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Thermographic Assessment of Extremity Temperature Alterations of Cases with Bucked Shin Complex, Splints, Carpal Osteoarthritis and Sesamoiditis in Sport Horses

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Summary: This study was aimed to describe the extremity temperature alterations of horses with bucked shin complex, splints, carpal osteoarthritis and sesamoiditis. In this study, 27 race horses with different breed (24 Arabian, three Thoroughbred), sex (23 males, four mares) and age (avg. 3.5-year-old) were used. After thermographic and clinical examinations, cases with existence of inflammation were subjected to radiographic examination. Clinical, radiographic and thermographic findings revealed that five horses had carpal osteoarthritis, two horses had bucked shin complex, 13 horses had splints, and seven cases had sesamoiditis. Medial aspects of carpus were 3-4˚C heater in carpal osteoarthritis cases compared to those of healthy carpus of same horses. The thermographic examination of bucked shin complex revealed that in Grade 1 (n=1), there was a hot spot in dorsal aspect of metacarpus and these spots had 4˚C higher temperature than that of normal control limb. The medial aspects of metacarpus was 1-2˚C warmer in splint cases compared to limb without lesions. The medial aspect of sesamoid bone was 6-7˚C warmer in medial sesamoiditis cases compared to normal limbs. In conclusion, the temperature of extremity tends to increase on the affected region where the orthopaedic problem exists. Because thermography shows the localization of inflammation, it could be used as a supportive diagnostic method in orthopaedic problems of race horses which come out with inflammation.

Key words: Bucked shin complex, osteoarthritis, sesamoiditis, splints, thermography

Spor Atlarında Sesamoiditis, Karpal Osteoartritis, Süro ve Sorşin Olgularında Ekstremite Sıcaklık Değişimlerinin Termografik Değerlendirilmesi

Özet: Bu çalışma sesamoiditis, karpal osteoartritis, süro ve sorşinli atların ekstremitelerindeki sıcaklık değişimlerini tanımlamayı amaçladı. Bu çalışmada, farklı ırk (24 Arap, üç İngiliz), cinsiyet (23 erkek, dört dişi) ve yaşta (ortalama üç buçuk yaş) 27 yarış atı kullanıldı. Termografik ve klinik muayene sonrasında, yangının mevcut olduğu olgularda radyografik muayene gerçekleştirildi. Klinik, radyografik ve termografik muayeneler sonucunda yedi olguya sesamoiditis, 13 olguya süro, iki olguya sorşin ve beş olguya karpal osteoartritis tanısı konuldu. Karpal osteoartritis olgularında aynı atın normal karpus'u ile karşılaştırıldığında, karpus'un medial yüzünde 3-4˚C'lik sıcaklık artışı belirlendi. Birinci derece Sorşin tanısı konulan olguda metacarpus'un dorsal yüzünde sıcak bir nokta vardı ve bu noktalar normal bacakla kıyaslandığında 4˚C daha sıcaktı. Süro tanısı konulan olgularda normal bacakla karşılaştırıldığında metacarpus'un medial yüzünde 1-2˚C'lik sıcaklık artışı görüldü. Medial sesamoiditis olgularında sesamoid kemiğin medial yüzünden alınan sıcaklık normal bacaktan 6-7˚C daha yüksekti. Sonuç olarak, ekstremite bölge sıcaklıları ortopedik problemin lokalize olduğu etkilenen bölge üzerinde artış gösterir. Termografi yangının lokalizasyonunu gösterdiğinden, yarış atlarının yangıyla ilişkili ortopedik problemlerinde yardımcı bir tanı yöntemi olarak kullanılabilir.

Anahtar kelimeler: Osteoartritis, sesamoiditis, sorşin, süro, termografi

Introduction

Bucked shin complex (BSC), splints (SP), carpal osteoarthritis (CO) and sesamoiditis (SE) are commonly seen in sport horse industry. The common causes of these orthopaedic problems are confirmation disorders, trauma, fatigue and overloading. The physical and radiographic examinations are common using methods in the diagnosis of these orthopaedic problems (5). Because extremity temperatures of horses can play an important role to detect inflammation and thereby orthopaedic injury, usage of infrared thermal camera has been increased in recent years (1,4,13,17). This methodology not only allows the clinician where the problem localizes, but also helps to measure tissue temperature to evaluate existence of inflammation (15). The aim of the present study was to describe the extremity temperature alterations of horses with BSC, SP, CO and SE.

