

Wartość terapeutyczna krioterapii miejscowej w leczeniu objawowym pacjentów z zespołem bólowym stawu barkowego

Therapeutic value of local cryotherapy in symptomatic treatment of patients with shoulder joint pain syndrome

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Streszczenie:

Wstęp. Cel przeprowadzonych badań opierał się na ocenie wpływu zabiegów krioterapii miejscowej na zakres ruchomości w stawie barkowym u pacjentów z chorobą zwyrodnieniową stawów. Uwzględniono w nim ruch zgięcia i wyprostu. Dodatkowo analizowano potencjalne zmiany w dolegliwościach bólowych wśród badanych pacjentów.

Materiał i metody. Grupa badana liczyła 54 pacjentów, wśród których wyróżniono 31 kobiet i 23 mężczyzn. Pacjentów poddano 15-tu codziennym zabiegom krioterapii miejscowej na okolicę stawu barkowego. Przed przystąpieniem do zabiegów został zebrany wywiad odnośnie chorób współistniejących, a także zbadano dolegliwości bólowe według skali VAS. U wszystkich badanych wykonano pomiar zakresu ruchów w stawie barkowym za pomocą goniometru. Został on wykonany przed rozpoczęciem terapii, a także po jej zakończeniu.

Wyniki. Wśród wszystkich badanych pacjentów, poddanych serii zabiegów krioterapii miejscowej można stwierdzić znaczną poprawę w zakresie ruchu zgięcia i wyprostu w stawie barkowym. Rozpatrując dolegliwości bólowe oceniane za pomocą skali VAS, po zakończeniu terapii wykazano pokaźne zmniejszenie deklarowanych wartości dolegliwości bólowych wskazywanych przez badanych na skali VAS.

Wnioski. Krioterapia miejscowa jest niezawodną metodą, która skutecznie redukuje dolegliwości bólowe, jednocześnie wpływając na poprawę zakresu ruchów w stawie barkowym u pacjentów z zespołem bólowym stawu barkowego.

Słowa kluczowe:

zimnolecznictwo, staw barkowy, krioterapia

Abstract

Introduction. The aim of this study was to determine the effects of the cryotherapy treatment on the mobility of the shoulder joint of the patients with osteoarthritis. We took into consideration the motion of flexion and extension. Additionally, the potential changes in the pain complaints were analyzed.

Material and methods. We examined 54 patients in the study, including 31 women and 23 men. They were put through the local cryotherapy on the shoulder joint 15 times daily. Before participating, all patients gave their informed consent to take part in the study and they were asked to rate their pain in the Visual Analogue Scale (VAS). The range of motion in the shoulder joint of every patient was measured by goniometer before and after cryotherapy.

Results. All patients who underwent the series of cryotherapy had significant improvement of flexion and extension in the shoulder joint. Taking into consideration the general analysis of pain rated in the VAS score by the participants, we observed a significant reduction in the values of VAS indicated by the patients after the series of treatments.

Conclusions. Local cryotherapy is a reliable method that reduce pain and improve range of motion in the patients with pain syndrome of the shoulder joint.

Key words:

cryotherapy, shoulder joint, cold therapy

Introduction

Every human body is subjected to overload in life. It is connected with physiological necessity of movement, increased physical activity and work requirements. So far there is no effective solution that could prevent the premature joint degeneration. Taking into consideration the general population, the cause of the pain coming from motor organs is the frantic pace of life. Soft tissue damage is not always caused by strong injury. Some of them are formed by overlapping microinjuries and overloading, which can result from daily activities (raising of the hand 3-4 thousand times daily) [1]. The shoulder joint injury is not uncommon and it is observed not only in athletes. It is very inconvenient because the joint takes part in every move of the upper part of the body [2]. The shoulder joint consist of the scapulohumeral, acromioclavicular, costoscapular, sternoclavicular articulation joints and the subacromial space. Structures providing support include: joint capsule, ligaments, synovial hem and muscles. Any of these compositions can result in the restriction of movement, pain and inflammation [3]. Shoulder pain is currently the second reason for visiting the general practitioner [4]. Bearing in mind how dangerous the effects of a shoulder joint injury can be, it is crucial to control their causes and symptoms [5]. The major focus should be on techniques reducing the subjective sensation of pain. One such technique is cryotherapy. Cryotherapy uses liquefied gases, carbon dioxide (CO₂: -75°C) or vapor of liquid nitrogen (N₂: -196°C) in order to cool the patient's body [6]. The course of this treatment is complex: in the beginning there is a contraction of blood vessels and then their extension occurs. This state persists for more than 2 hours.

