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Original article

A Study About The Effect of Type-II Collagen on Balance Performance in Women With Knee Osteoarthritis

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Abstract. In this study, the effect of hydrolyzed type-II collagen supplementation on Y balance performance investigated in patients with stage 2-3 osteoarthritis according to Kellgren Lawrence radiological staging. A total of 20 female patients that consists of 10 experimental groups with a average age of 38.7 ± 2.70 and 10 control groups with a average age of 38.3 ± 1.99 were included in the study. Tthe experimental group patients received paracetamol treatment with 1500 mg/day for three months orally hydrolyzed type-II collagen treatment on an empty stomach 10 g/day in the morning. The patients in the control group received only 1500 mg/day paracetamol treatment for three months. As a result of the statistical analysis that is performed at the end of the study, it is found that there are statistically significant differences in the Y balance's pre-test and post-test performance values of the experimental group ($p < 0.05$). However, there is no significant difference in the pre-test and post-test performance values of the control group ($p > 0.05$). As a result, it can be said that type-II collagen supplementation, which is one of the building blocks of joint cartilage in the body, can provide positive effects on the balance performance of female patients with knee osteoarthritis.

Key words: Osteoarthritis, Collagen, Balance.

Introduction

Osteoarthritis, which many people can come across worldwide, is one of the leading causes of chronic disability in developed countries. It is a disorder that occurs with the disruption of the balance between cartilage formation and destruction caused by various traumatic, inflammatory, biomechanical, and genetic factors in bone, cartilage, and synovial tissues. Osteoarthritis is characterized by degenerative and inflammatory processes that generally affect the hip, knee, ankle joints, and surrounding tissues (1). Knee osteoarthritis, which is more common in women, is one of the most primary osteoarthritis parts (2). The most important pathological feature of osteoarthritis is abnormal articular cartilage, which has aneular and avascular structures and does not directly cause pain. Proprioceptive sense can be defined as being aware of the position and movement of the extremity in space. Since degeneration in a joint will also damage the mechanoreceptors in that area, the proprioceptive feeling can be affected. Considering the importance of the knee joint in balance function, it has been reported in the literature that the disorders seen in this joint affect the balance negatively (3, 4, 5, 6). Collagen, found in the structure of bones, cartilage, fibers, and joints, consists of three alpha chains wrapped around each other. Type-II collagen, which is the most common type after type-I in the body, is essential in terms of joint health and cartilage formation. It is highly effective in joint pains and more advanced joint disorders (7). Many studies are carried out to prevent osteoarthritis-related joint damage. In these studies, the mechanisms underlying cartilage destruction gain importance, and pharmacological agents are developed. Considering the effects of type-II collagen, which is one of the building blocks of joint cartilage, it is thought that it can be a potential option in treating osteoarthritis. This study investigates the effect of collagen type-II supplementation on balance performance in women with knee osteoarthritis.

Materials and Methods

Twenty volunteer women participated in the study, which consists of ten experimental and ten control groups. All of the experimental and control groups were composed of individuals who lived a sedentary life and had no chronic diseases. Paracetamol treatment with 1500 mg/day for three months is recommended to the control group patients. On the other hand, the experimental group received hydrolyzed type-II collagen treatment orally on an empty stomach 10 g / day in the morning along with 1500 mg/day paracetamol treatment. According to Kellgren Lawrence, the radiological staging was included patients with stage two-three osteoarthritis in the study.

Height and Body Weight: The height measurements of the participants that belongs to the experimental and control groups were measured in cm with bare feet by using a pharmacy -type height measuring device. Body weights were measured in kg with pharmacy-type scales, leaving only shorts and t-shirts on them.

Body Mass Index Calculation (BMI): The BMI values of the participants were obtained by dividing their body weight by the square of height in meters (weight/height^2).

Y Balance Test: For the Y balance test, four pieces of 1.5 meter tape measure were affixed to the ground in a 45 degree angle. The athlete was asked to stand on one leg at the intersection point and extend the toe of the other foot in three directions (anterior, posteriolateral, posteriomedial). In the meantime, attention was paid to the person not to lose his balance and not to lift the foot on which he was standing. At the end of the test, the athlete was asked to bring his outstretched foot next to his standing foot on the ground without losing his balance or touching the ground. Three repetitions were performed for each direction and the best result was recorded in cm. To achieve normalization between individuals, the stretched distance was divided by the leg length and multiplied by 100 (8, 9).

Statistical Analysis: SPSS 26.0 statistical program was used to analyze all the data collected in our study. Normality analysis of the groups was done and it was found that the groups showed a normal distribution. While comparing the pre-test and post-test values within the groups, a paired-samples t-test is used. On the other hand, the independent samples t-test is used to compare the groups with each other. The level of significance was evaluated according to the "p <0.05" level.

