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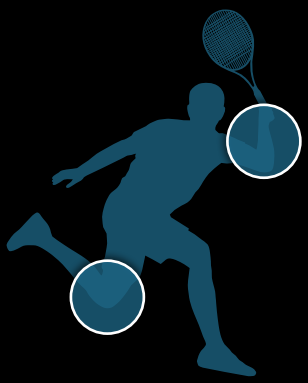

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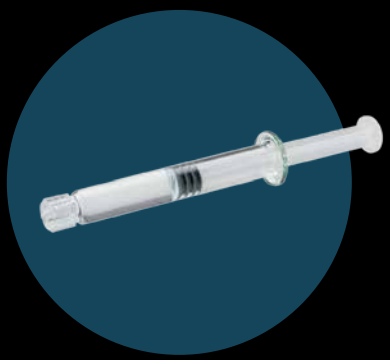

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The team from thesportgroup is pleased to cooperate with the Isokinetic Conference and the innovative and strong network in football medicine since 11 years. Exchange of knowledge and exchange between experts – that is our mission. So we are proud to cooperate with the Isokinetic Conference 2024 in Madrid and wish you an interesting conference with many innovative topics. Also, enjoy this issue.

Best regards yours thesportgroup-Team

IMPRINT

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COVER
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SEVERE GLUTEUS MEDIUS MYOFASCIAL INJURY

The Voice of a Patient – Extremely rapid regeneration thanks to combination therapy

PETER STILLER / MEDWORKS AUGSBURG

I would never have dreamt that at my age (45) I would actually be writing about my own muscle injury as a case report, but unfortunately, I was finally caught out at the end of 2023. My clinic was still very busy before the Christmas holidays, so a colleague from Radiology had to come and help quickly and my team and I quickly got down to treating me... with excellent results! But first things first...

CASE HISTORY

On 10 December 2023, I sustained a type 3b myofascial injury to my left gluteus medius muscle when doing a turn-and-shoot move as an assistant coach during my nine-year-old son's football training session. Immediately after the injury, I was initially incapable of even standing and was indeed unstable on my left leg during lateral stabilisation movements. At first even walking was not possible without help as I had developed a Trendelenburg walking pattern. Immediately after the injury, I could unfortunately only apply ice and cold-water baths (8° Celsius) for analgesia and for reducing the bleeding, and "elevate" as best I could; proper compression was not possible at this point and would certainly have been too painful. On the evening of the accident, it was impossible for me to lift my left leg sideways (in the sense of abducting the hip) while in the right lateral position due to the severe pain, which really worried me. A left-lateral position for the purpose of compression was also out of the question. An enormous haematoma developed at the base of the iliac crest within two days.

CLINICAL EXAMINATION FINDINGS PRIOR TO INITIAL TREATMENT ON 11.12.2023

Pain on pressure, stretching and tensing pain in the entire region of the gluteus medius and over the entire left side of the iliac crest, anteriorly and laterally.

DIAGNOSIS – Severe myofascial injury of the left gluteus medius muscle

There was also numbness of the skin over the gluteus medius immediately after the injury. Positive Trendelenburg gait pattern on the affected left side. Abduction of the left hip was not possible in the right lateral position and very significantly restricted when standing. VAS at rest 5 points, on loading 8 – 9!

MRI ON 11.12.2023

- extensive myofascial oedema (just over 9 mm) with haemorrhages from the proximal gluteus medius muscle (series 8 image 26, series 7 image 26) associated with partially amorphous and partially absent visualisation of the muscle fascia
- focal detachment (5 mm) of the gluteal fascia from the iliac crest
- partial, fascial avulsion of the muscle fascicles with an elongated wavy appearance (series 3 image 14).

Most likely, the following treatment would normally be initiated in a case with such severe pain, severe haematoma, and oedema as well as massive functional impairment of the injured muscles: NSAIDs for two to three weeks for pain management, continued cooling with ice packs in the usual manner plus manual lymphatic drainage by a physiotherapist, physical rest, possibly non-weight bearing on forearm crutches due to the instability (in which case, possibly even injections for thrombosis prevention). Later, pain adapted increase of load, assisted by a physiotherapist.

TREATMENT

Despite the severe pain, I refrained from taking painkillers (NSAIDs) because I am absolutely convinced of the scientifically

proven effect of NSAIDs in reducing tendon and muscle healing, and I did not want this for myself in such a situation. On establishing the diagnosis by MRI and excluding any indication for surgery, I opted for the following combination of conservative, regenerative treatment which was performed daily from 11.12. until 19.12.23 by my clinic team (whom I would like to thank from the bottom of my heart!!! You are simply great!!!):

- **High-power laser** (DolorClast High Power Laser, 300 W, Electro Medical Systems, Nyon, Switzerland): Daily anti-inflammatory treatment at three adjacent sites in the area of injury, each for 5 minutes (i.e. a total of 15 minutes per session)
- **Therapeutic nuclear magnetic resonance** (MBST (molecular biophysical stimulation therapy), Medtech, Arthro Spin Flex, treatment chip card for 7 tendon sessions): A total of 7 sessions of 60 minutes each with a tendon-torso chip card, once daily.
- **Radial shock wave therapy** (Swiss DolorClast, radial shock waves, Electro Medical Systems, Nyon, Switzerland): rESWT in the region of the injury and with increasing application pressure to the maximum tolerable pain limit and application until the pain is noticeably reduced (approx. 10,000 impulses, 25 Hz, 40-mm and 20-mm applicator)
- **Neuroreflectory hyperbaric CO2 cryotherapy** (Cryolight, ELMAKO, Iffezheim, Germany): The whole of the affected, swollen and painful region of the gluteus medius extending to the entire iliac crest; 3 x cooled down to 0 – 4 degrees
- As early and as much **movement** as possible (whatever the pain allows within the tolerable range!). Autonomous **athletic training** to stabilise and promote control.
- **Anti-inflammatory combination** comprising Insumed PhytoShake 1 x daily 10 g, Traumeel 6 x 2 tabs. and Wobenzym 3 x 3 tabs. during the entire treatment period.

We know from treating a large number of patients for the same or similar indications that the combination of these forms of therapy for muscle or tendon injuries has very often led to rapid relief of pain and better and faster regeneration than usual. Descriptions of the combined use of all of the above treatment methods for this type of clinical picture and, above all, with this severity are, of course, not available in the literature to date. High-energy laser was always applied directly before the MBST and therefore 60 minutes before the ESWT treatment as indicated above, as it has been proved scientifically that laser produces pain relief (reaching its peak after approx. 60 minutes), which means that significantly higher working pressures are then tolerated during the subsequent radial ESWT, rendering this therapy even more efficient. In my experience, this rapid pain-relieving effect also applies to MBST, which meant that the working pressure during ESWT could be increased very quickly and very strongly. Although pressures of only around 1.3 to 1.6 bars were possible on the 1st day of treatment, we were already able to apply 3.0 bar on the 2nd day and even 4.0 bar on the 3rd day using the large 40-mm applicator. From the 4th day on, this was even easily possible with the 20-mm applicator. However, much more important to me than pain relief was the well-known tissue-regenerating effect of MBST, which I have observed countless times in my own patients. Added to this is the synergism of the three forms of therapy, as laser (applied directly after injury) not only reduces oxygen radicals in the injured tissue and thus has an anti-inflammatory and anti-oedematous effect, but also inhibits collagen remodelling in the injured muscle and thus counteracts rapid scarring. This, in combination with the clearly scientifically proven, strong muscle-regenerating effect of radial shock wave therapy and also MBST, results in a perfect combination for muscle and tendon injuries. Hyperbaric CO2 cryotherapy was applied to the treated region three times after each session up to a temperature of 0 to 4 ° Celsius. It results in a rapid restoration of the semi-permeability of the cell membranes after injury and has an anti-inflammatory and very rapid pain-relieving effect. The injured muscles were trained as early as possible with abduction exercises, walking training, and stabilisation exercises from the first day of treatment with a rapid increase in intensity.

CLINICAL COURSE

These measures led to a very rapid improvement of the symptoms. Even after the 3rd treatment session, that is, on the 3rd day after the injury, I was able to fully abduct the left hip almost without pain while lying in the right lateral position and walk with such a feeling of stability that I was able to fully return to work. On the 4th day, I was already able to walk normally and without pain again, and on the 5th day do one-legged squats and stabilisation exercises. Jogging was possible on the 6th day, and on the 7th day I could sprint upstairs without any problems. As an assistant coach in my son's football team, I was also able to pass balls to the players again while warming up before a tournament. On the 10th day, I was able to jump with both legs and land one-legged on the affected leg as well as jog 3 km at speed without pain and with full stability. All of this is available as video documentation and can be viewed via the online article (QR code).

By the 11th day I was already able to participate in my son's training sessions again. On the 15th day, I was able to play football with the adults' team again and felt stable and completely free of pain.

MRI FOLLOW-UP ON 22.12.2023 (11TH DAY AFTER INJURY)

- The myofascial contours are more clearly defined. Partial demasking of well-circumscribed myofascial seromas without space-occupying effect (series 8 image 27 and series 7 image 27; previous scan series 8 image 26 and series 7 image 26).

PETER STILLER

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The complete video documentation of the case can be found at the online article.

» Today the avulsion from the iliac crest is no longer evident
» The previously documented elongated muscle fascicles once again show a more defined course with contact to the partially more distinct muscle fascia. (series 3 image 16 as compared with series 3 image 14 of the previous scan).

It should be noted here that the result of the MRI follow-up examination on completion of the combination therapy usually does not quite reflect the actual clinical course. In our experience, however, this is not necessary either. We always concentrate on the clinical course and not just on the MRI scan. In our view, too much emphasis is placed in sports medicine, and especially in professional sports, on complete recovery as shown on the MRI scan, which is, however, not necessary. In our experience, there is definitely no higher re-injury rate if you are guided by the clinical course, ultrasound follow-up examinations and, for example, EMG measurements of the affected muscles.

CONCLUSION

The combination of high-energy laser therapy, rESWT, MBST, hyperbaric CO2 cryotherapy, anti-inflammatory therapy comprising phyto-pharmaceuticals and enzyme therapy as well as early athletic training can achieve a very satisfactory and rapid result with weightbearing stability, associated with freedom from pain and the return to sport, even in the presence of such marked findings.

FUTURE PROSPECTS

In the future, the combination therapy described here or – if not all the components are available – at least some of them should, in my view, play an important role in the treatment of muscle injuries in both professional and amateur athletes. Unfortunately, the amazing regeneration potential with regard to the much faster healing of muscle, tendon and ligament injuries, the lower re-injury rate, as well as the prevention prospects, especially for muscle injuries, do not yet seem to have found their place in general sports medicine or orthopaedics, and unfortunately not in many areas of professional sports either. We are trying to change this via the "sportärztezeitung" network – for all those who are prepared to think outside the box. I really like this form of treatment; we have enjoyed incredible success for our patients, and now it has even saved me weeks, if not months, of problems myself.

I would like to draw two things to the attention of all colleagues who are interested:

1. "thesportgroup academy's" guided education training courses – face-to-face or online! The upcoming dates can be found here: www.sportaerztezeitung.com/events

2. The importance of workplace training in the field of sports medicine: We have in no way exhausted the conservative therapeutic options of modern treatment and prevention. Even though the realities of healthcare in our medical system and the individual patient's actual situation always have to be taken into account of course, our aim is to develop new standards for better sports medicine together with our colleagues and in collaboration with the "sportärztezeitung."

INPUT FROM A RADIOLOGIST...

In the diagnostic work-up of acute muscular injuries, MRI has the advantage over high-resolution ultrasound of showing the anatomy of the involved, but also non-injured, neighbouring structures more clearly. This applies to primary diagnostics, but also especially for the follow-up examinations. The severity of the injury, which is so important for the prognosis, but also its relationship to the biomechanical transmission chains (myofascial, myotendinous, purely muscular or combined) can be well documented. In the acute phase of the injury, however, MRI may overestimate the muscle injury due to the extensive oedema and haematoma. Here, image quality with a resolution that does justice to muscle anatomy is of crucial importance for the correct diagnosis! In the present case, myofascial injury to the gluteus medius muscle was clearly documented and was distinguishable from oedema and haematoma. The follow-up scan after 11 days already showed the reparative processes with fibrotic reorganisation of the fascia and re-attachment of the traumatic myofascial separation of the muscle fascicles. This is particularly well illustrated by the straighter course of the muscle fascicles, which had initially retracted after the injury and had demonstrated an elongated wavy course. This case well illustrates the rapid recovery capacity of an injured muscle.

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INPUT FROM AN ORTHOPAEDIC SURGEON...

Actionism? Yes, but with common sense: In today's sports medicine landscape, so highly pressured to achieve recovery, it is common to aspirate these injuries, infiltrate PRP (platelet rich plasma), administer Actovegin, local anaesthetics, Traumeel or similar medications, and get out the forearm crutches for 7 days. Peter impressively demonstrates that it is also possible to successfully treat a serious muscle injury very quickly without invasive measures. Apart from appropriately coordinated physical measures to modulate inflammation and healing, early pain-adapted mobilisation and avoidance of NSAIDs also appear to have made a significant contribution towards the successful outcome. It is particularly worth mentioning the MRI diagnostic workup during the course of management. This made it possible to reproduce the structural changes which developed after the multimodal therapy. This is what we need for the future of sports medicine. As said in the radiological commentary – "This case well illustrates the rapid recovery capacity of an injured muscle" – we and Peter Stiller were able to exert a significant positive effect on this with the therapy and nutrition (!) mentioned.

It is exciting to see that, despite our inclination towards invasive treatment methods, we can also act "differently" in a promising way and thus set an impressive example for physical measures in sports care.

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CHRONIC PATELLAR TENDINOPATHY

Multidisciplinary conservative treatment of a female U21 national hockey player

ALBERTO SCHEK MD/
PARACELSUS SPORTS MEDICINE AND PREVENTION CLINIC, BREMEN

JESPER SCHWARZ / EINTRACHT BRAUNSCHWEIG

Patellar tendinopathy is one of the most common pathological conditions of physically active people [1], with high prevalence and incidence rates in sports associated with high loads involving jumps and changes of direction [2]. Its pathogenesis is multifactorial, and various mechanisms are under discussion for the development of tendinopathy, which is normally associated with acute-on-chronic or chronic repetitive excessive loading of the individual tendon capacity [3, 4].