Materials and Methods

Animals

Twenty seven race horses with different breed (24 Arabian, three Thoroughbred), sex (23 males, four mares) and age (avg. 3.5-year-old) were used in this study. The horses were pre-

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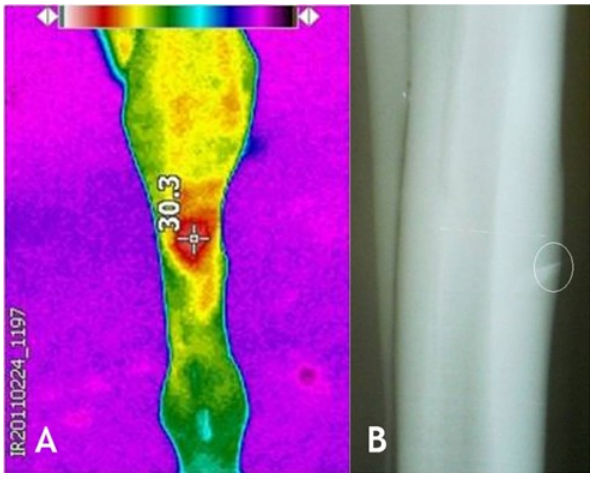

Figure 1. A) Dorsal thermogram of Grade III BSC. There was a hot spot on the dorsal view which observed as a red colour. **B)** Latero-medial radiography of the same case, note the oblique fracture line in the circle.

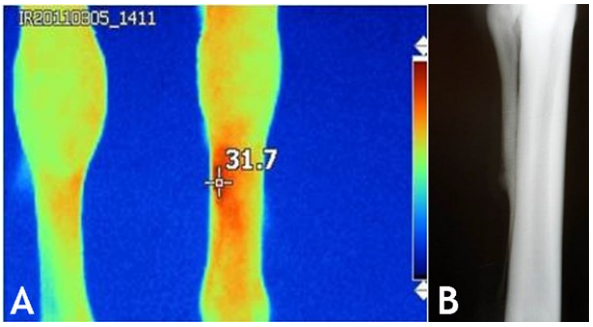

Figure 2. A) Medial thermogram of left SP. Increased temperature over the lesion was seen as a hot spot (red colour). **B)** DMPLO metacarpal radiography of the same case revealed a periosteal new bone on the distal 1/3 of metacarpus II.

sented to Turkish Jockey Club Sanliurfa Racecourse hospital with the complaint of acute forelimb lameness and/or swelling.

Clinical examination

Clinical examinations included palpation of extremity, flexion and extension tests of associated joint and lameness evaluation in accordance with known protocols (6,9).

Thermographic examination

Thermographic examination was performed before the clinical and radiographic examination to prevent possible alterations in extremity temperatures due to palpation of extremity. To minimize interferences of light and air flow, thermographic examination were carried a room not receiving sunshine with a temperature 22 to 23^{o}C. After allowing horses to rest for 15 min in this room, thermal camera (IR FlexCam S, Infrared Solutions Inc., Plymouth, MN) was kept one m distance from the examined region.

Thermographic scans were conducted on lateral and medial aspects of sesamoid bones, right and left carpus (dorsal, lateral, palmar and medial aspects), right and left metacarpus (dorsal, lateral and medial aspects). In all cases, the same animal's limbs without lesion evaluated as a control. The mean thermographic findings were calculated whenever possible (more than one case).

Radiographic examination

Radiographic examination of the fetlock (latero-medial, dorso-palmar and dorso 45° lateral-palmaromedial oblique), carpus (latero-medial, flexed latero-medial and dorso 45° lateral-palmaromedial oblique) and metacarpus (lateromedial, dorso 45° medial-lateropalmar oblique and dorso 45° lateral-palmaromedial oblique) were performed in accordance with the thermographic suspicion region.

Table 1. The mean temperature of same animal's limbs with and without lesion

Orthopedic Problem	Temperature of the lesion	Temperature of the same animal's limbs without lesion
BSC Grade I (n=1)	23.70°C	19.60°C
BSC Grade III (n=1)	30.20°C	26.90°C
Right SP (n=5)	29.64°C	25.30°C
Left SP (n=8)	29.61°C	26.80°C
Right CO (n=5)	28.74°C	24.54°C
Medial SE (n=4)	32.38°C	28.13°C
Lateral SE (n=3)	30.03°C	25.86°C

BSC: Bucked shin complex; SP: Splint; CO: Carpal Osteoarthritis; SE: Sesamoiditis