The increase in tissue congestion causes an increased concentration of oxygen in the muscles, which results in: lower concentration of lactate and histamine and increased concentration of angiotensin and bradykinin and ultimately pain reduction [7].

Materials and methods

The study took place in Regional Occupational Medicine Center in Szczecin.

54 participants took part in this study. The participants, male and female, were between the ages of 30-85 (mean age \pm standard deviation (SD) 60 \pm 14). The patients had a smaller range of movement, which was accompanied by pain in the shoulder joint. They were put through the local cryotherapy 15 times daily for 3 weeks excluding two weekends. Prior to participation, all subjects were asked to rate their pain on the Visual Analogue Scale (VAS). The range of motion in the shoulder joint of every patient was

measured by goniometer before and after cryotherapy. Before participating, all patients gave their informed consent to take part in the study.

The patients under study were subjected to local cryotherapy treatment, which was performed once a day using liquid nitrogen system medical cryotherapy gun. The treatment consisted of the application of cold to the area of the shoulder joint at the temperature of -160°C at the mouth of a nozzle. It caused only a local effect. The cooling of the shoulder joint was performed by use of a special nozzle targeted at the treatment area. For the patient safety, we ensured that the treated area was completely dry.

The mouth of the nozzle was in a sufficient distance (at least 10 cm) from the patient's body, and the nozzle of cryotherapy gun was regulated in cooperation with the patient, so that the cold flow would not always be pointed to one place in the treatment's area. The total treatment time was 2 minutes.

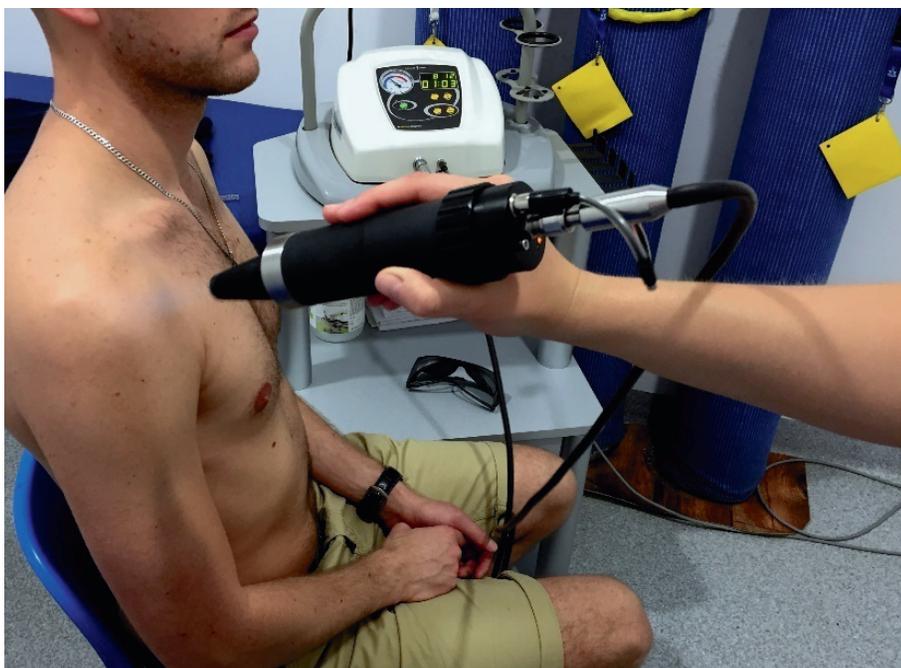


Fig. 1. Local cryotherapy on the shoulder joint

While measuring the range of flexion in the shoulder joint, the patient was on the couch in the supine position. The upper limbs were straightened and placed along the body. The examination was conducted in the plane median, where the axis goniometer was placed around the greater tubercle of the humerus. The arm, movable and immovable, was parallel to the long axis of the humerus and was targeted at the lateral epicondyle of the humerus. During the examination, the movable arm followed the lateral epicondyle of the humerus and the immovable arm remained in the initial position.