In the present case, we would like to show how purely conservative, interdisciplinary, multimodal, and drug-free management can lead to a pain-free return to competition within ten weeks, true to the motto: "come back stronger".

CASE STUDY

During a repetitive sprinting drill, the Hockey palyer felt a progressive and finally acute sharp pain over the apex of her right patella. She had already experienced several pain episodes in this area over the previous two years (!) and had to cease training due to the symptoms for some days quite often. She reported that in the past, due to player interchange rotations in Field Hockey, she had at times not felt "one hundred percent recovered" while on the pitch, although this had not unduly restricted her game. As a result, her problems had become even more protracted over time.

DIAGNOSTICS

Posttraumatic MRI scans of the right knee revealed a significantly signal-enhanced and thickened structure of the proximal patellar tendon in the PD FS sequence, with a signal typical of calcification of the patellar apex and a small defect as well as a bone bruise at the lower patellar pole (see Fig. 1A). Pain-free extension of the right knee against resistance was initially not possible. High resolution ultrasound diagnostics documented classic hypoechogenicity with tendon thickening, loss of the posterior border of the proximal patellar tendon to Hoffa's fat pad as well as significantly increased blood flow in the Doppler microvascularisation examination (see Fig. 2A), associated with very inhomogeneous tendon stiffness values on shear wave elastography. Apart from borderline low magnesium levels, her standard blood results showed no abnormalities, in particular for vitamin D, cholesterol, and glucose [10 – 13]. After recovering from the acute pain phase, she underwent a comprehensive functional analysis. In addition to well-known functional tests such as the Y balance test and various hop tests, other tests were also conducted to determine maximum isometric strength.

Testing of the hip abductors and hip adductors revealed no abnormalities. Apart from adequate strength compared with a standard group, the side-to-side difference of 2 % (abductors) and 3 % (adductors) was also within the normal range. Increased dynamic knee valgus alignment is considered a possible risk factor for the development of patellar tendinopathy [6]. Testing was able to

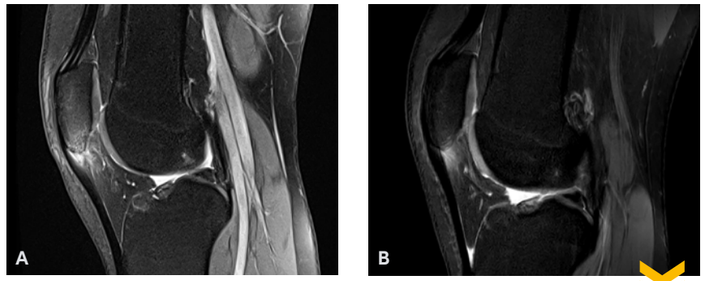

FIG. 1 MRI scans acute (A) and after ten weeks (B)

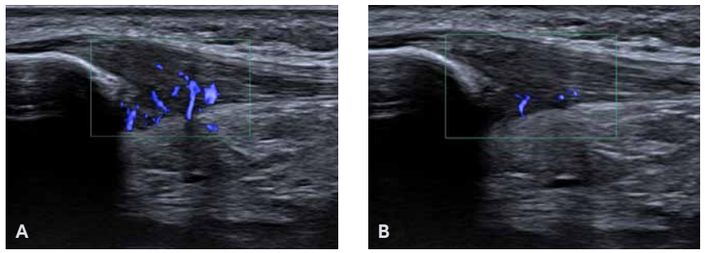

FIG. 2 Scans to assess microvascularisation acute (A) and after ten weeks (B)

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rule out this dysfunction. However, the athlete presented significant deficits in the muscles of her posterior chain, so that immediately after the acute pain phase, the test alone (Nordic hamstring exercise, see Fig. 3) was a major challenge for her. This was also reflected in her result of less than 100 N and thus significantly below the power values compared with a standard group. Even though weak hamstrings are not considered to be significantly predictive of patellar tendinopathy in the relevant literature [7], this muscle group was given targeted training, pursuing a goal of symmetrical and balanced musculature with an adequate H:Q ratio.

TREATMENT

The rehabilitation programme comprised the following:

- Load adjustment and compensation of the identified functional deficits
- Targeted progressive tendon loading exercises (PTLE) [5], based on OSINSTITUT education centre recommendations
- High-dose supplementation with phytonutrients and proteins to promote healing as a combination preparation (PHYTOSHAKE, Insumed GmbH) [8, 9]
- A combination of regular focussed (2500 impulses each, 5-mm transducer, single dose up to 0.82 mJ/mm²) and radial (3000 impulses each, 4 bar, 15-mm transducer) shock wave therapy (EMS Dolorclast) [14, 15]

Pain-adapted loading and tendon load training sessions were carried out under pain control using the NRS scale (0 – 10, with toleration pain up to 5 out of 10) [16]. Focussed extracorporeal shock wave therapy was given at weekly intervals in the area of the tendinopathy and radial ESWT along the involved muscle chain, focussing primarily on the quadriceps muscle (Fig. 4).

MORPHOLOGICAL CLINICAL COURSE

Approximately one week after starting phytonutrient supplementation, the player reported a significant improvement in her general wellbeing and knee symptoms, which she attributed to the dietary supplement. Shock wave therapy was soon increased to maximum intensity. She was retested several times during the rehabilitation process. The functional analysis ultimately allowed the athlete to be cleared for return to sport, with all tests showing a significant improvement. Above all, her power values were increased to 224 N. Although this represents a significant increase, a further increase in strength was programmed based on training therapy in order to reach the average power values of a comparison group (265 N). The strong increase in strength during re testing can be explained by reduced recruitment due to an initial inhibition of the muscles, although this was not the case for the quadriceps muscles. Clinically, the athlete was pain-free after eight weeks and was eager to return to the field.

The final MRI follow-up scan revealed a reduction of the signal of the oedematous bone marrow at the apex of the patella as well as of the tendon signal and the surrounding reaction (Fig. 1B). Hypervascularisation as shown on ultra sound was reduced in comparison with the previous examination (Fig. 2B). Shear wave elastography showed a continued increase in stiffness in the proximal tendon area but appeared significantly more homogeneous than in the initial examination (Fig. 5).

CONCLUSION

Patellar tendinopathy can often be successfully treated conservatively with structured diagnostics, provision of therapy closely coordinated between the physiotherapists, athletic trainers and the physician with a holistic approach to the condition. Even if the morphological correlate of "healing" as shown in the imaging procedures can often be incomplete in the short term, the noninvasive and drug-free concept is a very promising therapy method for a return to play at a high performance level if all influenceable parameters are optimised, including nutrition and tendonenhancing supplementation. As a result, the player in our case was able to play Bundesliga field hockey again, significantly strengthened and pain-free, and was looking forward to travelling to the World Championships in Chile at the end of the year.

Figs. 1 – 5: © Alberto Schek

References for this article can be found here

FIG. 3 The Nordic hamstring exercise

FIG. 4 Extracorporeal shock wave therapy

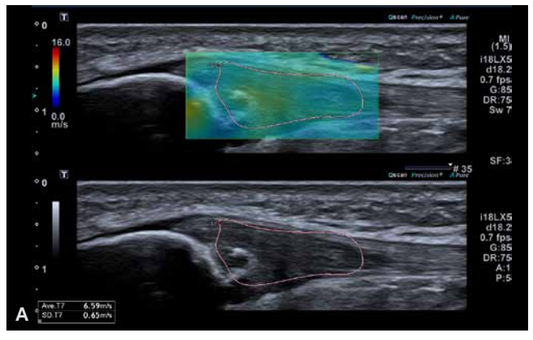

FIG. 5 Comparison of shear wave elastography results (A) acute and (B) at the final follow-up review with reduced stiffness of the tendinopathic area.

NUTRITIONAL MEDICINE

EPIGENETIC ACTIVITY OF CURCUMIN

as a therapeutic aspect in osteoarthritis

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Osteoarthritis (OA) is a multifaceted, extremely complicated disease that destroys the physiological integrity of joints. It affects around 18 % of all adults worldwide, with most patients being over the age of 65 years. However, above-average physical exertion seems to accelerate the disease process, which mainly concerns athletes.

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A recent SoccHealth study investigating the health of ex-professional soccer players reveals that around half of all female, and two thirds of all male, former professional football players between the ages of 40 and 69 years already suffer from OA. Despite its high prevalence as one of the most common causes of human disability worldwide, no effective treatment has emerged to date. That is why we need to broaden our knowledge of the underlying mechanisms of action of OA in order to find new therapeutic targets that slow down, or halt, the progression of the disease. There is unmistakable evidence that numerous environmental factors induce epigenetic changes promoting the development of the various manifestations of OA. Therefore, research into the role of epigenetics has become a current challenge in order to emphasise its causal relationship and importance in OA at the therapeutic level.

EPIGENETICS

Epigenetics is the study of the effects that lifestyle choices have on the gene expression of living organisms. In this context, various external environmental factors such as inflammation, inappropriate nutrition, metabolic disorders, oxidative stress, trauma, infections, and ageing lead to changes that can cause DNA methylation or histone modifications, meaning methyl or acetyl groups on the histones. Epigenetic processes therefore determine which genes are read and thus have an impact on the body and which genes are silenced without causing a mutation, i. e. no change is made to the genetic information in the genome. It is now known that the disruption of numerous essential cartilage-specific proteins during the development of OA is caused by aberrant epigenetic regulatory mechanisms and contributes to the development and progression of OA. In addition, currently approved conventional drugs, such as non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids, which are commonly used to treat OA, have well-documented and potentially significant side effect profiles with long-term use, including cartilage tissue degradation. This emphasises the possibility of considering new therapeutic targets that may alleviate OA disease.

PHYTOPHARMACEUTICS AS AN OPTION

With the promising and growing recognition of inflammation as a major cause of OA, the effectiveness of curcumin (from the plant Curcuma longa), with its exceptionally potent anti-inflammatory and anti-oxidative properties, has emerged in recent years as a remarkable natural agent for the prevention, containment, and treatment of patients with OA. Against the background that curcumin inhibits pain and the degradation of the extracellular matrix (ECM), inflammatory genes and enzymes (nuclear factor kappa B, NF-kB; cyclooxygenase-2, COX-2; matrix metalloproteases, MMPs), and the secretion of inflammatory messengers (cytokines such as TNF-α, IL-1β) in OA, a simultaneous anabolic effect was observed in cartilage tissue (ECM synthesis such as collagen type 2, cartilage-specific proteoglycans), together with the activation of the cartilage-specific transcription factor SOX9 and enhancement of cartilage tissue regeneration. Interestingly, the side effects of this approach do not appear to be significantly different from placebo controls and were generally considered to be low, making this phytopharmaceutical an attractive alternative for patients for whom NSAIDs or cortisone are contraindicated.

Additionally, curcumin can also be of great nutritional benefit to healthy people. As described above, its positive impact on the prevention of various diseases is of decisive advantage, as the internal functions of organs are supported above all by its significant anti-inflammatory and anti-oxidative properties. In daily use, the phytopharmaceutical can also reduce feelings of anxiety, suppress inflammation in the musculoskeletal system after sport, promote performance and regeneration, and help protect human skin from sunlight.

CONCLUSION

Overall, early and regular curcumin supplementation could be of protective benefit to maintain health in view of its comprehensive preventive and regenerative potential, especially for highly stressed competitive athletes, and we suggest that its integration into everyday life should be investigated.

References for this article can be found here

INJURIES IN FEMALE ATHLETES

Their causes and prevention in professional football

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During the last year, public interest in female professional football in Germany has risen, partly due to the success of the German women's national team during the European Championship. In the field of sports medicine, the focus is particularly on research into the causes and prevention of injuries to female athletes.

INJURIES

In football, injuries to the lower limbs, especially to the ankle and knee joints, but also to the muscles, are among the main reasons for absence from training or competition [1]. Since, in addition to the initial event, secondary injuries at the same or at a different site during convalescence also play a significant role, targeted rehabilitation is of great importance, in addition to injury prevention. While in comparison between the sexes, men are more prone to lesions of the hamstrings and in the groin area, women are more likely to suffer injuries to the quadriceps or severe knee and ankle ligament injuries [2]. For this reason, prevention strategies should be tailored to the needs of female athletes.

MALE-FEMALE DIFFERENCES

General considerations: Research into the biological differences between the sexes has increased significantly in recent years, and further findings relevant to prevention and rehabilitation are to be expected. Nevertheless, it is still the case that the majority of conclusions on optimising the aforementioned topics in professional football are based on studies predominantly involving male athletes [3, 4]. Differences exist, for instance, with regard to height, weight, muscle mass, and muscle fibre type and composition. In addition, there are also differences in maximum aerobic capacity (approx. 10 %) and in hormone household, whereby the 10 to 20 times lower testosterone levels are the main reason for the lower strength potential of women as compared with men [5].

Specifically the knee joint: Depending on the particular study, the risk of a cruciate ligament injury for women as opposed to men is about three to six times greater, especially regarding non-contact injuries. There are known anatomical and functional conditions, such as more cases of genua valga, excessive hip adduction and thus an increased Q-angle, quadriceps dominance with lower hamstring activity, increased tibial slope, narrow notch width as well as reduced trunk stability and increased femoral anteversion with the resulting internal rotation gait pattern. When comparing the sexes, this all results in creating an increased strain on the anterior cruciate ligament in female athletes. A temporal correlation of ligament injuries in female athletes, especially of the anterior cruciate ligament, can be found in the first phase of the menstrual cycle. The reasons for this range from the negative preovulatory effect of oestrogen on the tensile strength of the cruciate ligament up to a greater anterior laxity during the follicular phase. A clear additional hormonal effect on neuromuscular control has not been found [6, 7]. Whether the general risk of anterior cruciate ligament injury can be reduced by oral contraceptives does not appear to have been fully clarified [8].