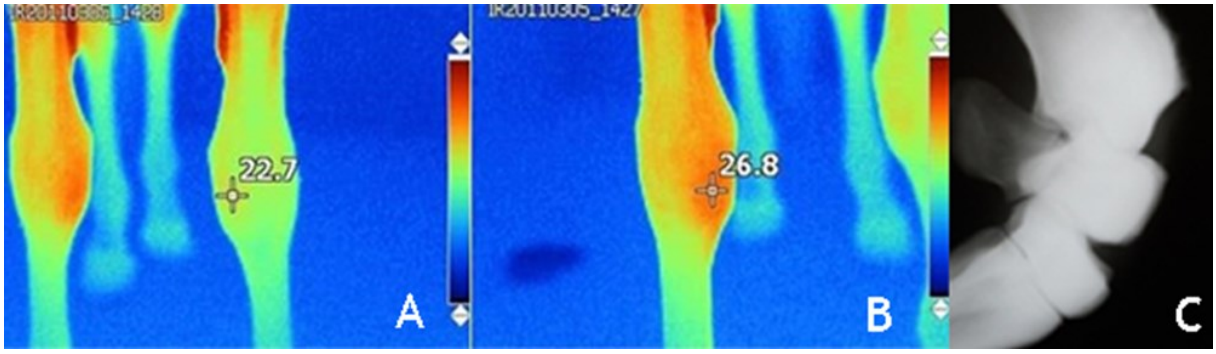

Figure 3. A) Medial thermograms of left normal carpus and right carpus with CO. Increased temperature was seen on the medial view of the carpal joint as a red colour, healthy left carpal joint was seen as a yellow colour. **B)** Right carpus was about 4°C warmer than healthy one. **C)** Flexed lateromedial carpal radiography of the same animal. Note the distal radial exostosis in the circle.

Diagnosis

Diagnoses of the cases were confirmed with clinic and radiographic examinations. Grade 1 BSC was diagnosed when there was a pain on the dorsal palpation of the metacarpus without radiographic abnormality. Grade 3 BSC was diagnosed when there was a pain on the dorsal palpation of the metacarpus and radiographic evidence of fracture line. SP was considered when there was a periosteal reaction on metacarpus II. CO was considered when there was an osteophyte formation on carpal region. SE was defined when there were an enlarged vascular channels and/or osteophyte formation and/or deformation.

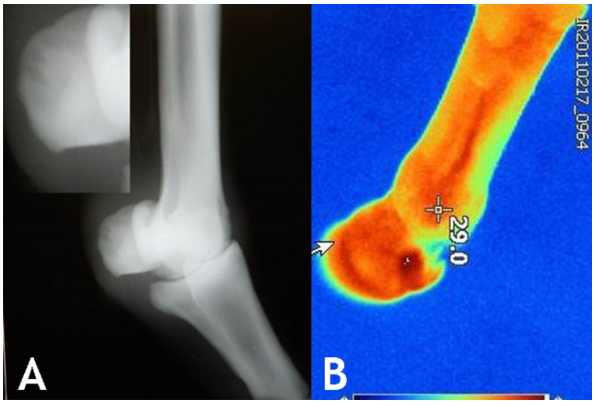

Figure 4. A) Lateromedial radiography of lateral sesamoiditis. Note the enlarged vascular channels in the circle and osteophyte formation on the basis of sesamoid bone. **B)** Lateral thermogram of lateral sesamoiditis. Hot spot (29°C) seen as a red colour over the sesamoid bone.

Results

Clinical findings

Palpation and flexion of the carpal joint resulted with pain in CO cases, and these cases had moderately lower leg lameness. No swelling was detected in CO cases. A hard painful swelling on the medial side of the metacarpus was noted in five horses of the SP cases. No swelling was detected in eight cases with SP; however palpation of medial side of metacarpus revealed a pain in these cases. All the SP cases had mild lower leg lameness. Palpation and flexion of fetlock joint caused severe pain in SE cases and all of the cases had moderate lower leg lameness. Palpation of dorsal side of the metacarpus caused a pain response in BSC cases (n=2). Grade 3 BSC caused lower leg lameness, whereas no lameness was observed in Grade 1 BSC.

Thermographic findings

Thermographic examination of Grade 1 BSC (n=1) revealed a hot spot in dorsal view of metacarpus and the temperature of these lesions were 4˚C higher than that of control limb. There were no any temperature differences in other aspects of Grade 1 BSC. Hot spots were seen in dorsal (Fig. 1A), medial and lateral aspects of metacarpus in Grade 3 BSC (n=1), and these hot spots were 4˚C warmer than that of control limb.

The temperature of medial aspects of metacarpus was 3-4˚C heater in SP cases (n=13) compared to limb without lesions (Fig. 2A). The temperatures of medial aspect of carpus (Fig. 3A) were 4˚C higher in all CO cases (n=5), compared to the same animal healthy carpus (Fig. 3B). Dorsal and lateral aspect of carpus were 2-

3˚C warmer in four out of five CO cases. However, there was no increased temperature in palmar aspects of all CO cases.