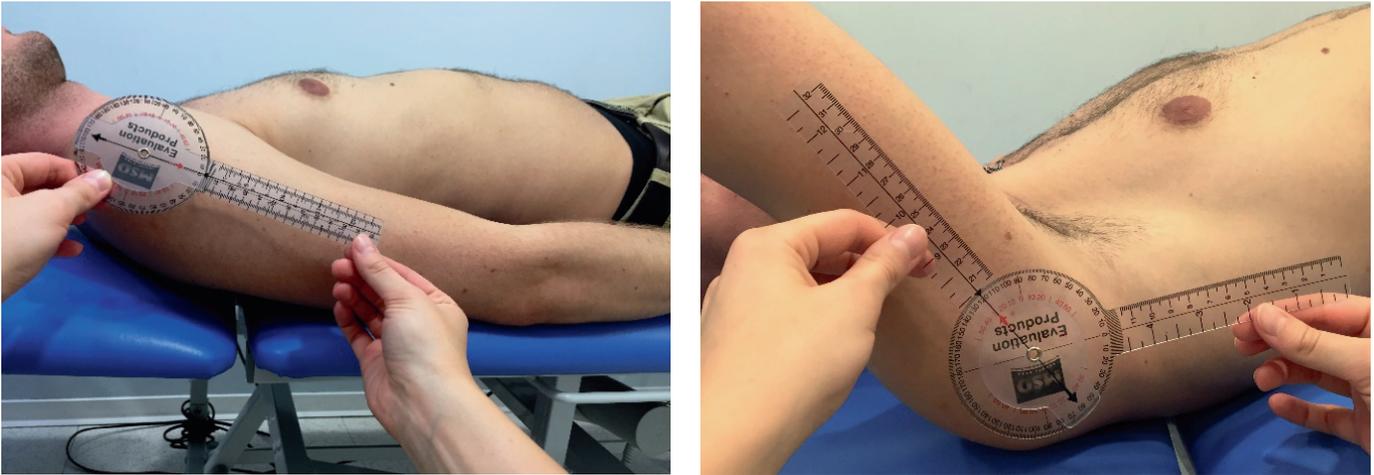


Fig. 2. The measurement range of flexion in the shoulder joint

While measuring the range of extension in the shoulder joint, the patient was on the couch in the prone position. The protractor axis was applied to the greater tubercle of the humerus. Both arms of the protractor were placed in accordance with the long axis of the arm. During the study, the movable arm followed the protractor's arm and the arm in static position remained parallel to the long axis of the body [8].

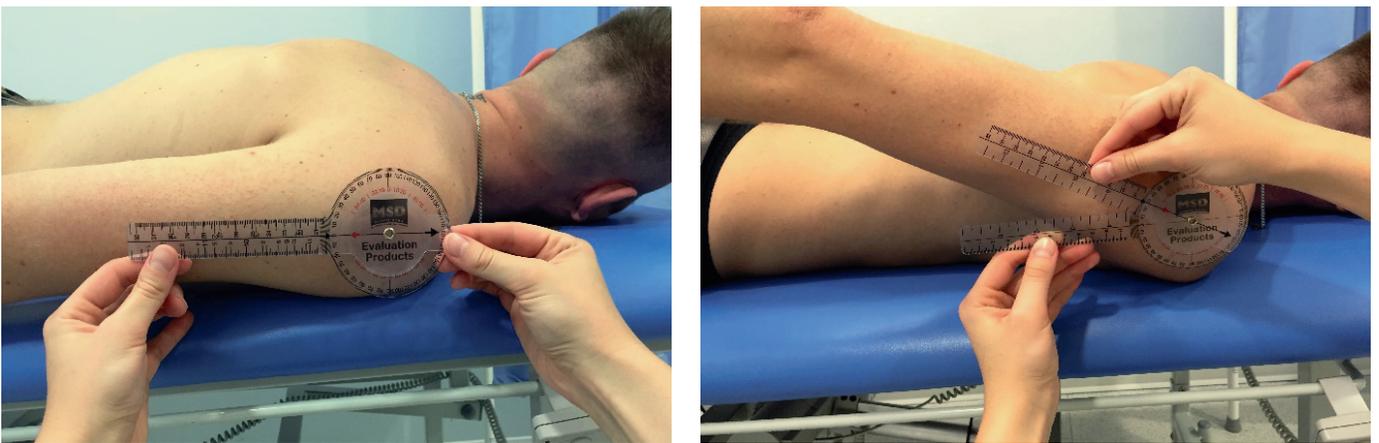


Fig. 3. The measurement range of extension in the shoulder joint

The correct ranges of movement in the shoulder joint by International Standard Ortopedica Measurement are $160-180^\circ$ for flexion and $40-65^\circ$ for extension.