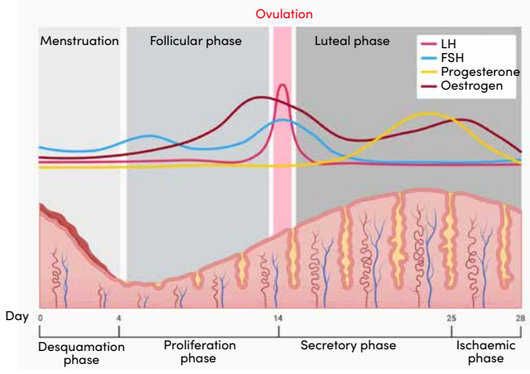

FIG. Menstrual cycle
(Source: www.doccheck.com/de/detail/photos/42168-weiblicher-zyklus)

SEARCH FOR CAUSES

We believe that the gender-specific differences in injury patterns can be attributed to both obvious and non-obvious causes (particularly at a professional or semi-professional level). Apart from the anatomical differences already mentioned, hormonal differences are of particular relevance. And this is precisely where the problems of finding the causes arise in practice. The menstrual cycle appears to be a common exclusion criterion for involving female athletes in trials. Menstrual cycle-dependent changes are seen as a confounding factor and, if at all, the athletes are therefore tested in isolated phases of their cycle in order to minimise their impact [9 – 11]. We regard the different financial circumstances in male and female football as a non-obvious cause. Whereas the men's teams in the football Bundesliga are made up exclusively of professionals, players in the women's Bundesliga often have a job or study commitments in addition. The whole focus, therefore, cannot be placed on prevention or, in the case of injuries, on rehabilitation. Experts believe that the conditions in terms of general training intensity and quality and the necessary medical and sports psychology support at a completely professional level exist in very few clubs in the first and second Women's Bundesliga. Support with regard to athletic training or nutrition is also not comparable. It is noticeable, for example, that the frequency of injuries during matches is six to seven times higher than in training. It is therefore debatable whether training optimally prepares the players for the physical demands of the game, particularly with regard to non-contact injuries [1].

PREVENTION

General considerations: The current lack of data, coupled with the multifactorial causes of injury in female athletes, makes it difficult to develop an improved prevention strategy. Given that the anatomical differences cannot be changed, it is still possible to intervene in individual components of the causes of injury. In recent years, the German Football Association (DFB) has launched so-called “Performance Days” in

cooperation with the University of Freiburg. In addition to medical tests, biomechanical examinations are also carried out at regular intervals on the selected female teams and special knowledge is passed on to the players in the form of appropriate modules. The ultimate aim is to make the players more sensitive to topics such as injury prevention and performance optimisation, on the one hand, and to use the data obtained to generate assistance in working through movement-specific and muscle-stabilising deficits and to raise awareness of typical movements and injury situations. However, this individual approach involves a corresponding financial outlay, which is not usually available to aspiring professional female football players. The further dissemination of established prevention programs such as FIFA11+ [12, 13] or eccentric strength training (the Nordic hamstring exercise) [14, 15] could lead to a further reduction in injuries, including those to the anterior cruciate ligament. These measures and focus would seem recommendable in view of the current lack of professionalism in junior women's football and the absence of support in the field of athletics. Contrary to expectations, their use in professional football is also currently low [16].

Images: © Sofieke van Bilsen/DFB

INFO: FIFA 11+ is a standardised warm-up programme for the prevention of injuries to football players. It involves running exercises and other exercises for strength, plyometrics and balance.

MENSTRUAL CYCLE

Any general prevention strategy based on cycle-related performance and susceptibility to injury cannot be derived from current data [17]. Different performance-related parameters are affected during the menstrual cycle, but a direct impact of these parameters, and thus significant conclusions regarding recommendations and training individualisation, cannot be drawn with any certainty [18]. Based on self-reports from 1,086 female athletes from 57 types of sports, it was shown that cycle-related complaints, in particular dysmenorrhea and premenstrual symptoms, are widespread. The use of oral contraceptives appears to at least alleviate these symptoms. Only in rare cases are these symptoms taken into account when planning training and competition workload [19]. Different perceptions in relation to athletic workload differ during the individual menstrual phases.

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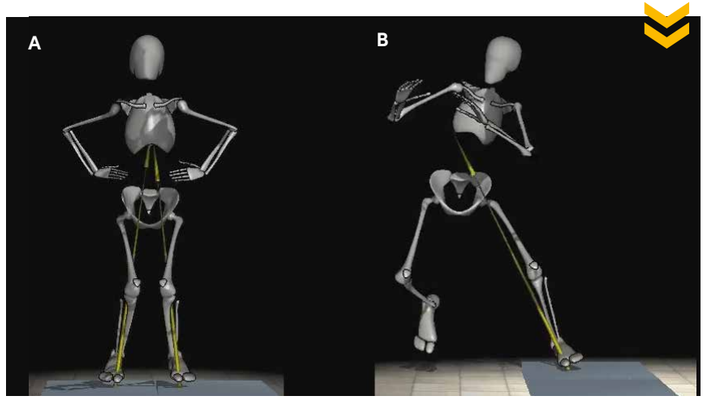

FIG. A + B Biomechanical examinations to address movement-specific and muscle-stabilising deficits. Examinations during the DFB Performance Days. (a) Double leg drop jump (dynamic knee valgus position of both legs), (b) alternating lateral jumps
(provided by the Institute of Sport and Sport Science, Albert-Ludwig University of Freiburg)

References for this article can be found here

The individual phases of the female cycle did not have an impact on the experienced level of exertion. Motivation and competitiveness, on the other hand, were assessed as better in the late follicular to ovulation phase. Mood disorders tended to occur prior to menstruation, while menstrual symptoms and a decrease in vigour were directly associated with menstruation [20]. The hormonal profile of the menstrual cycle varies both between individual athletes and between the individual cycles of one person. This poses a major problem when it comes to generalising training and prevention recommendations. The current findings are inconsistent and at times contradictory. However, there is general agreement that training and competition management should be adapted to take account of individual reactions to physical performance during the different phases of the menstrual cycle [17]. Given the assumption that match performance is not significantly affected by the menstrual cycle phases [21], it seems difficult to achieve acceptance from all participants of the concept of individualisation, especially in team sports with several players and a full-time schedule. The personalised training plan, tailored to the phases of the menstrual cycle, is much easier to implement for the individual athlete. Ultimately, recording female athletes' symptoms during the menstrual cycle could be useful to raise awareness of the players involved of the physical and psychological aspects of the menstrual cycle and how it affects performance.

CONCLUSION

Changing prevention strategies to avoid injuries while taking the needs of female athletes into account would be desirable. Causes such as anatomical and physiological gender differences can only be influenced to a limited extent, if at all. The insufficient number of isolated studies available on female athletes is problematic. Causes and prevention strategies for injuries related to the female menstrual cycle cannot be clearly and broadly identified based on the data currently available.

READ FOR YOU

The best types of exercise for reducing blood pressure

In this network meta-analysis of randomized controlled studies, all modes of exercises were effective for reducing systolic blood pressure (SBP) and diastolic blood pressure (DBP), but isometric exercise seemed to be superior to other types of exercise.

Written by Brady Holmer, BS, PhD(c); Edited by Dmitri Barvinok, BA; Reviewed by Morgan Pfiffner, MS

After our Webinar about tendon repair and the importance of isometric training, I came across this highly interesting meta-analysis. This analysis was conducted on 270 randomized controlled exercise studies. The exercise protocols were categorized into the following primary training modalities: aerobic exercise training, dynamic resistance training, combined (aerobic + resistance) training, high-intensity interval training (HIIT), and isometric exercise training. Subgroups were defined within each category: Aerobic exercise (walking, running, and cycling), HIIT (sprint interval training and aerobic interval training), Isometric exercise: handgrip exercise, leg extension, and wall squats.

AND THE OUTCOME WAS AS FOLLOWS:

Except combined training for DBP, all modalities of exercises were effective for reducing SBP and DBP. When exercise modes were ranked for their effectiveness in reducing SBP isometric exercise was the most effective (−10 mmHg), followed by combined training, resistance training, aerobic exercise training, and HIIT. The subgroup ranking was as follows: wall squats, leg extension, handgrip exercise, cycling, running, combined training, sprint interval training, resistance training, aerobic interval training, and walking. When exercise modes were ranked for their effectiveness in reducing DBP, isometric exercise (− 6 mmHg) was also the most effective, followed by resistance training, HIIT, combined training, and aerobic exercise training. Subgroup rankings were as follows: running, wall squats, handgrip exercise, leg extension, cycling, sprint interval training, resistance training, aerobic interval training, combined training and walking.

In summary isometric training is a perfect way for reducing both SBP and DBP. During isometric exercise, prolonged muscle contraction temporarily cuts off blood flow through the vasculature. After the exercise, the reactive hyperaemia is leading to a large release of nitric oxide and the relaxation of blood vessels. This process improves the health and function of blood vessels and reduces blood pressure.

Performing these isometric exercises with a larger muscle by doing wall squats or leg extension has an even greater effect. And this is why the analysis shows that wall squats were the most effective exercise (SBP – 10 mmHg und DBP – 6 mmHg).

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INJURY PREVENTION IN FOOTBALL

Implementation of an Injury Prevention Program

ANDREAS GERG / WSG TIROL, AUSTRIA

The combination of speed, strength, endurance, and technical skill places high demands on the physical performance of football players. However, these demands often come with an increased risk of injury, which cannot always be completely avoided due to many uncontrollable factors. Nevertheless, the risk of injuries can be reduced through appropriate preventive measures. It is important to develop strategies and implement measures based on scientific knowledge and evidence-based methods.

Significant progress has been made in the field of injury prevention in football over the past three decades. Numerous research studies have been conducted, ranging from the sequence of research steps and the investigation of injury causes to the development and implementation of corresponding prevention programs. Van Mechelen et al. [1] developed a fundamental conceptual 4-step protocol for the prevention of sports injuries in 1992, which has since been further developed and adapted for many sports and injuries. Finch [2] expanded this model with two additional steps and formulated the TRIPP model, which aims to facilitate the transfer of research findings into injury prevention practice. Padua et al. [3] further supplemented this model with two additional steps focusing on the development and implementation of prevention programs. Meeuwisse [4] developed the dynamic, multifactorial model of the etiology of sports injuries to consider a variety of external and internal factors that can influence the risk of injury. To understand the injury-triggering event and the combination of factors that lead to an injury, Bahr & Krosshaug [5] developed a model that takes these events into account.

Using these models, multimodal injury prevention programs for the lower extremities have been developed. There is extensive evidence supporting the effectiveness of movement interventions in the form of neuromuscular training as a warm-up program to reduce football-related injuries in both genders, all age groups, and different skill levels. Examples of effective programs include the FIFA 11+ program [6], the Knee Control Program [7], and the Prevent Injury and Enhance Performance Program [8]. Specific selected exercises such as the Nordic Hamstring Curl (NHC) [9] or the Copenhagen Plank [10] also show a positive effect on reducing injuries. Despite the existence of evidence-based programs, there is often inadequate implementation in practice. This is often due to the required time commitment, associated costs, or lack of coaching staff. Careful adherence and consistent implementation by the coaching team also play a crucial role. Programs are often irregularly carried out or only parts or modified programs are applied. Reasons for this may include a lack of knowledge or insufficient experience in implementing and correctly executing these programs, as well as the complexity of the exercises [11].

8-STEP MODEL

In Figure 1, an 8-step model is presented that is intended to help better understand the various components and steps of a successful injury prevention system, starting from the identification of sport-specific requirements to knowledge transfer and program effectiveness assessment.

INDIVIDUALIZATION

A crucial factor for the success of injury prevention programs lies in the individual alignment during the development and implementation of corresponding measures. It is important to differentiate between primary, secondary, and tertiary prevention in the sports context. Primary prevention aims to prevent initial injuries. Secondary prevention involves the timely diagnosis and treatment of minor physical complaints or injuries with the goal of reducing severity. Tertiary prevention focuses on the rehabilitation of injuries with longer absence from training or competition and minimizing the risk of recurrent injuries [12].

When designing injury prevention programs, it is essential to differentiate between healthy players without injuries and players with injuries or a history of injuries. For athletes with previous injuries, it is important to identify specific risk factors that could lead to a recurrent injury. Additionally, potential neuromuscular and sensorimotor deficits that may have resulted from previous injuries should be considered. This can be done through written questionnaires, verbal interviews, or through assessments and

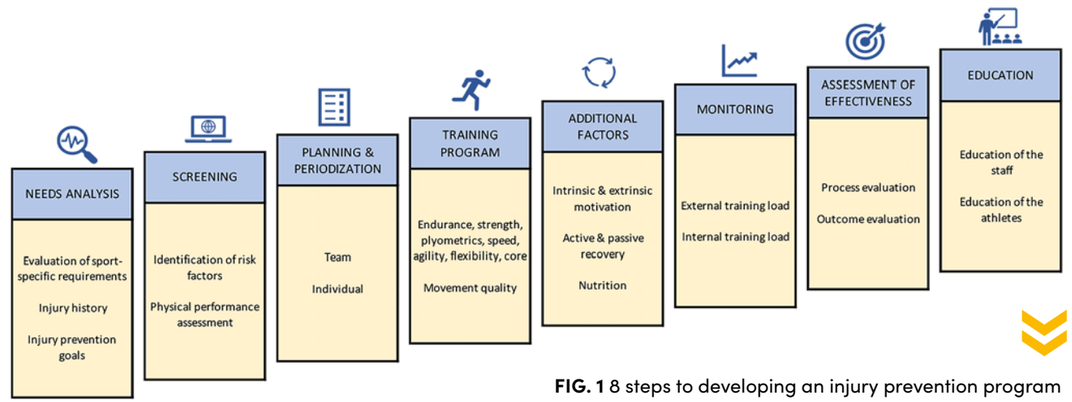

FIG. 1 8 steps to developing an injury prevention program

screenings (e.g., FMS). Healthy athletes require a less conservative and more progressive approach. The prophylactic application of standardized prehab/rehab protocols is usually not sufficient for them. Healthy athletes typically adapt more quickly to demands and require appropriate progressions to avoid plateaus. The intensity threshold and neuromuscular challenge to achieve the desired adaptation will be higher in healthy athletes than in recently injured players. There may also be differences in motivation, as healthy athletes may be less intrinsically motivated to reduce pain and other symptoms compared to recently injured players. To ensure long-term compliance in healthy players, greater variation in exercises will be required to avoid training monotony.

Nutrition also plays an important role in the injury prevention process and should be adjusted accordingly. Proper nutrition not only helps supply the body's energy stores and adjust to the demands of the sport but also supports the body's natural healing and recovery processes. The physiological demands on athletes vary not only between different sports but also within a sport depending on position (e. g., goalkeeper vs. forward). Considering the individual weight goals of athletes, it is clear that generalized nutrition strategies are inadequate. These should be individually tailored based on actual training intensity, volume, and level to allow for precise alignment of energy intake and energy needs. Additionally, it is important to ensure adequate fluid intake before, during, and after training or a game. A fluid deficit at the start of a game can significantly impair performance and increase the risk of hyperthermia [13].