The increased temperature of fetlock was seen in four cases of medial SE, and three cases of lateral SE. The medial aspect of sesamoid bone temperature in medial SE cases were 4˚C higher than normal limbs. Additionally, the hot spots were also seen in lateral aspects of all medial SE cases. In lateral SE cases, 5˚C increased temperatures were detected in lateral aspects of sesamoid bone (Fig. 4B). The mean temperature of orthopedic problems (the same animal's limbs with and without lesion) was shown in Table 1.

Radiographic findings

Radiographic findings of CO cases were osteophyte formation on distal of the radius (n=3) (Fig. 3C), third carpal bone (n=1) and radiocarpal bone (n=1). Periosteal reaction (Fig. 2B) was noted on metacarpus II in SP cases (n=13). Enlarged vascular channels (n=2) (Fig. 4A), osteophyte formation (n=4) and deformation (n=1) were detected on sesamoid bones in SE cases. Oblique fracture line was noted on the dorsal view of third metacarpal bone in Grade 3 BSC (n=1) (Fig. 1B).

Discussion

The thermography is the non-invasive imaging technique that determines the inflammation (12). The determination of extremity temperature to reveal the existence of inflammation is important for early diagnosis of the encountered orthopaedic problems in horses (17). Our results confirmed previous reports stated that the bone needs to be in relatively close contact with the skin for using infrared thermal camera to evaluate orthopaedic problems in horses which originated from the bone (16).

Bucked shin complex, SE, CO and SP are associated with inflammation and frequently seen in racehorses (5). BSC commonly affects horses in the first two years of training due to overload of exercise, which lead to change the morphology of the dorsal surface of the metacarpus (7). BSC with Grade 1 and 2 cause diffuse periostitis, whereas Grade 3 is associated with stress fracture on the dorsal cortex of metacarpus III (2). In Grade 1 and 2 hot spots are seen on the dorsal surface of metacarpus and these hot spots are 1-2˚C warmer than surrounding tissue. Otherwise, in Grade 3 hot spots are also seen in lateral and medial aspects of the metacarpus, and these hot spots are 2-3˚C warmer than surrounding tissue (3). Similarly, our results showed increased temperature in only dorsal aspect of metacarpus in Grade 1 and these hot spots were 4˚C warmer than the same animal control limb. Moreover, in Grade 3 in addition to the dorsal aspect, we also recognized 4˚C temperature increase in medial and lateral aspects of metacarpus compared to control limb of the same animal.

Splint caused a local inflammatory swelling on the medial side of the metacarpus II (8). It has been reported that hot spots are easily recognized by thermography over the lesion if the bone is closely contact the skin such as metacarpal bones (11). Similarly in the current study, SP caused hot spots on the lesion, and medial metacarpal temperatures were 3-4˚C higher than normal control limb.

The inflamed joints show an increased heat over the joint when viewed from the lateral and medial sides (14). Similarly, in our study, CO caused an increased temperature on the medial, dorsal and lateral views. Because the palmar view did not show any increased temperature in all of our cases, it seemed insignificant to use this direction for detecting CO when the problem is associated with distal radius, third carpal bone and radiocarpal bone.

Sesamoiditis is caused by great stress placed on the fetlock during training or racing, resulting with inflammation (10). There is no information in the literature to evaluate extremity temperatures of horses with SE. In this research, it was found that sesamoid bone temperature was 6-7˚C higher in SE cases than control limbs. The lateral aspects of the sesamoid bone temperature were increased about 4-5˚C even medial sesamoiditis cases. Depending on our results, it could be said that sesamoiditis caused severe inflammation at the fetlock joint, and this inflammation can be easily detected by thermography.

The main limitation of this study is the lack of statistical analysis due to insufficient data to perform and/or lack of standardization among the cases. Nevertheless, this study has showed that the thermography point out the localization of orthopaedic problems in horses which resulted with temperature increase over the associated area and helps the clinician to figure out where the problem is, and to perform the detailed examination after the detection of suspicion area.

Based on these findings, it can be said that thermography may be useful for diagnosis of BSC, CO and SE in horses. Moreover, it is concluded that using thermography in horses with SP helps the clinician to evaluate the existence of inflammation. In conclusion, the thermography can show and quantitatively prove the existence of inflammation in horses with bucked shin complex, sesamoiditis, carpal osteoarthritis and splints, but it must be emphasized that thermography in the diagnosis of orthopaedic problems of horses is only useful in combination with a thorough clinical examination including additional imaging technique such as radiography.

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