock wave therapy is an effective, non-invasive method of treatment of pain connected with "tennis elbow". Performed treatment provided to the significant improvement of patients health state.

The result of this study is similar to the results obtained by other scientists. Shock wave therapy is an effective, new method of pain treatment without any adverse effects (Dziak, Tayara 1999, Veneziano et al. 2007).

Presented research is the preliminary study. In further stages of conducted examinations, extension of examined group of patients and formation of comparable control group are recommended.

Conclusions

1. Extracorporeal shock wave therapy influenced the decrease of pain intensity measured by visual analogue scale (VAS).
2. The therapy improved the results of functional tests.
3. The therapy improved the functionality of elbow joint estimated by Mayo Elbow Performance Score (MEPS).

Bibliography

1. Duk A., Szyguła Z. (1997) Łokieć tenisisty – patomechanizm uszkodzenia, profilaktyka. „Medycyna Sportowa" 66: 15-19.
2. Dziak A., Tayara S. (1999) Urazy i uszkodzenia w sporcie. Kraków, Wydawnictwo Kasper.
3. Franek A., Kusz D., Durmała J., Król P., Wilk R., Detko E., Wnuk B., Dolibog P., Błaszczak E., Dolibog P., Błaszczak E., Dolibog P., Wiercigroch L., Taradaj J. (2012) Próba wykorzystania zogniskowanej fali uderzeniowej w leczeniu wybranych schorzeń ortopedycznych - doniesienie wstępne. „Fizjoterapia Polska" 2(4), 12: 147-158.

4. Gaździk T. (2000) Choroby stawu łokciowego. PZWL, Warszawa.
5. Korabiewska I., Sipko H., Lewandowska M., Białoszewski D. (2010) Ocena skuteczności leczenia falą uderzeniową i terapią skojarzoną pacjentów z tzw. łokciem tenisisty. „Acta Balneologica" Tom 52, 2(120): 76-83.
6. Król P., Franek A., Wiercigroch L., Porębska B., Franek E., Dolibog P., Dolibog P., Zinka W., Król T. (2012) Aktualny stan wiedzy na temat zogniskowanej i radialnej fali uderzeniowej w ortopedii i fizjoterapii. Cz.1. „Fizjoterapia Polska" 2(4), 12: 83-100.
7. Krushaara B.S., Nirschl R.P. (1999) Tendinosis of the Elbow (Tennis Elbow). Critical Features and Findings of Histological, Immunohistochemical, and Electron Microscopy Studies. „J Bone Joint Surg Am" 81: 259-279.
8. Marks W., Lasek J., Jackiewicz A., Lisiecka- Tyszko S., Gwoździewicz J., Stasiak M. (2005) Leczenie przewlekłych stanów zapalnych tkanek miękkich w okolicach struktur kostnych przy użyciu źródła zewnątrzustrojowych, niskoenergetycznych fal uderzeniowych nowej generacji - badanie prospektywne. „Kwart. Ortop" 3: 216-221.
9. McClure S., Weinberger T. (2003) Extracorporeal Shock Wave Therapy: Clinical Applications and Regulation. Clinical Techniques in Equine Practice: 358-367.
10. Pilecka K., Hagner W. (2004) Łokieć tenisisty: przyczyny, diagnostyka, sposoby leczenia, profilaktyka. „Kwart Ortop" 1: 22-27.
11. Plaatsman G.P., Kokosz M. (1997) Leczenie „łokcia tenisisty" jako zespołu. „Medycyna Manualna" 1(2): 3-6.
12. Ryngier P., Saulicz., Dworaczek G. (1999) Diagnostyka funkcjonalna oraz leczenie łokcia tenisisty. „Fizjoterapia" 7(3):52-55.
13. Stasinopoulos D., Stasinopoulou K., Johnson M.I. (2005) An Exercise Programme for The Management of Lateral Elbow Tendinopathy. „Br J Sports Med" 39: 944-947.
14. Stokłosa K. (2009) Fala uderzeniowa – podstawy teoretyczne i zastosowanie kliniczne. „Rehabilitacja w Praktyce" 1: 35-37.
15. Świerkot J., Marczyńska-Gruszecka K., Borysewicz K., Śmiechowicz H. (2008) Wybrane zespoły bólowe tkanek miękkich okołostawowych. Family Medicine & Primary Care Review, 10(1): 87-93.
16. Tylman D., Dziak A. (1986) Traumatologia narządu ruchu. PZWL, Warszawa.
17. Walaszek R., Kasperczyk T., Kużdżał A. (2005) Kompleksowy program postępowania fizjoterapeutycznego w zespole bólowym bocznego przedziału stawu łokciowego (tzw.łokieć tenisisty). „Fizjoterapia Polska" 5(4): 451-456.
18. Wittek R. (1999) Łokieć tenisisty – diagnoza i fizjoterapia. „Fizjoterapia" 7(1): 42-45.
19. Veneziano Ch., Matthew J., Nofziger J., Nirschl R.P. (2006) Anatomia i badanie fizykalne stawu łokciowego W: Ręka, łokieć, ramię. (red.) T.Sz. Gaździk. Elsevier Urban&Partner. Wrocław.
20. Vicenzino B., Cleland J.A., Bisset L. (2007) Joint Manipulation in The Management of Lateral Epicondylalgia: A Clinical Commentary. „The Journal of Manual & Manipulative Therapy": 50-56.

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