PLANNING THE IMPLEMENTATION OF AN INJURY PREVENTION PROGRAM

The selection of exercises, training frequency, timing, intensity, and volume play a crucial role in the design and subsequent implementation of injury prevention programs. The programs should include various exercises in the areas of endurance, strength, plyometrics, speed, agility, and flexibility. In addition to these areas, prevention programs may include exercises to improve core stability, balance, and proprioception [14, 15]. An overall protective effect of endurance training is that athletes become more resilient to neuromuscular fatigue. This is particularly important as injuries often occur in the final phase of a game when athletes are already fatigued. Adequate strength training increases the load tolerance of the musculoskeletal system to the microtraumas that occur in training or games, leading to faster recovery. When selecting appropriate exercises in strength training, factors such as range of motion, speed of movement, and contraction form should be considered based on the respective injury mechanisms. A commonly used exercise, for example, is the Nordic Hamstring Curl (NHC). Eccentric training improves the muscle's ability to absorb more energy before reaching muscle failure [16].

However, in this exercise, the proximally stressed muscles remain in a relatively constant position. Relevant hamstring injuries mainly occur during the terminal swing and early support phases of running. A suitable complement could be the Romanian Deadlift, as it also engages the proximal part of the hamstrings. Plyometric training not only improves explosive power but also has a preventive character. The focus should be on correct technique and mechanics in landing, jumping, and change of direction movements [17]. However, to prevent injuries, sport-specific and speed-oriented training is also required. A large portion of hamstring injuries occur during sprinting, so training at maximum speed should be given more attention. It is recommended to integrate sprint training at least once a week, reaching < 90 % of individual maximum speed [18].

	MD +1	MD +2	MD-4	MD-3	MD-2	MD-1	MD
Physical Focus	Active Recovery	Passive Recovery (Day Off)	(Technical) Strength	Endurance	Speed	Activation	Match
Area of Play	Medium-/large-sided games		Small-sided games	Large-sided games	Medium-sided games	Medium-/large-sided games	
Focus during Warm-Up	• Individual		• Adductors • Ankle • Acceleration • Deceleration • Change of direction • Plyometrics lateral + horizontal	• Knee • Hamstrings • Change of direction • Maximum velocity • Plyometrics vertical	• Hamstrings • Maximum velocity • Plyometrics horizontal	• Individual • Reactive agility	
Injury Prevention	• Eccentrics during Cool Down (e.g. NHC) • Upper Body Strength		• Lower Body Strength	• Specific endurance training	• Sprinting (1-2x 40-60m)		

FIG. 2 Example microcycle with injury prevention strategies.

As part of the training program, athletes should apply appropriate recovery strategies. Active recovery measures usually consist of aerobic training, which can be performed through various methods such as cycling, jogging, aqua jogging, or swimming. Active recovery is often seen as more beneficial compared to passive recovery due to improved blood flow and the elimination of metabolic waste products through increased oxygen supply. Among passive recovery methods, sleep is generally considered the most important factor. Inadequate sleep or poor sleep quality not only affect performance but also increase the risk of injury and negatively impact recovery after training or games. Athletes who sleep ≤ 7 hours per night over an extended period already have a 1.7 times higher risk of experiencing an injury compared to athletes who sleep ≥ 8 hours per night [19, 20].

PERIODIZATION

The integration of an injury prevention program into the weekly and daily training cycle can be a significant challenge but also offers many opportunities. Figure 2 illustrates a possible integration of injury prevention measures into a microcycle of one week. Prevention measures can be integrated into both the warm-up and cool-down, depending on the focus of the exercises or the training session [21]. An advantage of integrating into the warm-up or cool-down with the team is that the exercises are performed under the supervision of a coach, ensuring a higher quality of execution. Additionally, training takes place in a group setting and generally enhances athletes' motivation. Likewise, appropriate prevention exercises can be integrated into the athletes' individual strength training, where the coach may not be able to make corrections during execution. Integrating preventive exercises into the coach-supervised strength training could provide an additional opportunity to ensure the necessary individualization while maintaining high quality. Injury prevention training should ideally be conducted 2 – 3 times per week, preferably at the beginning and middle of the week. Performing isolated eccentric training at the end of the week could negatively impact game performance due to the regeneration time of up to 72 hours. Eccentric training on the day after the game results in significantly fewer microtraumas than performing it on the third day after the game [22].

CONCLUSION

Significant progress has been made in injury prevention research and application over the past 30 years. However, translating theoretical knowledge into practice remains a major challenge for all involved, yet it also presents one of the most promising opportunities for the future of football medicine. To successfully integrate injury prevention into clubs and teams, a systematic approach and a comprehensive understanding of each step are required. Further research, particularly on parameters such as exercise selection, volume, intensity, and periodization, is necessary to adapt programs to different contexts. Established programs that already exist and have been successfully tested can be easily implemented by amateur teams with limited training time. Professional teams, on the other hand, require a variety of evidence-based exercises with appropriate progressions and variations. Injury prevention should not be viewed in isolation from performance enhancement, as they are closely linked. The foundation for this should be individualization, distinguishing between athletes with or without a history of injury. The success of injury prevention programs depends on regular implementation. Therefore, measures to reduce injuries should be an integral part of football training. This, in turn, requires a high level of willingness to implement on the part of the players, coaching staff, and the club.

References for this article can be found on here

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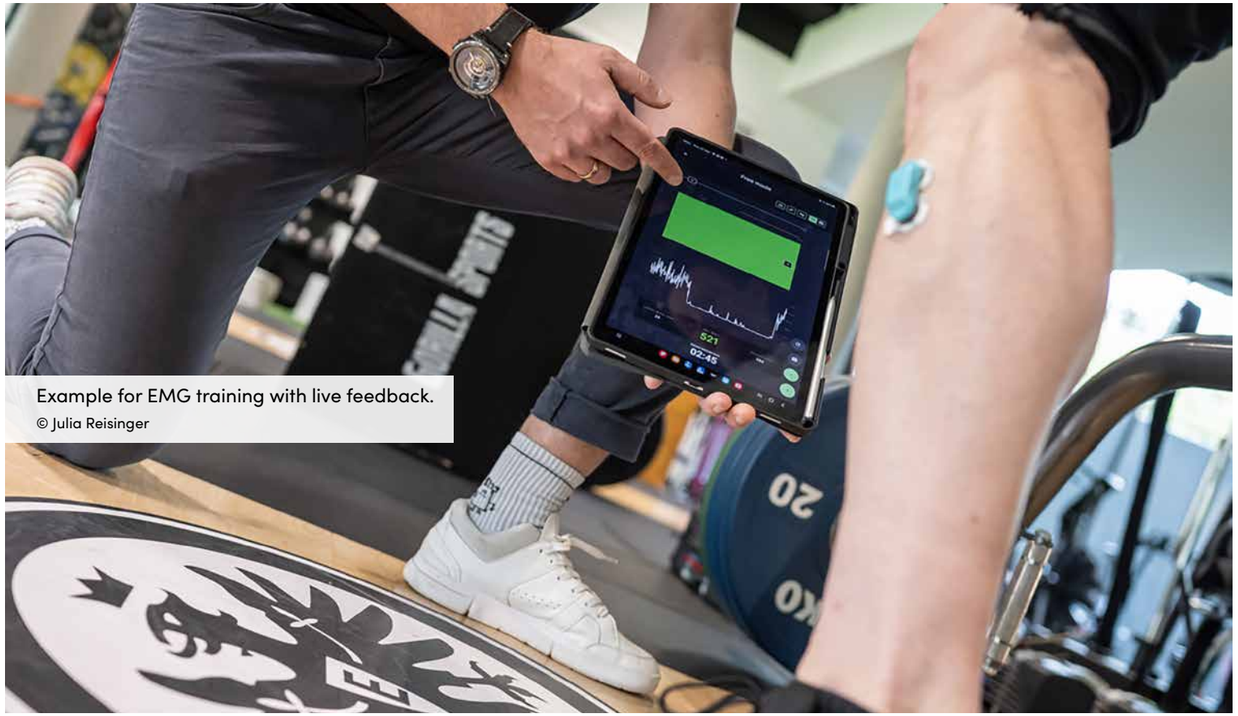

Example for EMG training with live feedback.
© Julia Reisinger

MONITORING MUSCLE ACTIVITY IN PRO FOOTBALL

EMG use case on gluteus medius screening and biofeedback training

DR. THOMAS BLOBEL / EINTRACHT FRANKFURT
SIMON ROTH / MYOACT, INES WILLEKE/ MAINZ 05

While Electromyography (EMG) has been traditionally known from scientific studies or tech heavy tests in movement labs, the technology is increasingly used for rapid analysis and as a training tool in professional sports. The new era of muscle activity analysis through EMG, is based on wireless bluetooth sensors in combination with user-friendly tablet-based software solutions.

As the EMG application differs greatly in its areas of use, a general distinction has been outlined in Table 1. The use case described here addresses use cases A and B. An EMG mapping compares three activity states. The "Resting tone" is measured while standing and should not exceed a maximum activity of 15 µV (exept for pelvic floor/transversus area and the soleus muscle). If abnormalities are found, detonic measures should be considered and intensive activation can help. "Voluntary activation", or the ability to intentionally activate a muscle, enhances an athlete's control over their strength and can be significantly improved in just a few training sessions. "Involuntary activation" visualizes the muscle economy during movement and is mostly displayed as a balance score. High activity values reached in this test are not necessarily "good". They may indicate weakness compensated by high effort (high activity). Therefore involuntary activity should always be interpreted in relation to resting tone and voluntary activation.

Mapping results should always lead to biofeedback training to improve both voluntary and involuntary activation. Muscle-specific strength can only be enhanced considering additional parameters such as full ROM and adjusted resistance according to the individual strength goal. Dynamic training exercises are equally important to ensure targeted and rapid muscle activation ability in sport-specific movement. This should be illustrated using the selected use case for the gluteus medius of a professional football player.

TAB. 1 Differentiation of EMG complexity and user scenarios

	(A) EMG Biofeedback Training	(B) EMG Fast Diagnostics (mapping)	(C) Medium Diagnostics	(D) Advanced Diagnostics
No. of sensors	1 – 4 (max)	1 – 4 (max)	2 – 4	flexible
Main Use Case	training and biofeedback	live analysis	post analysis	advanced and explorative post analysis
Standardisation	low	medium	high	very high
Complexity	medium	medium	high	very high
System Requirements	fix set up for analysis	standardized test protocols with pre set reporting	flexible setup with analysis and report frameworks	open setup with access to raw data
Fields of Application	sports clubs - physicians - physiotherapists - gyms - personal coaches	sports clubs - physicians - physiotherapists - gyms - personal coaches	- advanced motion and gait facilities - movement and gait labs	- movement and gait labs - universities

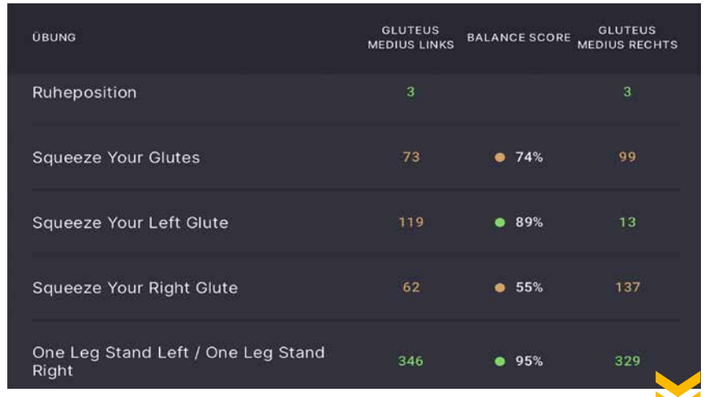

FIG. 2 Overview of the athletes' test results of the three EMG mappings. **(A)** Initial gluteus medius mapping

THE IMPORTANCE OF GLUTEUS MEDIUS

The GM is crucial for stabilizing the pelvis and supporting the lower back, leading to improved posture (pelvic control and hip stability) and movement efficiency. Its proper function can help prevent injuries in unilateral loading situations. The analysis of EMG screenings of 48 male football players from Germany's top three leagues revealed significant variability in the voluntary activation of the gluteus medius (average: 430 µV [± 215 µV], range: 140 – 1133 µV). Similar patterns were observed in involuntary activation (average: 449 µV [± 168 µV], range: 219 – 1116 µV), with the highest averages found among players in the first Bundesliga. These data serve as guidance and do not claim strict scientific validity.

CASE: EXERTION-DEPENDENT HIP PAIN

The following case study illustrates the interplay of mappings and biofeedback training sessions of the gluteus medius based on an athlete with exertion-dependent hip pain. In football, especially in the supporting leg, sagittal stability is crucial to ensure optimal performance and economy. Evaluating the neuromuscular function of the gluteus medius serves as an important parameter in this regard.

INITIAL GLUTEUS MEDIUS MAPPING (SEE FIG. 2 A)

At the beginning, a standardized mapping of the gluteus medius was done with the athlete. The mapping consists of 6 exercises in total and always starts with the rest position, which in this case showed good results far below the guideline of 20 µV. The second exercise is squeezing both glutes (voluntary activation) in which the player reached a balance score of 74 % ending up slightly below the symmetry goal of 80 %.

A significant difference showed up in the unilaterally isolated activation exercises three and four. The left gluteus can be addressed «alone" and reached 119 µV at a balance score of 89 %. But the right gluteus only reached a 55 % balance score, as the left gluteus compensates when the athlete is asked to individually squeeze his right muscle.

The last exercise "one leg stands left and right" aim at the involuntary activation and have been unremarkable as they nearly reached the 400 µV guideline each side.

BIOFEEDBACK TRAINING

In biofeedback training mode the player sees the muscle activity values of the

EMG sensors in front of him on a tablet screen and visual goals in the EMG scale can be set (external focus). This setting helps the athlete to develop a basic sense of targeting his gluteus medius and is the basis to improve voluntary and "isolated" voluntary activation. The real time visual feedback enhances body awareness and the athlete`s motivation and compliance, all of which are important requirements for the exercises to come.