Pain complaints were examined before and after a series of local cryotherapy treatments according to a 10-point Visual Analogue Scale. The patients marked the level of pain intensity on a scale of 10 cm, where 0 was no pain, and 10 was the strongest pain they could imagine. The values 0-3 of VAS showed the positive effects of the therapy. Those with scores over 7 were considered to have a strong pain and they needed further diagnostics and consultation with a doctor.

The statistical analysis used Statistica 10.0 PL software. Apart from the descriptive statistics (arithmetic mean, standard deviation, minimum, maximum), we defined normality distribution of test parameters using the Shapiro-Wilk test.

As most of the measured values showed abnormal distribution, we used the non-parametric Wilcoxon test to compare the values of the range of motion before local cryotherapy treatment [t1] and after it [t2] and to compare the VAS before local cryotherapy treatment [t1] and after it [t2]. In order to verify the significant differences between the male and female groups, we used the non-parametric U Mann-Whitney test. Differences were rated significant at $p < 0.05$.

Results

In the entire study group, which was put through a series of local cryotherapy treatments, significant improvements in flexion and extension of the shoulder joint could be observed (in both cases at the level of $p \leq 0.01$ and $p \leq 0.001$). Taking into consideration the sex of the participants, we found that there was a highly statistically significant improvement ($p \leq 0.001$) in the range of motions before and after treatment. In assessing the range of flexion and extension in the shoulder joint in the male group before the series of local cryotherapy treatments and after them, we observed that there was an improvement and the difference was statistically significant ($p \leq 0.01$) (Table 1).

Table 1 The range of motion before local cryotherapy treatment [t1] and after cryotherapy treatment [t2]

Groups	Z ¹ t1 [°]			Z t2 [°]			W ² t1 [°]			W t2 [°]		
	\bar{x}	min	max	\bar{x}	min	max	\bar{x}	min	max	\bar{x}	min	max
Men+Women n=54	145.17 ± 9.48	116	158	153.91 ± 9.21	127	167	35.17 ± 5.07	24	46	41.04 ± 4.75	31	51
				Zt1 _{K+M}						*Wt1 _{K+M}		
Women n=31	144.16 ± 10.74	116	158	154.45 ± 10.30	127	167	34.58 ± 5.24	24	46	40.74 ± 4.86	32	51
				***Zt1 _K						***Wt1 _K		
Men n=23	146.52 ± 7.23	132	157	153.17 ± 7.43	138	165	35.96 ± 4.72	23	46	41.43 ± 4.56	31	51
				**Zt1 _M						**Wt1 _M		

Taking into consideration the general analysis of pain rated in the VAS score by the participants, we observed a significant reduction in the values of VAS indicated by the patient after the series of treatments in the whole study group, which undoubtedly translates into a reduction in pain and better physical and mental state of the patients ($p \leq 0.001$). Considering the gender of participants, we can say that the series of 10 local cryotherapy treatments had a much more positive effect on the female participants than on the male participants. Reviewing the declared values of pain in the VAS score in the female group before and after treatment, we can see a statistically significant improvement, which translates into a significant reduction in declared pain ($p \leq 0.001$). The level of pain in the male group decreased significantly after a series of local cryotherapy treatments, although it was not as significant as it was in the female group ($p \leq 0.01$) (Table 2).

