

Terminology and Classification of Athletic Muscle Injuries

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Abstract

Although athletic muscle injuries are very frequent, a consistent and comprehensive classification system as well as a clear terminology were so far missing. In order to facilitate effective communication among medical practitioners and to support the development of systematic treatment strategies, we developed

NOTE: Since this book chapter is based on consensus statements published not before October 2012 (Epub ahead of print), the new nomenclature and classification used in this chapter is not yet reflected consistently in all chapters of this book.

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practical and systematic definitions of muscle injuries as well as a new and comprehensive classification system, both based on an international consensus meeting.

The classification system differentiates basically between (A) *indirect* and (B) *direct* muscle injuries and within the *indirect muscle injuries* between (1) *functional muscle disorders*, describing disorders without macroscopic evidence of fiber tear, and (2) *structural muscle injuries* with macroscopic evidence of fiber tear, i.e., structural damage. Subclassifications are presented for each type.

This comprehensive classification system is proven in the daily practice and scientifically validated. It will help to improve clarity of communication for diagnostic and therapeutic purposes and can serve as the basis for future comparative studies to address the continued lack of systematic information on muscle injuries in the literature.

1.1 Introduction

Muscle injuries are a substantial problem for athletes. They constitute 31 % of all injuries in elite football (soccer) [12]; thigh muscle injuries are the most common diagnosis in track and field athletes with 16 % [24, 25]. Their relevance has also been documented in many other sports like rugby (10.4 %) [23], basketball (17.7 %) [5], and American football (46/22 % practice/games) [14].

Muscles that are frequently involved in injuries are often biarticular [19] or have a more complex architecture (e.g., adductor longus). They usually undergo eccentric contraction and contain primarily fast-twitch type 2 muscle fibers [1, 30]. Ninety-two percent of all muscle injuries affect the four major muscle groups of the lower limbs: hamstrings (37 %), adductors (23 %), quadriceps (19 %), and calf muscles (13 %) [12]. Sixteen percent of muscle injuries in soccer are reinjuries and cause significantly longer absence times than the initial injuries [12].

Particularly in elite athletes, where decisions regarding return to play and player availability have significant financial or strategic consequences for the player and the team, there is an enormous interest in optimizing the diagnostic, therapeutic, and rehabilitation process after muscle injuries in order to minimize the absence from sport and to reduce recurrence rates.

However, little information is available in the international literature about muscle injury definitions and classification systems. Since injury definitions are not standardized and guidelines are missing, proper assessment of muscle injury and communication between practitioners are often difficult to achieve [29]. Moreover, it has been documented that variability between definitions creates significant differences in study results and conclusions [7, 17, 20]. Thus, it is critically important to establish a standardization. *Muscle strain*, for example, presents one of the most frequently used terms to describe athletic muscle injury, but this term is still without clear definition and used with high variability [29].

The aim of this book chapter is to present a standardized English terminology for muscle injuries in order to improve diagnostic, therapeutic, and scientific communication. The standardized definitions were established in a consensus meeting of international sports medicine experts working in the field of muscle injuries.

In addition, an empirically based comprehensive and practical classification system is presented that reflects the differentiated spectrum of muscle injuries seen in athletes. This classification was recently published as a consensus statement [29]. It is based on an extensive, long-term experience and has been used successfully in the daily management of athletic muscle injuries.

It has to be pointed out that this book chapter is mainly based on the 2013 publication by Mueller-Wohlfahrt et al. in *British Journal of Sports Medicine*.

1.2 Terminology

Even among sports experts, considerable inconsistency exists in the use of muscle injury terminology. There is no clear definition, differentiation, and use of several terms like *strain*, *tear*, *pulled muscle*. To evaluate the currently used English terminology of athletic muscle injuries, a survey of sports medicine experts was conducted by the authors. The results confirmed that even among experts working frequently with athletic muscle injuries at the elite level, considerable inconsistency exists in the use of muscle injury terminology.

After this survey, a consensus meeting of 15 international experts on the basic science of muscle injury as well as sports medicine specialists involved in the daily care of premier professional sports and national teams was established. The meeting was endorsed by the International Olympic Committee (IOC) and the Union of European Football Associations (UEFA).

In the consensus meeting, practical and systematic scientific terms of muscle injuries were defined. In addition, a new comprehensive classification system was developed.

The following consensus definitions were established:

1.2.1 Functional (=non-structural) Muscle Disorder

“Acute indirect muscle disorder without macroscopic evidence (in MRI or ultrasound) of muscular tear.

Often associated with circumscribed increase of muscle tone (muscle firmness) in varying dimensions and predisposing to tears. Based on the etiology several subcategories of functional muscle disorders exist.”

According to Fuller et al., a sports injury is defined as *“any physical complaint sustained by an athlete that results from a match/competition or training, irrespective of the need for medical attention or time loss from sportive activities”* [15].