To transfer learnings to involuntary movements, single-leg standing with external rotation of the raised leg have been introduced. It is crucial to ensure that the athlete can control the weight. If activity decreases or stagnates with increasing additional weights, it indicates compensation by other muscles. Voluntary (isolated) activation and single-leg standing with external rotation are excellent simple exercises for home or pre-training use to enhance conscious voluntary activation of the gluteus medius. Improvements should be noticeable with the first training session, at the latest after a few days of active practice.

TARGETING TRICKS

Athletes can be assisted with their understanding of voluntary activation of the gluteus medius with two simple tricks. Trainers can locate the muscle and then press down with their thumb while athletes try to push it away actively. Additionally, initiating muscle contraction with external rotation of the leg during single-leg standing, can be beneficial. The gluteus medius becomes noticeably palpable at an external rotation of the lifted leg at approximately 30 degrees.

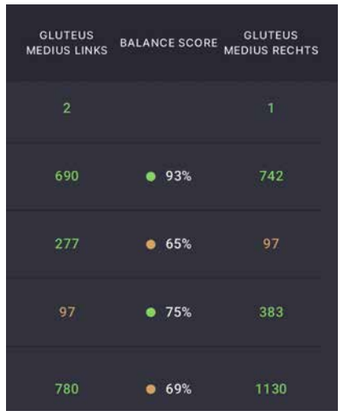

FIG. 2 (B) 2nd Mapping (after 3 weeks)

FIG. 2 (C) Mid-season screening (after 6 months)

CONTINUOUS USE IN ATHLETIC TRAINING

The athletic trainer added gluteus medius exercises to the athlete's individual training plan. Measuring activation during strength exercises ensured correct execution and enhanced exercise efficiency. For example, during a side plank, complete pelvic thrusting often increases activation by up to 200 µV, highlighting the importance of small execution adjustments. EMG also aids in identifying compensatory patterns by monitoring the activity of muscles such as the tensor fasciae latae and biceps femoris, allowing trainers/therapists to make appropriate corrections.

FIRST PHASE RESULTS (FIG. 2 B)

After three weeks of intervention, the resting tone of the athlete remained stable, and voluntary activation (Squeeze Your Glutes) has been significantly improved from 100 µV to 600 µV both sides. Since strength training is limited in the competition phase, this increase is less attributed to strength gains but rather can be explained by a considerably better voluntary activation. This is also evident in isolated voluntary activation (Squeeze Your Left/Right Glute) with higher µV values and better balance scores. The involuntary exercises (One Leg Stand) also recorded higher values but an asymmetry of 69% balance score occurred, which has been addressed in the next training phase.

TAB. 2 Overview glutes medius mapping, guidelines and intervention advice

Mapping (exercises)	Guidelines (microvolt)	Focus	Intervention Options
(1) Rest Position	(1) 0 – 20 µV	- Resting tone ≤ 20 µV	Voluntary Activation:
(2) Squeeze your glutes	(2) 350 µV	- Dysbalance ≤ 20 %	- intentionally contract and relax
(3) Squeeze your left glute	(3) 250 µV	- max. voluntary activation ≥ 350 – 400 µV	- One leg stand: dynamic leg raise and extension rotation
(4) Squeeze your right glute	(4) 250 µV	- voluntary vs. involuntary patterns	Involuntary Activation:
(5) One leg stand left	(5) 400 µV	- Check exercise history graph for deep details of control ability	- Side Plank (lever short/long)
(6) One leg stand right	(6) 400 µV		- Single Leg Squat
			- Single Leg Romanian Deadlift

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RE-TEST IN MID-SEASON SCREENING (FIG. 2 C)

After a period without intensive EMG supervision and mapping, the presented athlete was reexamined during the team's mid-season screening. Voluntary activation remained good but showed a left-dominant imbalance and slightly increased activity of the passive muscle on each side. These patterns may have developed due to the absence of targeted training for conscious voluntary activation. Remarkably, there was a significant decrease in the involuntary activation of the gluteus medius during the One Leg Stand on the right, returning to the value of the initial mapping (see Fig. 2 A). This highlights how quickly muscle activation can change. It can be unlearned without regular training but also rapidly improved again by targeted biofeedback training. Figure 3 shows this development over the three different measurements of the athlete for the exercise Squeeze Your Right Glute. It shows the increase after 3 weeks intervention and a slight decrease after 6 months.

FIG. 3 Three mappings of exercise 4: Squeeze your Right Glute in comparison over time of the athlete. Source: MYOact GmbH

CONCLUSION

EMG screenings provide deep insights into muscle activity and support individual diagnostics. Biofeedback training improves the muscle activation ability and assists the athlete intuitively with the efficient execution of exercises.

With the multitude of diagnostics presented to athletes, it can be challenging to stimulate their engagement and motivation. Biofeedback training, offering immediate visual feedback and showing positive changes, can have a positive supportive effect.

Successful integration of EMG into athletic routines requires user-friendly, intuitive, preferably wireless systems for flexible and effective use. The opportunity to rapidly collect and interpret data is crucial in professional sports.

TREATMENT

REVIEW OF EFFICACY AND OUTCOMES OF ESWT THERAPY IN SPORT INJURIES

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Extracorporeal shockwave therapy (ESWT) is a non-invasive intervention that creates sound or pressure waves that propagate through tissues to stimulate interstitial and extracellular responses. Such biological responses include increased collagen synthesis, cellular proliferation, wound healing and neovascularization. The two main types of ESWT include radial shockwave therapy (R-SWT) and focused shockwave therapy (F-SWT).

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High-level evidence for efficacy of ESWT has been reported in common athletic injuries, such as Patellar tendinopathy, plantar fasciitis and Achilles tendinopathy with minimal side effects including temporary pain at the application site and skin bruising or erythema. Given that ESWT often requires minimal to no time away from sport, and the treatment response can manifest as early as 1 – 3 months, ESWT can be considered a feasible treatment option for athletes.

A randomized controlled trial investigated European football players with groin pain with bone edema of the pubic bone (osteitis pubis). Visual analog scale for pain and Hip Disability and Osteoarthritis Outcome Score were significantly improved in the group receiving ESWT at 1 and 3 months. The athletes who received ESWT were also able to return to football significantly earlier (73.2 days vs. 102.6 days).

Another 2-case series reported outcomes following ESWT in acute and chronic muscle injuries. In professional soccer players with acute muscle injuries, R-SWT applied daily along with other therapeutic modalities such as resistance training, cryotherapy, manual therapy improved pain and facilitated return to soccer. Players were able to return at the mean of 3.3 days for type 1a muscle injury, 6.2 days for type 2b muscle injury and 13 days for type 3a muscle injury. In eight amateur athletes with chronic muscle injuries, low energy ESWT with PT resulted in improvement of pain, muscle strength and Tegner score at the end of treatment (6 – 8 weeks). The mean time to return to sports activities was 8.1 weeks after the first ESWT.

A prospective observational study evaluated athletes treated with a graded running program and F-SWT over 9 weeks for medial tibial stress syndrome. The authors demonstrated significantly faster time to full recovery, defined by running 18 min consecutively without pain, compared to a graded running program alone

A recent systematic review that investigated the efficacy and outcomes following. 56 studies included in this review with 1874 athletes or physically active individuals were included. Results of the review showed that ESWT may be effective alone in plantar fasciitis, lateral epicondylitis and proximal hamstring tendinopathy and as an adjunct to exercise treatment in medial tibial stress syndrome and osteitis pubis in athletes or physically active individuals. In most studies, athletes were allowed to continue activities and training and tolerated ESWT with minimal side effects.

CONCLUSION

Future research should focus on developing standardized techniques and treatment protocols for specific diagnoses. Validated patient-reported outcome measures including both pain and functional components should be used in clinical practice to evaluate treatment outcomes for patients. Further high-level evidence is needed to better compare the effects of radial, focused, or combined ESWT versus sham or placebo ESWT for specific refractory musculoskeletal and neurologic diagnoses.

Original study
Rhim HC, Shin J, Kang J, et al
Use of extracorporeal shockwave therapies for athletes and physically active individuals: a systematic review
British Journal of Sports Medicine
2024;58:154 – 163.
https://doi.org/10.1136/bjsports-2023-107567

ACL INJURIES IN FEMALE FOOTBALL PLAYERS

The great injury mystery

Image: © IMAGO Images / Sports Press Photo, Alexander Canillas

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ACL injuries continue to represent the highest injury burden amongst professional women footballers [1]. Female athletes have up to an eight-fold increased risk of sustaining an ACL injury compared with their male counterparts [2]. The persistently high number of these injuries has led to the introduction of an expert panel by UEFA to help gain a deeper understanding of ACL injuries in women's game [3].

RISK FACTORS

Several anatomical, biomechanical and hormonal risk factors have been proposed over the years. From an anatomical perspective, a smaller notch width or notch-width index, a smaller ACL volume, an increased tibial slope and general increased ligament laxity compared to male athletes have been associated with increased risk of sustaining an ACL injury [4 – 8]. Endogenous hormonal fluctuations during the menstrual cycle, specifically variations in the levels of oestrogen and relaxin during the follicular and ovulatory phases may increase ACL injury risk due to overall elevated ligament laxity [8 – 10]. Although there is some research into the association between oral contraceptives and a reduced ACL injury risk, currently there is not enough high-quality research demonstrating this relationship [8, 11, 12].

One of the typical non-contact ACL injury mechanism in female football is a change of direction combined with deceleration prior to sidestepping and landing from a jump [13, 14]. Biomechanically, several kinematic, kinetic and muscle activation patterns have been found to be related to increased risk of sustaining an ACL injury. Increased knee valgus angles at both initial contact and peak contact in landing, increased ipsilateral trunk motion combined with higher hip adduction angles, reduced knee flexion angles and limited hip flexion angles as well as increased tibial external and internal rotation angles are kinematic patterns that have all been found to be associated with higher ACL injury risk [13, 15 – 18]. In terms of kinetic parameters, landing with a more extended knee position and erect posture at initial contact is associated with higher vertical ground reaction forces and thus increased ACL strain [13, 19 – 21]. Anterior tibial translation due to shear forces and increased external knee abduction moments combined with elevated internal rotation moments significantly contribute to ACL peak strain [13, 22].

Neuromuscularly, sex-specific differences in muscle activation have been shown. Excessive quadriceps activation compared with insufficient hamstring co-contraction in females may contribute to limited knee flexion angles upon landing, which may increase ACL strain. In contrast, increased hamstring co-contraction prevents valgus stress on the knee, while gluteus maximus and medius activity reduces peak knee abduction angles and increases knee flexion angles upon landing [13, 23]. In female athletes, decreased activation of the vastus medialis compared to the vastus lateralis as well as decreased activation of the medial hamstrings compared to the lateral hamstrings have also been demonstrated. This medial-to-lateral imbalance may explain why many females lack the ability to resist excessive abduction loads in the knee joint [13, 24].

IS THE KEY PROFESSIONALISATION?

Sex disparities in access to training facilities and optimization of a crowded match calendar and travel may also play an important role in the risk of ACL injuries between males and females. Similarly, football boots, pitches quality, and football size and weight have been based on male, but not tailored around females' characteristics [8].

Perhaps the most important extrinsic risk factor that exists in women's football is the discrepancy in resources available. For example, there is a tangible gap in the quality of pitches between the women's and men's games. Due to poor availability of high-quality grass pitches, women are forced to play on either poor-quality surfaces or more recently, artificial turf, as seen during the 2015 FIFA Women's World Cup [26, 27]. This is almost unheard of in the men's game. Whilst these surfaces help mitigate cancellation of female events due to adverse weather conditions, the risk that it may pose to the female ACL is often overlooked. Indeed, findings of a recent meta-analysis published in the Orthopaedic Journal of Sports Medicine indicate that an increased risk of ACL secondary to match participation on artificial turf is only seen in female football players and not their male counterparts [28, 29].

Additionally, female football boot technology is someway behind that seen in men's boots. Females exhibit several intrinsic anatomical differences in foot structure that may place them at a biomechanical risk of ACL rupture. Although there is a lack of research supporting the relationship between boot choice and ACL rupture risk, recent research by the European Clubs Association has found that 80 % of female players playing in major European leagues report discomfort with their football boots. Although major football brands are making progress with their goals of better supporting the needs of female players [31], the availability of female-tailored boots is poor, or at best, poorly advertised [26].

The discrepancy in resource availability is further highlighted by reduced accessibility to gyms to aid injury prevention

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programmes. This not only due to a lack of sufficient equipment within these gyms, but also the barrier to female participation underpinned by long-standing issues such as gender-based norms dictated by society. It has been suggested that females have a lower training age considering the amount of time and exposure an athlete has had to structured, coached, and progressive training [8, 30]. Another key principle could be promotion of effective communication and collaboration within the wider club-ecosystem. As part of the UEFA Women's Elite Club Injury Study, Ekstrand et al found that risk factors for injury with the highest average importance were "lack of communication between medical staff and coaching staff" and "load on players" [32]. Although this was in the context of hamstring injuries, the same principles could be applied to ACL injuries. The medical team could collaborate directly with the sports science department to implement effective load management strategies on the same level like it is done in men's football, and these to be communicated with the coaching staff to facilitate forward planning and implementation of such measures, including management of player's match minutes and training schedules [33].

CAN AN ACL INJURY BE PREDICTED?

Jauhiainen et al. used an extensive screening test battery of 880 female elite athletes to investigate the predictive potential of multiple predictive machine learning methods on the risk of sustaining an ACL injury. Despite analysing a large prospective data set, the predictive ability was too low for ACL injury risk assessment in clinical practice. The reasons for the low predictive model might have been due to the failure to record training and match load data, including short term changes in physical variables and training loads. Therefore, further studies are needed to investigate what exact type of data and machine learning approaches should be used for more accurate injury prediction [25].

CONCLUSION

Over 20 years of research has failed to combat the disparity in the burden of ACL injuries between male and female footballers. Future work should look to define specific ACL risk reduction measures and demonstrate how these might be implemented in the elite football setting. To do this, we should not focus only upon the specific intrinsic risk factors in women footballers, but also on the environmental and psychosocially driven risk factors that currently exist [8, 33].

References for this article can be found here

CALF MUSCLE TEAR

Return-to-competition – A multimodal, assessment-supported treatment concept for a professional American football player

HANS OLAF BAACK / SPORTHOPAEDIC HAMBURG

Muscle and musculotendinous injuries are among the most common pathologies in team sports involving fast-paced movements in certain game situations. The sprint in football resulting in muscle fibre tears of the hamstrings is a particularly good example of this (Sportreport of the VBG 2021, the German Employer's Liability Insurance Association). But American football is also notable for the extreme strain it places on muscle and tendon tissue, for example when the running backs sprint or the defensive line intercepts the opposing quarterback.