Findings

When Table 1 is examined, it is observed that the mean values of age, height, weight, and body mass index of the control and experimental groups.

In Table 2, when the pre-test scores of the Y balance test performance values of the experimental and control groups were compared, no statistically significant difference is found in all values (p> 0.05).

In Table 3, when the post-test scores of the Y balance test performance values of the experimental and control groups were compared, statistically, significant differences are found in all values (p <0.05). However, there was no apparent significant difference between the right and left leg anterior post-test values of the experimental and control groups (p> 0.05).

In Table 4, when the pre-test and post-test scores of the Y balance test performance values of the experimental group were compared, there are statistically significant differences found in all values (p <0.05).

In Table 5, when the pre-test and post-test scores of the Y balance test performance values of the control group were compared, there is no statistically significant difference found in all values (p> 0.05).

Table 1. Descriptive statistical values for the subjects

Variables	Experimental Group Average ± S.S.	Control Group Average ± S.S.
Age (year)	38,7±2,70	38,3±1,99
Height (cm)	171,7±4,69	170,9±5,98
Weight (kg)	80,68±3,23	80,31±3,41
BMI (kg/m2)	27,36±2,08	27,46±2,01

Table 2. Statistical values for the Y balance performance pre-test scores of the subjects

Variables	Experimental Group (Average ± S.S.)	Control Group (Average ± S.S.)	F	P
Anterior Right Leg	38,76±3,75	41,82±5,67		
Anterior Left Leg	37,95±4,99	41,49±4,88		
Anterior Average (cm)	38,35±4,31	41,65±4,67	0,787	0,199
Posteriomedial Right Leg	60,77±6,12	59,54±4,11		
Posteriomedial Left Leg	59,84±4,96	60,73±3,45		
Posteriomedial Average (cm)	60,35±5,18	60,13±3,98	0,501	0,439
Posteriolateral Right Leg	54,77±4,88	53,22±5,34		
Posteriolateral Left Leg	52,62±4,77	51,56±5,11		
Posteriolateral Average (cm)	53,69±4,34	52,39±5,13	0,677	0,299
Total Average Y Balance Test	50,79±4,81	51,39±5,09	0,581	0,399

*p<0.05 significance level.

Table 3. Statistical values for the Y balance performance post-test scores of the subjects

Variables	Experimental Group (Average ± S.S.)	Control Group (Average ± S.S.)	F	P
Anterior Right Leg	43,11±3,66	40,67±4,39		
Anterior Left Leg	43,88±3,09	42,55±4,74		
Anterior Average (cm)	43,49±3,38	41,61±4,86	0,865	0,134
Posteriomedial Right Leg	66,89±5,65	59,76±3,99		
Posteriomedial Left Leg	67,29±4,05	61,56±3,68		
Posteriomedial Average (cm)	67,09±4,91	60,66±3,74	2,766	0,019*
Posteriolateral Right Leg	61,60±5,01	52,99±5,09		
Posteriolateral Left Leg	61,11±4,51	52,87±5,45		
Posteriolateral Average (cm)	61,35±4,69	52,93±5,31	4,087	0,001*
Total Average Y Balance Test	57,31±4,33	51,73±4,89	3,011	0,003*

*p<0.05 significance level.

Table 4. Comparison of experimental group Y balance performance pre-test and post-test scores.

Variables	Pre-Test (Average ± S.S.)	Post-Test (Average ± S.S.)	F	P
Anterior Right Leg	38,76±3,75	43,11±3,66		
Anterior Left Leg	37,95±4,99	43,88±3,09		
Anterior Average (cm)	38,35±4,31	43,49±3,38	3,911	0,001*
Posteriomedial Right Leg	60,77±6,12	66,89±5,65		
Posteriomedial Left Leg	59,84±4,96	67,29±4,05		
Posteriomedial Average (cm)	60,35±5,18	67,09±4,91	2,987	0,013*
Posteriolateral Right Leg	54,77±4,88	61,60±5,01		
Posteriolateral Left Leg	52,62±4,77	61,11±4,51		
Posteriolateral Average (cm)	53,69±4,34	61,35±4,69	3,509	0,008*
Total Average Y Balance Test	50,79±4,81	57,31±4,33	3,778	0,001*

*p<0.05 significance level.

Table 5. Comparison of control group Y balance performance pre-test and post-test scores.

Variables	Pre-Test (Average ± S.S.)	Post-Test (Average ± SS)	F	P
Anterior Right Leg	41,82±5,67	40,67±4,39		
Anterior Left Leg	41,49±4,88	42,55±4,74		
Anterior Average (cm)	41,65±4,67	41,61±4,86	0,127	1,897
Posteriomedial Right Leg	59,54±4,11	59,76±3,99		
Posteriomedial Left Leg	60,73±3,45	61,56±3,68		
Posteriomedial Average (cm)	60,13±3,98	60,66±3,74	0,134	1,811
Posteriolateral Right Leg	53,22±5,34	52,99±5,09		
Posteriolateral Sol bacak	51,56±5,11	52,87±5,45		
Posteriolateral Average (cm)	52,39±5,13	52,93±5,31	0,111	1,762
Total Average Y Balance Test	51,39±5,09	51,73±4,89	0,098	1,645

*p<0.05 significance level.