Table 2. The VAS scores before local cryotherapy treatment [t1] and after cryotherapy treatment [t2]

Groups	VAS t1			VAS t2		
	\bar{x}	min	max	\bar{x}	min	max
Men+Women n=54	6.65 ±1.52	3	10	4.72 ±1.52	1	8
				***VAS T1K+M		
Women n=31	6.32 ±1.53	3	10	4.35 ±1.51	1	7
				***VAS T1K		
Men n=23	7.09 ±1.38	4	10	5.22 ±1.38	1	8
				**VAS T1M		

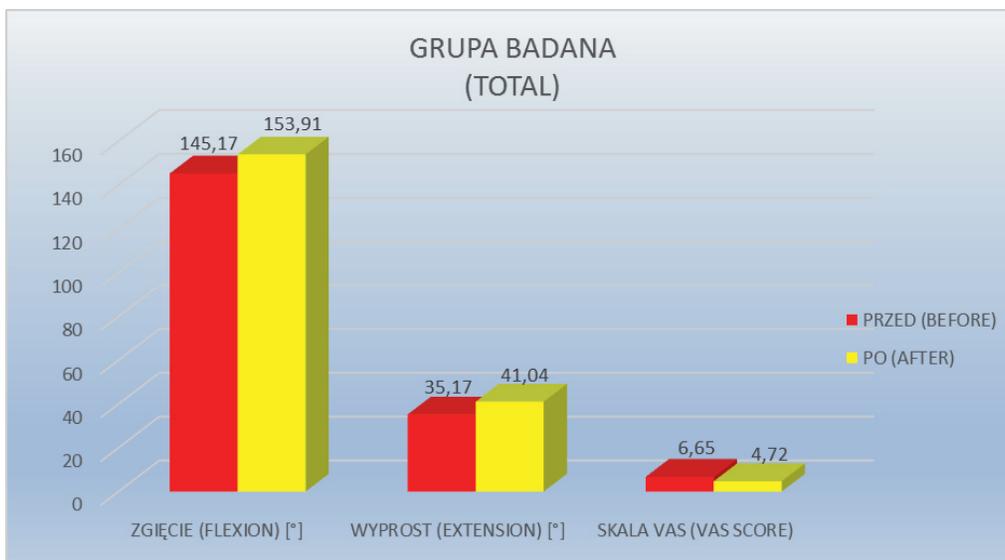


Fig. 4. The average value ranges of motion of the shoulder joint and the level of pain associated with it in the whole study group before and after the application of local cryotherapy

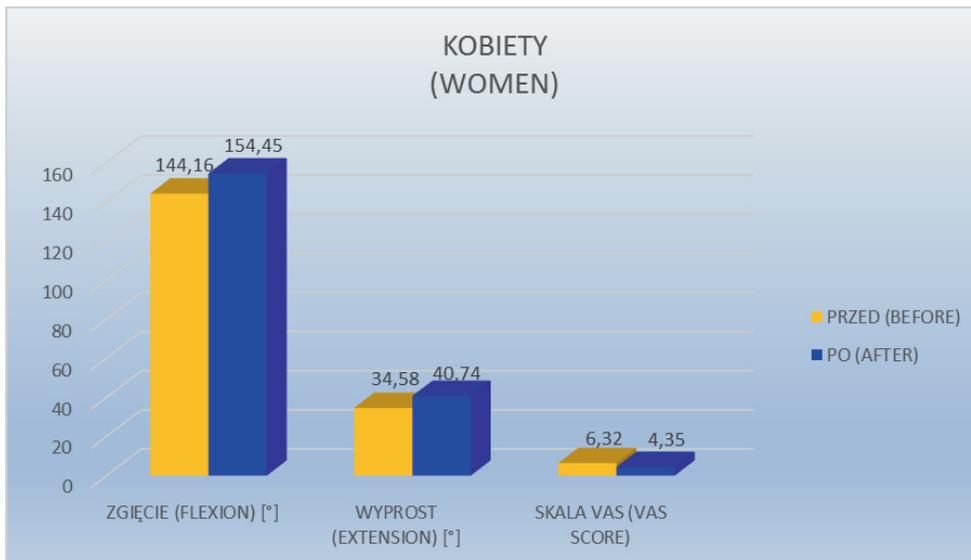


Fig. 5. The average value ranges of motion of the shoulder joint and the level of pain associated with it in the female group before and after the application of local cryotherapy