In the latter game situation, the defensive ends must as quickly as possible prevent the opposing team's quarterback from setting up play during the pass rush or, ideally, sack him (bring him down) or block the running back's path. The defensive ends are usually tall and heavy. Nevertheless, they have to be extremely fast for their key role in the game. Therefore, a large mass of often 120 kg must be accelerated to its maximum. In our case, the player is 194 cm tall, weighs 115 kg, and can run the 40-yard dash (approx. 37 m) in 4.8 seconds. In this case study, we present a multimodal treatment concept for a muscle tear, which led to a pain-free return to competitive sport after just five weeks. Here, as always, the inter-individuality of each patient must be considered. Additionally, the season in American football (in this case the European League of Football (ELF)),which is very short as compared with other team sports, creates a certain degree of pressure to succeed.

CASE STUDY

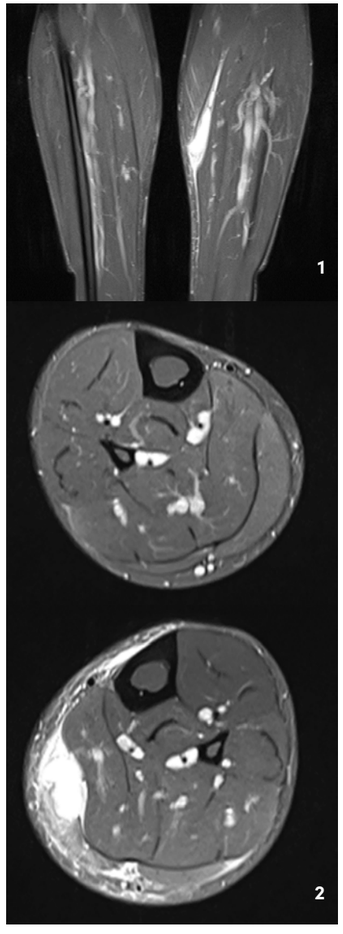
In mid-July, the 27-year-old defensive end player of the Hamburg Sea Devils suffered a muscle tear of the medial head of his gastrocnemius during sprint steps in the 4th quarter of a season game. At that time, the very short three-month regular season of the ELF to qualify for the play-offs was about halfway through. Until then, the player had been able to take part in training and matches without any significant restrictions or injuries. Furthermore, he had suffered no previous injuries to his calf muscles.

DIAGNOSTICS

The MRI scans of the left lower leg obtained after the injury demonstrated a substantial, semi-circumferential medial fluid collection along the superficial soleus fascia. There was oedema within the medial head of the gastrocnemius which showed a circumscribed haematoma measuring 12 x 29 mm. In addition, there was an extensive lamella of fluid extending to the anterior margin of the tibia. The retracted tendon core of the medial head of the gastrocnemius was evident at the inferior margin of the haematoma, at the level of the middle third of the tibial shaft (Figs. 1 + 2). On clinical examination, the patient reported significant pain of the muscle on stretching and pressure. Distal perfusion, motor function and sensory function were normal. One week after the MRI examination, the first follow-up ultrasound scan was obtained. No continuous pennate appearance of the medial head of the gastrocnemius was evident, only mild residual seroma, while elastography was unremarkable. Further ultrasound scans were obtained every seven days to monitor progress (Figs. 3 – 5). At each review appointment, the temperature on the contralateral side was also measured (Delta T), and the visual analogue scale (VAS) was recorded to quantify the pain.

TREATMENT

The multimodal treatment concept comprised the following components:



FIGS. 1 + 2 Acute MRI scan

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In the acute phase (Delta T > 1.2 °C, VAS > 4, significant pain on stretching and pressure):

- Application of a zinc paste dressing
- Application of a calf muscle bandage for compression and stabilisation
- Neuroreflectory hyperbaric CO2 cryotherapy (directly to the lesion and along the course of the efferent lymph vessels, 4 x /week)
- Radial shock wave therapy (applied carefully directly to the lesion and along the course of the efferent lymph vessels, 4x /week)
- Induction therapy (capillarisation programme, 4 x /week)

In the subacute phase (Delta T >1.2 °C, VAS > 4, mild pain on stretching and pressure):

- Neuroreflectory hyperbaric CO2 cryotherapy (directly to the lesion and along the course of the efferent lymph vessels, 4 x /week)
- Radial shock wave therapy (applied carefully directly to the lesion and along the course of the efferent lymph vessels, 4x /week)
- Induction therapy (capillarisation programme, 4 x /week)
- Neuromuscular electrical stimulation of the gastrocnemius muscle (atrophy programme, 2 x/week) active, eccentric, while standing on the edge of a step

In the subclinical phase (Delta T < 0.8 °C, VAS 1 – 2, no pain on stretching or pressure):

- AlterG Anti-Gravity Treadmill (high starting speed up to 16 km/hr, 50 % body weight, 2 x/week)
- Neuromuscular electrical stimulation of the gastrocnemius muscle (atrophy programme, 2 x/week) active, eccentric, while standing on the edge of a step
- Radial shock wave therapy (applied directly to the lesion and along the course of the efferent lymph vessels, 4 x /week)
- Start of American football training (with tape / calf muscle bandage) involving cutting manoeuvres, acceleration runs, etc.

The aim of this treatment concept was initially to relieve pain and reduce effusion and to improve the local metabolic situation. This was followed by functional therapy to meet the demands placed on the calf muscles of a defensive end as far as possible and to simulate them.

MORPHOLOGICAL CLINICAL COURSE

The symptoms had already improved noticeably after about a week, so that the intensity of the radial shock wave was gradually increased (by increasing the pressure from 1.5 bar to 2.5 bar). At the same time, the follow-up ultrasound scan after seven days showed a clearly reduced effusion. Twelve days after the injury, additional eccentric training of the calf muscles was already started. The intensity was continually adjusted from one therapy session to the next. This also meant that intensity needed to be reduced whenever muscle soreness became a significant problem. Sixteen days after the injury, the patient started treatment on the AlterG Anti-Gravity Treadmill, which was alternated with NMES-controlled eccentric training. Whereas cryotherapy was no longer used once the subacute phase was over, radial shock wave therapy remained a basic component of the treatment and was applied after the patient had done initial active exercises. The ultrasound examinations continued to show a reduction of the effusion. Four weeks after sustaining the injury the patient was free of pain for the first time. Another five days later and two days before the next league match, the patient was given the all-clear to play (with white tape for compression). The decision criteria here were the absence of pain on stretching and pressure, the almost continuous pennate appearance of the muscle and only slightly visible residual effusion on ultrasound. The patient was able to complete both the competitive match and the training session the following day without any discomfort.

CONCLUSION

The reported case shows us that a multimodal treatment concept together with close monitoring plus adapted therapy and exercise management can be an effective form of treatment for musculoskeletal injuries. Apart from the clinical examination and the patient's own subjective perception, this was also confirmed by the imaging procedures. A non-invasive and drug-free treatment concept was adopted as a basic rule, which may well also have had a positive impact on patient compliance. So far, the patient has not suffered a recurrent injury and has been able to play all the remaining games of the season.

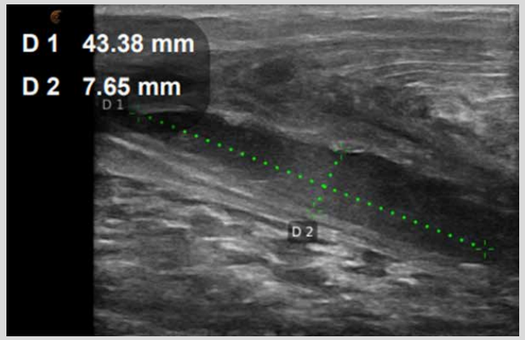

FIG. 3 Ultrasound 5 days after injury

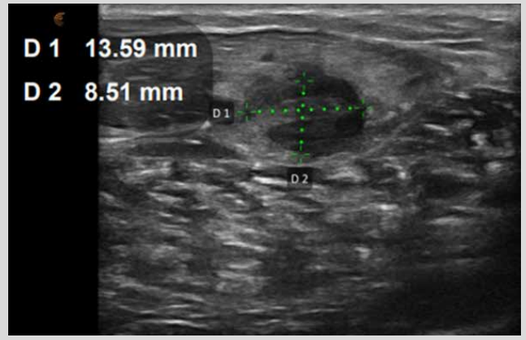

FIG. 4 Ultrasound 4 weeks after injury

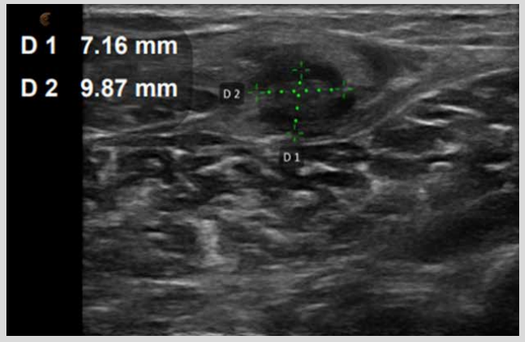

FIG. 5 Ultrasound 5 weeks after injury

FIG. 6 Neuro-reflective hyperbaric CO2 cryotherapy

FIG. 7 High-energy inductive therapy

FIG. 8 Neuromuscular electrical stimulation with eccentric training

READ FOR YOU

Topical Treatment Is Effective and Safe for Acute Ankle Sprains: The Multi-centre, Double-blind, Randomised, Placebo-Controlled TRAUMED Trial

Ludger Gerdesmeyer, Johannes Vester, Christian Schneider, Britt Wildemann

Ankle sprains are common injuries, accounting for more than one million medical consultations per year worldwide and 8000 injuries to the ligaments of the ankle in Germany per day. A large proportion of these are sports-related, where it is of great interest to both the athlete and the club that the injury heals as quickly as possible.

Apart from initiating traditional RICE treatment, ointments are also frequently applied to counteract swelling and reduce pain, especially since oral NSAIDs are associated with a considerable side effect/complication profile and have also been used less recently because they tend to inhibit inflammation more than resolve it. This last issue also applies to topical NSAIDs such as diclofenac gel, the gold standard to date. Currently, focus is being increasingly directed towards accelerating the resolution of inflammation rather than inhibiting the inflammatory-associated pathways non-physiologically, e. g. with NSAIDs.

Traumeel Gel is a well-established complex preparation which consists of 14 natural components and supports these inflammation-resolving pathways at multiple-levels.

The present trial was aimed at investigating the efficacy and safety of Traumeel Gel (Traumed/Tr14) in comparison with diclofenac and placebo.

METHODOLOGY

This is a three-arm, multi-centre, prospective, randomised, double-blind confirmatory trial which investigated the effects of seven days of topical treatment with one of the two mentioned active substances versus placebo for grade 1 and 2 acute ankle sprains. Three grams of the blinded preparation were applied three times a day for seven days. The treatment course was documented for a total of 14 days. Each participant was provided with an elastic bandage for the fresh injury and recommended to use forearm crutches for four days. Patients with grade 2 injuries were also prescribed a semi-rigid brace from day seven as needed. The use of up to three components of the RICE treatment regimen was allowed.

RESULTS

Traumeel Gel was shown to be superior to placebo in reducing pain after four and seven days and was noninferior, even superior, to diclofenac gel. The VAS scores for pain on passive movement also improved significantly in comparison with placebo gel and diclofenac gel.

Tr14 gel improved the absolute VAS scores for pain at rest during the trial compared with placebo gel. In comparison, Tr14 was not superior to diclofenac.

Joint function (FAAM-ADL/ Foot and Ankle Activity Measure – Activities of Daily Living) showed a significant improvement after application of Traumeel Gel in comparison with placebo gel and was noninferior to diclofenac gel.

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The time to 50 % improvement for pain on passive movement was 6.0 days in der Traumeel Gel group and 7.1 days in the placebo gel group. In the comparison Traumeel versus diclofenac, the 50 % improvement time was 6.0 days and 7.0 days, respectively.

The time to 50 % improvement for pain at rest was 4.0 days in the Traumeel Gel group and 6.0 days in the placebo gel group, with the comparison between Traumeel and diclofenac demonstrating a similar difference (4:6 days), which was, however, not significant.

Thus, the patients treated with Traumeel Gel experienced pain reduction on average more quickly and significantly.

SAFETY

Twenty side effects, which tended to be minor, developed in 18 of the 625 patients, the most common symptoms unrelated to the preparation being headache and dry skin. The differences between the individual study arms tended to be the result of random variation.

COMMENTS

The trial showed that Traumed Gel has a statistically significant pain-relieving effect which is even of clinical relevance. The trial also confirms the current trend in sports medicine that with injuries it is less a matter of suppressing the development of inflammation but rather of enhancing the rapid resolution of the physiological inflammatory reaction which is otherwise essential for the body. Whenever possible and if at all needed, NSAIDs should therefore only be given during the initial phase of injury in order not to delay inflammation resolution and subsequent healing.

ANTERIOR CRUCIATE LIGAMENT TEAR

Surgical versus conservative management

PROF. MIRCO HERBORT MD / OCM KLINIK MÜNCHEN
AO UNIV-PROF. CHRISTIAN FINK MD / GELENKPUNKT INNSBRUCK

Image: © IMAGO Images / SOPA Images Bruno de Carvalho

With an incidence of 68.6 / 100,000, an anterior cruciate ligament (ACL) tear is still a common serious ligament injury, especially in the young and physically active patient population, and often results in chronic ligament instability of the knee joint [14].

Absence of ligament stabilisation together with medial displacement of the rotational axis of the knee joint result in significant translational instability of its lateral compartment. According to current study data, this injury can result in chronic translational instability of the knee joint in 75 – 87 % of cases after conservative treatment and in 8 – 50 % of cases after surgical management [10, 15, 16, 20]. This chronic instability has been shown to have a negative impact on the patient's sports ability, the function of the knee joint and the patient's quality of life, as well as towards accelerating the progression of osteoarthritis [2, 8, 14]. However, the choice of adequate treatment after an anterior cruciate ligament injury is still part of an ongoing scientific debate. In this article, we would like to take an up-to-date look at this still controversial issue, on which the Ligament Committee of the German Knee Society (DKG) has completed and published a consensus project [5, 11, 12]. According to current S1 guidelines (AWMF), ACL reconstruction using an autologous graft is indicated in cases associated with concomitant injuries to the collateral ligaments, repairable meniscal tears, and significant instability. According to meta-analyses and various cohort studies, it has been possible to reliably prevent secondary damage to the menisci and cartilage as well as to restore the previous level of activity to a large extent by ACL reconstruction [1, 9, 14].