Discussion and Conclusion

Osteoarthritis is the most common type of arthritis globally and causes erosion of the joint cartilage, which is generally observed in elderly individuals (10). The primary purpose of osteoarthritis' treatment is to reduce functional limitation by slowing down cardiac damage progression. For this purpose, pharmacological and non-pharmacological treatment methods are used. The main event in osteoarthritis's pathophysiology is the damage to the type-II collagen network because type-II collagen is an essential structural element of joint cartilage. Therefore, type-II collagen gains importance as an effective pharmacological agent (11).

In our study, the presence of neuropathic pain is investigated in patients with knee osteoarthritis and the effect of hydrolyzed type-II collagen on knee osteoarthritis. Knee osteoarthritis is more common in elderly patients (12). It is reported that there is a relationship between age and knee pain and functionality, and that functionality decreases as knee pain increases (13). The average age of the subjects we used in our study is 38.7 ± 2.70, and it is consistent with the literature. Dıraçoğlu et al. (3) found that patients with knee osteoarthritis lost their sense of proprioception compared to healthy individuals of the same age and sex.

Osteoarthritis adversely affects the person by causing loss of motion and muscle weakness in individuals.

This results in weaknesses in functions such as balance, walking, and climbing stairs (14). Besides, osteoarthritis affects the quality of life of individuals negatively. In a study that is examined the relationship between quality of life, depression, and neuropathic pain, it is found that there is a significant relationship between WOMAC total values and neuropathic pain. In another study similar to this, a significant relationship was found between neuropathic pain and the Lequesne knee index (15). A study conducted on 850 people with knee osteoarthritis found significant relationships between balance and proprioception and the WOMAC Pain and WOMAC Physical Function subscales (16). Sütbeyaz et al. (17) investigated the relationship between quality of life and osteoarthritis using the SF-36 scale and reported that the quality of life was affected by osteoarthritis. Our study observed that collagen type-II treatment applied 10 g / day for three months to the experimental group consisting of patients with stage 2 and 3 knee osteoarthritis had positive effects on Y balance performance. As a result, statistically significant differences were found between pre-test and post-test performance values. Unlike these values, no statistically significant difference is found in the Y balance test pre-test and post-test performance values of the control group, who received only 1500 mg/day paracetamol treatment.

In our study, 10 g / day of oral hydrolyzed type-II collagen was supplemented to the experimental group on an empty stomach. Moskowitz (18) examined the effect of collagen hydrolyzate on osteoarthritis in his study. Collagen hydrolyzate intake of 10 g / day for 60 days is beneficial in the treatment of osteoarthritis. This study is parallel with the amount of collagen that is used in our study. Since collagen hydrolyzate increases protein synthesis on cartilage tissue and causes the anabolic effect that stimulates the development of tissues, there are strong reasons that it strengthens the joint structure and integrity in athletes to reduce joint pain. In a study conducted with adult athletes in Germany in 2006, 79% of the participants in a 12-week study showed positive improvements in joint mobility and flexibility after consuming 10 g / day collagen hydrolyzate (19).

When we examine other studies in the literature, Scarpellini et al. (20) applied 2 mg/day hydrolyzed native collagen type II treatment to glucosamine chondroitin sulfate in one group and glucosamine chondroitin sulfate to the other 104 patients with osteoarthritis. In addition, a significant improvement was found in the VAS scores of both groups, but no significant difference was found between the groups. In another study, it was reported that collagen type-II treatment provided significant improvements in walking distance and reduced the need for pain medication (21).

Collagen type-II treatment has been reported to positively affect pain and functional status in human and animal studies. There was a decrease in pain in flexion and extension movements (22). Thanks to the non-denaturing collagen type-II applied to obese dogs with arthritis for three months; there is an increase in physical activity levels like sitting and standing. Also, there is a decrease in pain within flexion and extension movements (22). A study conducted on stage 3 knee osteoarthritis individuals found that proprioception was weaker than cases with early-stage osteoarthritis (23).

Consequently, when we examined the studies conducted, it was found that the presence of neuropathic pain in patients with knee osteoarthritis increases the severity of pain and leads to a decrease in the functional status and balance performance of the patients. In the study, we examined the effect of type-II collagen treatment on balance performance, which is one of the main building blocks of cartilage in osteoarthritis pathogenesis; it is detected that there is a positive relationship between knee osteoarthritis and type-II collagen treatment.

Conflict of Interest: No potential conflict of interest relevant to this article was reported by the authors.

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