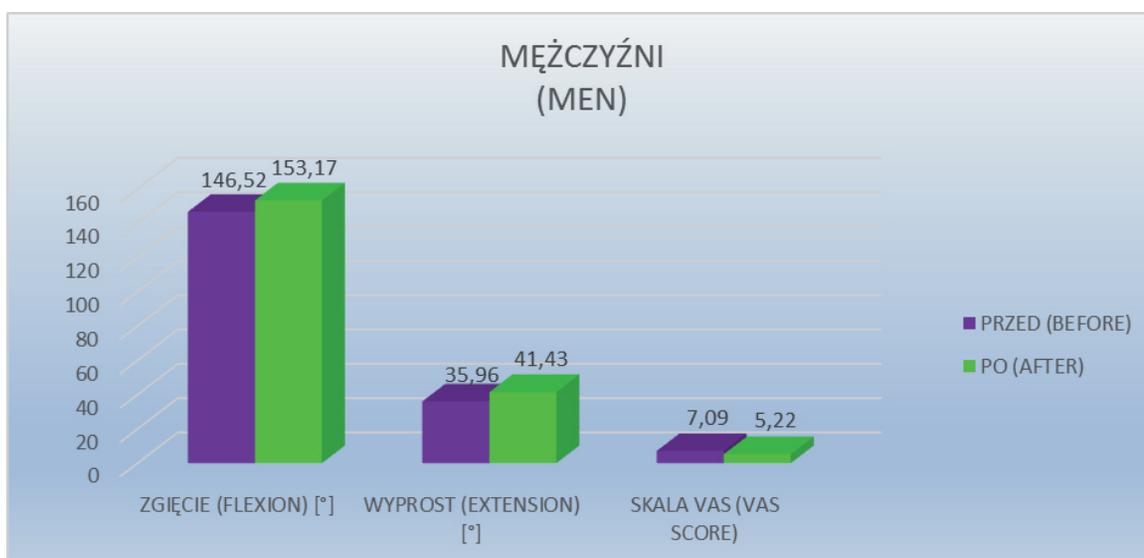


Fig. 6. The average value ranges of motion of the shoulder joint and the level of pain associated with it in the male group before and after the application of local cryotherapy

Discussion

This study shows the influence of the local cryotherapy treatment of pain in the shoulder joint considering the range of motion in the plane median. The results of our research showed a reduction in pain and an increased range of flexion and extension. Piechura et al., in their study conducted in 2008/2009 on a group of 20 participants diagnosed with one-side shoulder pain syndrome is confirmed our results. The highly statistically significant ($p < 0.0001$) therapy improved the ranges of motion in the shoulder joint as well as reduced the pain [9]. Boerner et al. reported a lower intensity of pain

and a higher range of motion, especially abduction and external rotation of the affected the scapulohumeral joint on the basis of statistical analysis [7]. Krukowska et al., conducted a study on 38 rehabilitated patients (25 women, 13 men) diagnosed with painful shoulder syndrome, who were divided into two groups: 1 – consisted of 23 participants who underwent cryotherapy on the affected joint area, 2 – consisted of 15 individuals who did not use a cold shot of CO₂. Prior to the treatment, the average value of bending was similar in all subjects. However, after the treatment this range increased by 51.50° in group 1 and by 30.50° in the group 2. Similar results were observed while measuring the range of extension: in group 1 (about 13.60°) and in the group 2 (about 9.50°). The results were statistically significant ($p < 0.05$) [10]. Bienias- Jedrzejska and Wrzosek also conducted a study on the impact of cryotherapy in the treatment of painful shoulder. They pointed out that after cryotherapy treatment of painful shoulder the range of motion in the analyzed plane slightly improved. In all cases there was a very clear reduction of pain [11]. Michalik et al. undertook a monthly examination of pain in patients using physiotherapy with local cryotherapy. After the treatment, the reduction of pain was over 50%, which can be classified as a satisfactory result [12]. The aforementioned results show that cold therapy is an effective and efficient method for analgesic, which has been confirmed by several studies. Patients suffering from conditions associated with strong pains, thanks to procedures such as cryotherapy can reduce or desist the use of many painkillers. It is very important to implement such actions in every well-conducted physiotherapy. Cryotherapy is a well-tested and recommended physical treatment of patients with pain syndrome of the shoulder joint.

Conclusions

1. Local cryotherapy procedure significantly higher improvement in flexion and extension movements in the shoulder joint in both groups.
2. Local cryotherapy reduces of the severity of chronic pain in patients under study associated with the pain syndrome of the shoulder joint.
3. Local cryotherapy improving the physical and mental state of patients and the efficiency of everyday functions.

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