ADEQUATE TREATMENT OF CONCOMITANT PATHOLOGICAL CONDITIONS OFTEN REQUIRES SIMULTANEOUS ACL RECONSTRUCTION

An important prerequisite for deciding whether an ACL tear can be treated conservatively with a high probability of achieving a good result is the exclusion of relevant concomitant pathological conditions which, without surgical intervention, have a major bearing on the function and durability of the biological knee joint. The most important of these conditions is the complex meniscal tear, which has a good chance of healing after suturing but has a relevant negative impact on the joint if resected [11]. Many clinical studies have demonstrated beyond doubt the protective function of the menisci, with the lateral meniscus being of particular importance. Furthermore, the simultaneous stabilisation of the anterior cruciate ligament was shown to significantly improve the healing chances of a meniscal suture. Toman et al. demonstrated a meniscal healing rate of 70 – 92 % after simultaneous stabilisation of an ACL tear compared with a healing rate of 50 % without stabilisation [11, 17, 19]. Apart from the need to stabilise the knee joint by means of ACL reconstruction,

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a stem cell-promoting effect of ACL surgery to support meniscal healing is also under discussion, which is why a one-stage treatment approach is recommended.

MANAGEMENT OF AN ISOLATED ACL TEAR

With regard to the treatment of a presumed isolated ACL tear, a prospective randomised study by Frobel RB et al. in particular has received a great deal of attention, and especially the lay press has suggested an equal value of surgical and conservative treatment [3, 4]. Taking a closer look at the study, however, the fact that it reveals a change from conservative to surgical treatment after five years in 51 % of the treatment groups must be viewed very critically, given that the results of these operated patients are attributed to the conservative group. However, other studies have also shown that delayed surgical management significantly increases the risk of secondary injuries to the menisci and cartilage [6]. In their cohort study, Sanders et al. found a five-fold increased risk of secondary meniscal tears after conservatively treated ACL ruptures compared with the surgically treated group [13].

ACL RECONSTRUCTION HAS A PROTECTIVE EFFECT AGAINST SECONDARY INJURY TO THE MENISCI AND CARTILAGE

Overall, evidence thus shows that ACL reconstruction has a protective effect on menisci and cartilage and can prevent secondary injuries [11]. Another prospective randomised study was published by Tsoukas D et al. in 2013. In contrast to the Frobel study, however, this trial found an advantage in favour of surgical treatment in terms of both functional knee scores and stability values [18]. A systematic review of current studies was published in 2018 by Krause M. et al. in the German medical journal Deutsches Ärzteblatt [7]. The authors come to the conclusion that, based on the currently published RCTs (randomised controlled trials), no clear conclusion can be drawn as to whether surgical or conservative (wait and see) management leads to a better functional outcome. In observational studies, however, the authors were able to show a trend towards better results in favour of surgical management. Nevertheless, if concomitant injuries requiring urgent treatment have been ruled out and the patient has a moderate level of activity, a conservative treatment approach is primarily feasible. The patient should, however, be closely monitored and thus enable any persistent or progressive instability to be recognised in order to reconsider whether surgery is now indicated. Secondary injuries after ACL insufficiency in particular are a significant problem that can be successfully minimised by means of ACL reconstruction.

CONCLUSION

Many new findings on the impact of the peripheral ligament structures (ALL, MCL), certain meniscal pathologies, and the significance of the tibial bony slope have considerably improved our understanding of individual ACL injuries and should be increasingly taken into account in future when deciding on tailored treatment for individual patients. Apodictic “surgery or conservative therapy” should be a thing of the past. This way, it is certainly possible to improve the results of our cruciate ligament patients, whether by conservative or surgical management.

References for this article can be found here

RESVERATROL

A pearl of nature with prophylactic, therapeutic and regenerative potential

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Even as early as the fourth century BC, the famous physician Hippocrates is said to have recognised the following: "Wine is a thing, wonderfully suited to man, provided that the beverage is used judiciously and in the right measure in good and bad health, in accordance with the physical constitution of the individual." Aside from that, the "French paradox" remains a persistent hypothesis, stating that the socially accepted higher consumption of red wine in France lowers the risk of cardiovascular disease. But what is behind all this? Should we really drink red wine in order to stay healthy for life?

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From a scientific point of view, this is clearly to be denied as it is now known that the natural polyphenol resveratrol, which is found in significant amounts in grapes of all colours, represents the central health-promoting component of red wine. After the discovery of this secondary plant substance in 1939, an extensive search for its origins began, yielding numerous fruits as natural sources of resveratrol. Apart from grapes, these include most berries, such as strawberries, mountain cranberries, blueberries, and red and black currants, as well as nuts such as peanuts and pistachios. But why do so many plants contain resveratrol? This phytoalexin protects them from infection, adverse weather conditions and premature over-ripening, thereby increasing the survival time of these fruit and plants.

THE EFFECT OF RESVERATROL ON THE HUMAN BODY

In view of this, the last few decades have been used to intensively investigate resveratrol's effects on human cells and the human body. All in all, the investigations revealed a variety of effects that protect, maintain and defend our health. The phytopharmaceutical influences the metabolic as well as immune system and has both neuroprotective and cardioprotective effects. Interestingly, treatment with resveratrol increases the enzyme nitric oxide synthase, which is responsible for the production of the well-known cardiac vasodilator nitric oxide (NO). In addition to these prophylactic mechanisms, resveratrol is even able to inhibit the growth of cancer cells and increase the effect of classic chemotherapeutic agents by sensitising the cells. This extensive modulation is based on a strict regulation of the inflammatory cascades around the main transcription factor of all inflammatory processes, known as nuclear factor kappa B (NF-kB).

In order to curb both acute and chronic inflammation, resveratrol restricts the secretion of pro-inflammatory cytokines and enzymes such as TNF-α, TNF-β, IFN-γ, COX-2, MMPs and various interleukins, thereby preventing the activation of NF-kB. However, the phosphorylation of NF-kB itself and the production of its inflammation-promoting end products are also blocked by this natural polyphenol. Additionally, the plant substance has an anti-oxidative effect in all organs and eliminates environmentally induced irritation in various tissues by balancing nitrogen oxides and reducing stress in cells.

Besides these catabolic options of intervention, resveratrol also utilises anabolic processes in healthy tissues and stabilises primary connective tissue cells such as osteocytes, chondrocytes and tenocytes. In this respect, a clinical study showed that the daily consumption of blueberries containing resveratrol significantly improved the quality of life of patients with symptomatic osteoarthritis of the knee joint by reducing pain and improving function.

It was also recently discovered that the intake of blackcurrant nectar by healthy volunteers leads to a significant reduction in sports-related muscle damage. Apart from its anti-inflammatory and anti-oxidant effects, this suggests that resveratrol also has regenerative potential. Fortunately, the phytopharmaceutical can be taken as part of a balanced diet or in regular doses as a supplement. So far, neither relevant side effects nor allergic reactions to resveratrol administration have been encountered in humans.

CONCLUSION

Overall, the regular use of resveratrol represents a promising preventive and (co-)therapeutic approach to complementary medicine and could also prove to be a multifunctional pearl of nature from a sports medicine perspective in the future.

References for this article can be here

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UPDATE ON INTRA-ARTICULAR INJECTIONS

An overview of current literature

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Recently, several treatment recommendations for knee and hip osteoarthritis have been published with very different (mostly negative) statements on injection therapy for these joints, which sometimes make it difficult to provide practicing physicians with a proper "common thread". The statements expressed in these articles are mainly based on meta-analyses or guidelines from various international societies.

However, if you take a look at the publications of recent years on the subject of autologous blood / platelet-rich plasma (PRP) injections, it is surprising that this type of therapy comes off so badly in the treatment recommendations. With the following article, I shall try to shed some light into this darkness and encourage you to think about the topic, above all for yourself.

The current issue of "Osteoarthritis and Cartilage" deals with joint-preserving treatment recommendations for knee and hip osteoarthritis. This study assessed the levels of recommendations from international professional societies and summarised their results. Twenty-five guidelines were included, seven of which were rated as "of higher quality". In particular, the importance of exercise, weight management and patient education is emphasised. With regard to injection therapy, the guidelines recommend glucocorticoid injections for the knee joint. At the same time, however, the included recommendations advise against hyaluronic acid (HA) injections of the knee joint and PRP injections of the knee and hip joints [1]. In a recent issue of the German medical journal Deutsches Ärzteblatt, the topic is presented in a similar, albeit somewhat more differentiated, way. Here, glucocorticoids are recommended for short-acting pain control for refractory symptoms, but it is made clear that prolonged use increases the risk of cartilage loss and, subsequently, osteoarthritis progression. Based on the underlying guidelines, the evidence for the use of hyaluronic acid is rated as low, with the observation that high molecular weight hyaluronic acid could produce better results than low molecular weight hyaluronic acid. As regards injections with PRP, aspirates from bone marrow/adipose tissue or expanded mesenchymal stromal cells (MSC), the sources used to date do not provide any convincing evidence of longer-term therapeutic effects [2]. Unlike the two studies mentioned above, the European Society for Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA) takes a very positive stance on the use and evidence of injectable orthobiologics in the treatment of osteoarthritis of the knee in its ORBIT (ORthoBiologics InitiaTive) Consensus 2022. They recommend PRP for knees with moderate osteoarthritis, consider PRP to be safer than glucocorticoids, especially with respect to the chondrotoxicity of cortisone, and favour PRP over HA. As far as the superiority of leukocyte-poor or leukocyte-rich PRP and the other differences between the individual PRP products are concerned, the ORBIT Group does not see sufficient scientific evidence to provide any recommendations. On the question of the number of injections, more than one is recommended [3].

Even though this is not a guideline or registered meta-analysis, it should be added that Jörg Jerosch, who unfortunately died far too early, also commented on injection therapy with cortisone, hyaluronic acid and PRP in one of his last review articles on the conservative treatment of osteoarthritis. He ascribes glucocorticoid injections a short-term positive effect in activated osteoarthritis of the knee but puts this into perspective by adding that hyaluronic acid injections are already superior after just eight weeks. With respect to the various HA preparations, he quotes that high molecular weight HAs show better clinical results than low molecular weight HAs. He gives a positive assessment of intraarticular PRP injections and refers exclusively to the above-mentioned ESSKA consensus paper [4].

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PRP IN THE CURRENT LITERATURE

When looking at the recommendations given above [1, 2], it is somewhat surprising that the role of PRP in the treatment of knee and hip osteoarthritis in particular is presented so negatively, and that glucocorticoid injections are still recommended. The current literature actually takes a different view. Over recent months, various meta-analyses have appeared which report clearly positive results in the use of PRP in large patient groups. Xue et. al. summarise 16 randomised and controlled studies with a total of 1652 patients which favour PRP over all other injectable substances with respect to pain, stiffness and function [5]. Large meta-analyses involving 1805, 1292 and 1042 patients reached similar results [6 – 8].

PRP AND HA IN THE CURRENT LITERATURE

The majority of current comparative studies favour PRP in comparison with HA. In a meta-analysis, Belk et al. compared 811 patients after PRP injections with 797 patients after HA injections [9]. The PRP group demonstrated a better result as compared with the HA group with respect to various clinical scores (WOMAC, VAS and IKDC). In the PRP group, the leukocyte-poor preparations showed significantly better results than the leukocyte-rich preparations. Another meta-analysis involving 1077 patients in the PRP group and 1009 patients in der HA group also reached similar results for the comparison between PRP and HA [10]. Current meta-analyses looking at the combination of PRP and HA are also very interesting. Thus, all available studies show no increased side effects rates for the combination of both preparations in comparison with single therapy with PRP or HA [11 – 13]. Interestingly, Zhang et. al even report that fewer side effects developed with combination therapy of PRP and HA than with single therapy with PRP. In terms of various clinical scores, the present meta-analyses show better results for a combination of PRP and HA in comparison with single therapy with PRP or HA [11 – 13].

THE ROLE OF GLUCOCORTICOIDS

Here, too, a look at the current literature is somewhat surprising with respect to the statements made in the recommendations discussed at the beginning of this article [1, 2]. If PRP injections are compared directly with glucocorticoid injections, then significantly better results are found for patients after PRP injections [14]. Donavan et al. present similar results (also in "Osteoarthritis and Cartilage"), reporting that recurrent cortisone injections are clearly inferior to PRP or HA [15]. Even more decisive, however, is a look at various studies linking cortisone injections with an accelerated progression of osteoarthritis. For example, large groups of data from the „Osteoarthritis Initiative" in the USA show that glucocorticoid injections are associated with an increased risk of needing a total knee replacement (TKR) in the course of the disease [16]. Another analysis of an even larger database shows very comparable results correlating dose-dependent intra-articular cortisone injections with an increased risk for knee replacement within the next five years [17].

CONCLUSION

If one looks at the current literature cited here (only sources from 2020 onwards), one gets the impression that the meta-analyses cited from the large patient groups shown do not necessarily correspond to the statements of the first two recently published treatment recommendations. PRP treatment, especially of osteoarthritis of the knee, certainly has a good and positive foundation in the literature. The combination of PRP and HA injections, in particular, appears to be a safe and promising combination therapy. The intra-articular injection of glucocorticoids should be reviewed and carries the risk of progression of cartilage damage.

References for this article can be found here

NOTE FROM THE EDITORIAL TEAM

In this respect, see also the articles in by Prof. Dr. Oliver Werz / Dr. Markus Werner „Glucocorticoids[1] – New mechanisms of action decoded – timing counts in therapy" and by Aranka Brockmüller and Prof. Dr. Mehdi Shakibaei „Epigenetic efficacy of curcumin as a therapeutic goal in osteoarthritis" (p. 12) & „Resveratrol – A pearl of nature with prophylactic, therapeutic and regenerative potential" (p. 52).

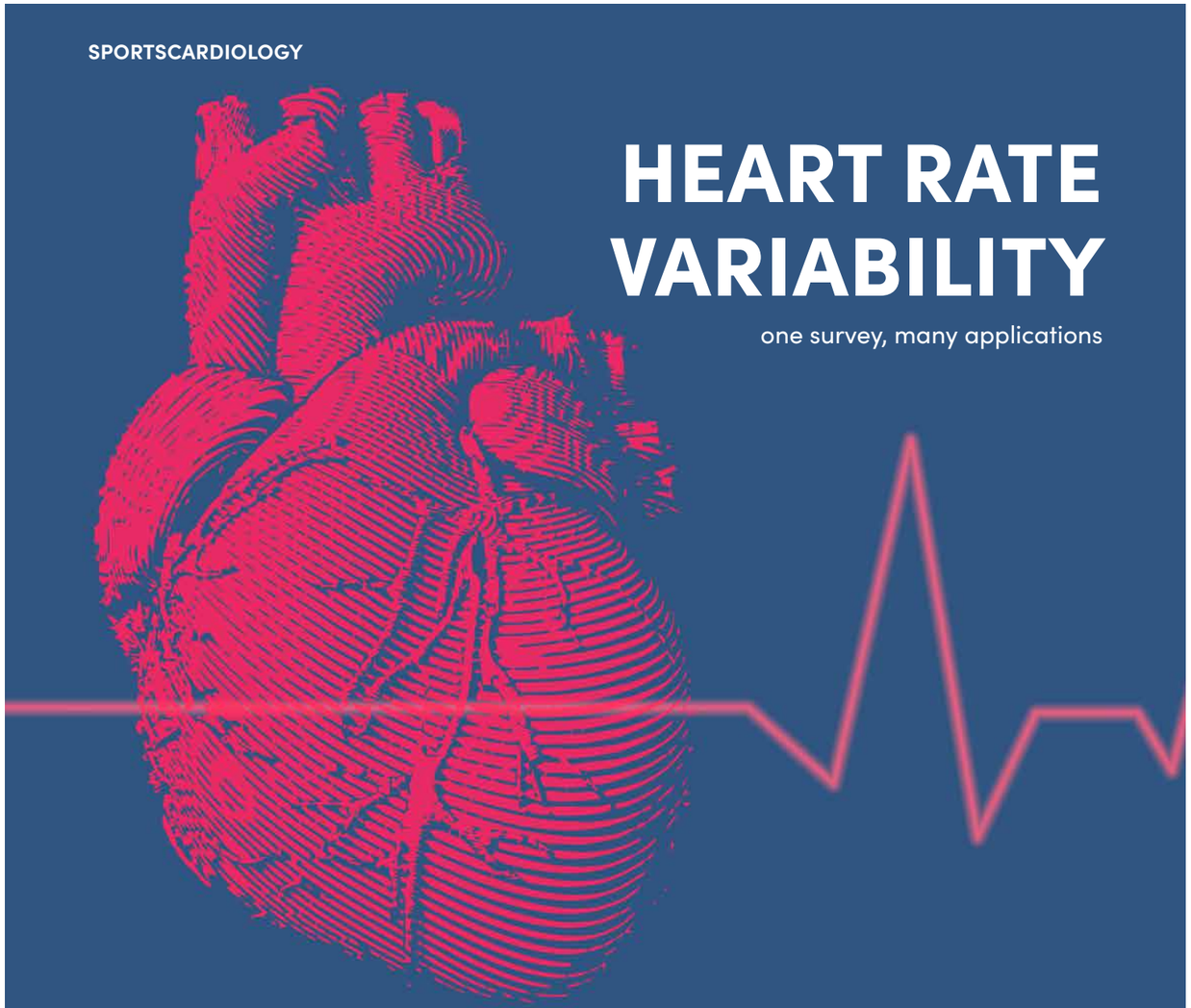
We would also like to draw your attention to further articles on osteoarthritis therapy, including those by Dr. Weisskopf, Prof. Dr. Jerosch and others, online on our sports medicine portal: https://sportaerztezeitung.com/?s=Arthrose[2].

1

In line with this topic

Following a decision by the German Federal Administrative Court, natural health practitioners are not allowed to take blood from their patients to produce autologous blood products (Ref.No.: BVerwG 3 C 3.22, BVerwG 3 C 5.22 and BVerwG 3 C 4.22).

2



HEART RATE VARIABILITY

one survey, many applications

MOSÈ MONDONICO / ITALIAN OLYMPIC COMMITTEE (CONI), ROME

Heart rate variability (HRV) is a term used to describe the variability in time intervals between heartbeats. In other words: The heart does not beat at a constant rate, even when we have an average beat of 60 beats per minute, the heart does not beat exactly every second. There are always variable times between beats. How come? Why are we interested in measuring this variability?

The human body, on a physiological level, tries to maintain a state of balance, called homeostasis, which is necessary for optimal functioning. The body perceives stress through our senses, and sends this information to the brain, which decides how to react. Regardless of the source that causes stress, the body responds the same way.

Returning to our cardiac variability, the non-constant times between one beat and another reflect the activity of the autonomic nervous system in response to stimuli, i.e. sources of stress. When we encounter a form of stress, the autonomic nervous system carries the impulses received from the brain to the various muscles and organs of the human body. This mechanism of the autonomic nervous system controls nearly 90 % of the functions of the human body, both short-term ones such as breathing and more long-term ones.

To summarize, the autonomic nervous system controls and regulates many processes within the human body as well as our body's responses to various forms of stress. HRV is regulated by the autonomic nervous system, in particular by the parasympathetic system (at least the easiest variables to interpret) and consequently it can reveal important information about our body's reaction to stress, regardless of what generated it (training, a difficult period at work, etc.).

HOW IS IT MEASURED?

HRV can be measured in various ways. The reference system is the electrocardiogram, although fortunately in recent years there have been technological developments that have brought these measurements somewhat into the hands of anyone with an interest, through the use of chest straps.

Once we have chosen a system for measuring HRV, unfortunately there is an additional complexity, which is that there are various ways to quantify cardiac variability. Normally, the most reliable methods and on which there is more consensus in the scientific community, are related to the measurement of the parasympathetic system, i. e. the one that deals with the state of recovery of the body. The most common way of quantifying cardiac variability is the so-called rMSSD, or a derivation thereof. rMSSD is a mathematical formula used to transform changes in beats over a period of 1 to 5 minutes into a single number indicating the activity level of the parasympathetic system.

WHAT FACTORS INFLUENCE THE DATA?

By the very nature of what HRV quantifies, i.e. the activity of the vagus nerve, or activity of the autonomic nervous system, everything affects it a bit. Let's try to make a list of factors that have been associated with HRV in recent publications: they range from physical exercise, to nicotine, caffeine, medicines, time of day (circadian rhythm), alcohol, age, digestion of food or even water, illness , etc. – how then do we draw valid conclusions if the processes we measure are influenced by so many parameters? It is essential to measure cardiac variability in order to limit the effect of so-called external stress sources as much as possible: the simplest way to create a so-called reproducible context in which to take the measurement is to do it as soon as you wake up, before exercising, eating, getting to work, or before being influenced by the various forms of everyday stress.

WHY IS THIS DATA IMPORTANT FOR AN ATHLETE? HOW SHOULD IT BE INTERPRETED?

In the context of athletes, HRV application and monitoring are more prevalent due to the ability to quantify the form

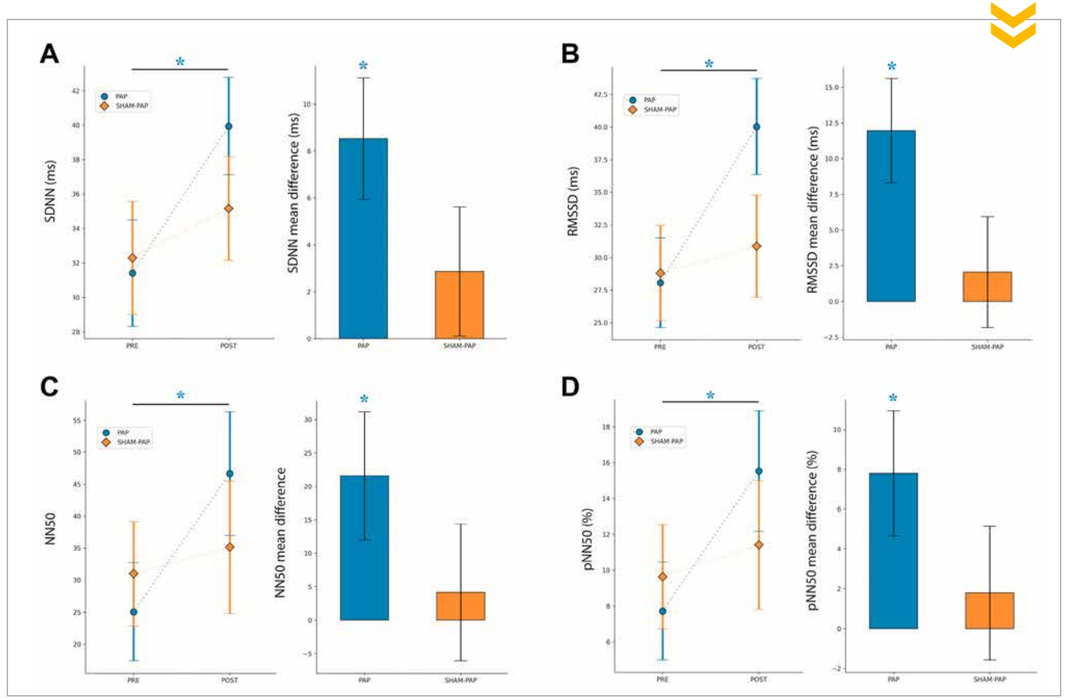


FIG. 1 Time-domain parameters of HRV at rest, pre- and post-treatment. (A) SDNN, (B) RMSSD, (C) NN50, (D) pNN50. Data presented are mean ± standard errors of the mean (SEM). Asterisk marks a significant difference ($p < 0.05$).

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of stress, i.e. training. The relationship between training and HRV is evident and has been proven several times in various scientific studies, as training is a very high form of stress for the body. For other applications, for example related to physical and mental health, it can be much more complex to identify and quantify the sources of stress, making it difficult to implement feedback as well as then modify our plans to improve things.

In professional athletes, the risk of overtraining is always present, due to very high training volumes. However, amidst all of this, we must not overlook the athlete's body response to the training program. Is it adapting well? Or is he/she struggling more than expected? An objective measure of stress status can help us implement changes on the go. For the non-professional athlete, perhaps who trains when he/she doesn't have to devote time to work or family, measuring HRV can be even more important, as all forms of stress are detected in this way, and we can better understand when it is appropriate to slow down with training, or when we can indulge in an extra intense session, always with the aim of improving physical performance in the long term.

Speaking of stress, even after an injury, a therapeutic process begins, HRV can provide us with important data to see how the therapy works.

OUR RESEARCH

Published in the "International Journal of Environmental Research and Public Health" we evaluated how HRV can be used to verify the positive effects of a therapy on subjects with orthopedic injuries. Specifically, we have seen how combining classic physiotherapy therapy with technologically advanced tools such as the papimi Ion-Induction-Therapy (IIT) within the same session leads to an improvement in all HRV parameters, a sign of an effective therapy (See Fig. 1 & 2).

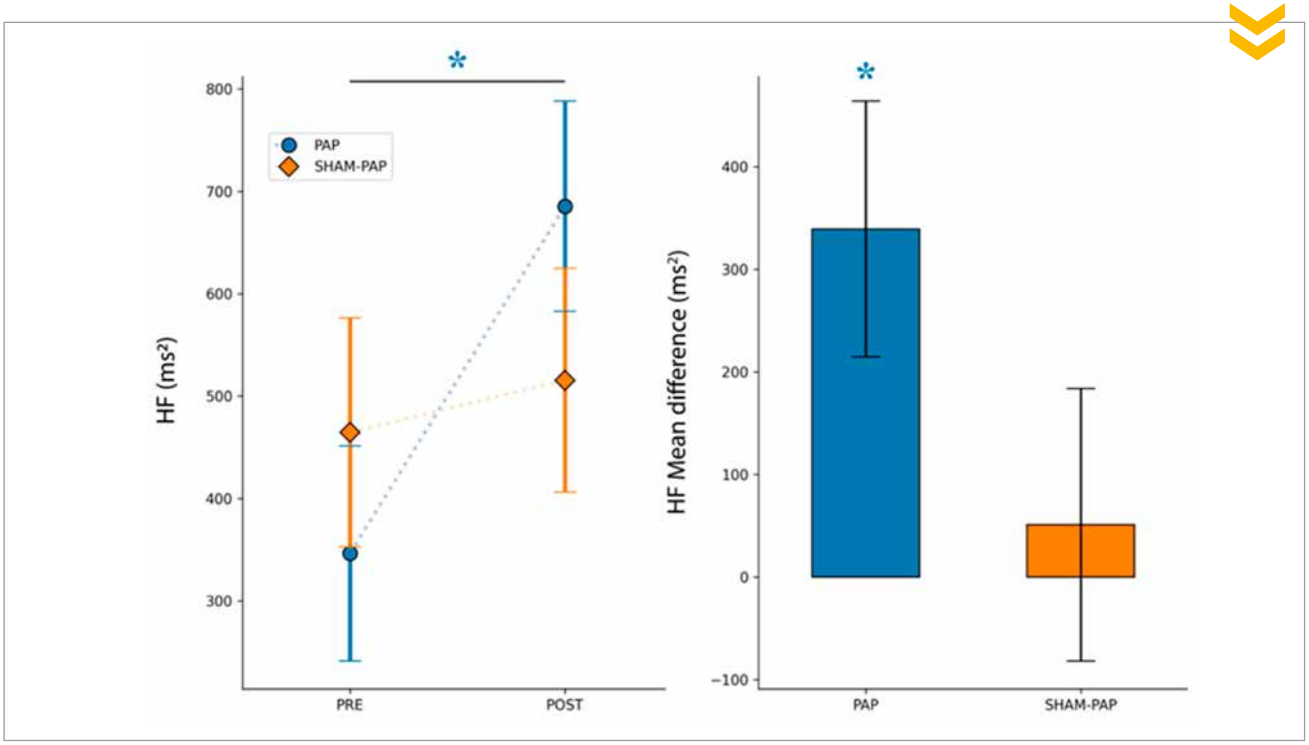

FIG. 2 Frequency-domain parameter of HRV at rest, pre- and post-treatment. HF band.
Data presented are mean ± standard errors of the mean (SEM). Asterisk marks a significant difference ($p < 0.05$).

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