That means also irrespective of a structural damage. By this definition, *functional muscle disorders*, irrespective of any *structural* muscle damage, are *injuries* as well. However, the term *disorder* better differentiates *functional disorders* from *structural injuries*. Thus, the term *functional muscle disorder* was specifically chosen by the consensus conference.

Functional muscle disorders are *indirect injuries*, i.e., not caused by external force, and present a distinct clinical entity. They result in a *functional* limitation for the athlete, e.g., painful increase of the muscle tone which can represent a risk factor for *structural* injury. However, they are not readily diagnosed with standard diagnostic methods such as MRI since they are without macroscopic evidence of *structural* damage, defined as absence of fiber tear on MRI.

A recent UEFA muscle injury study has demonstrated the relevance of *functional muscle disorders* in football/soccer [13]. This study included data from a 4-year observation period of MRI obtained within 24–48 h after injury and demonstrated that the majority of injuries (70 %) were without signs of fiber tear. However, these injuries caused more than 50 % of the absence of players in the clubs [13].

1.2.2 Structural Muscle Injury

“Any acute indirect muscle injury with macroscopic evidence (in MRI or ultrasound) of muscle tear.”

It must be pointed out that MRI is usually precise enough to determine if there is a relevant tear or not. However, MRI alone is not appropriate to determine the diagnosis and extent of a muscle injury. Careful combination of diagnostic modalities including medical history, inspection, clinical examination, and imaging will most likely lead to an accurate diagnosis, not imaging alone.

For example, the history of a sharp acute onset of pain, experience of a snap, and a well-defined localized pain with positive MRI for edema but indecisive for fiber tear strongly suggest a minor partial muscle tear, below the detection sensitivity of the MRI. Edema, or better the increased fluid signal on MRI, would be observed with a localized hematoma and would be consistent with the working diagnosis in this case. The diagnosis of a small tear (*structural* defect) that is below the MRI detection limit is important in our eyes, since even a small tear is relevant because it can further disrupt, e.g., when the athlete sprints.

1.2.3 Strain and Tear

Strain represents certainly one of the most frequently used terms to describe athletic muscle injury. Hägglund et al. defined it as “*acute distraction injury of muscles and tendons*” [17]. However, this definition is rarely used in the literature and in the day-to-day management of athletic muscle injuries.

Strain is a biomechanical term which is not defined and used indiscriminately for anatomically and functionally different muscle injuries. Some authors use *strain* exclusively as a term for “grade I injuries” or “minor muscle injuries” involving only a few muscle fibers [9], whereas others subsume different grades of injuries ranging from mild to severe [25, 30]. Again other authors differentiate *strain* from *ruptures*.

Thus, we do not recommend the use of this term. Instead, we propose to use the term *tear* (which has the same meaning like *rupture*) for *structural injuries* of muscle fibers/bundles leading to loss of continuity and contractile properties. *Tear* better reflects *structural* characteristics as opposed to a mechanism of injury.

The following terms are without specific recommendation:

Strain – See above.

Pulled muscle – A lay term for different, undefined types or grades of muscle injuries and cannot be recommended as a scientific term.

(Further recommended consensus definitions are presented below together with the new classification system.)

1.3 Classification

Usually, researchers compare the results from their study with results from other published studies. But comparisons of different muscle injuries and layoff times can only be made between studies with essentially the same injury definitions and classification system. Since so far no universal and comprehensive classification existed that includes all types of athletic muscle injuries, the significant methodological differences between studies do not allow for comparison between study results [10].

Different classification systems are published in the literature (Table 1.1), but no system is consistently used within studies and in daily practice [8]. Most of the grading systems classify acute muscle injuries as grade 1, 2, and 3. However, this does not accurately reflect the occurrence of muscle injuries in athletes. Previous systems are either based upon clinical signs or upon imaging.

All previous grading systems lack subclassifications within the grades or types. In consequence, injuries with a different etiology, treatment pathway, and prognostic relevance are categorized in the same group. Moreover, no terminology or grading system (sub)classified disorders without macroscopic evidence of structural damage, even though a muscle injury study of the *Union of European Football Associations (UEFA)* has emphasized their high clinical relevance in professional athletes, as mentioned above [13].

The most recently published classification system by Chan et al. is imaging based, even though many authors have stated that diagnosis and prognosis of muscular injuries are normally mainly based on clinical findings and radiological methods such as MRI or ultrasound are used for additional information in order to confirm a diagnosis [13, 22].

Table 1.1 Previous muscle injury classification systems

	O' Donoghue 1962 [31]	Ryan 1969 (initially for quadriceps) [36]	Takebayashi et al. 1995, Peetrons 2002 (ultrasound based) [35, 40]	Stoller 2007 (MRI based) [39]	Chan et al. 2012 (MRI/ultrasound based) [9]
Grade I	No appreciable tissue tearing, no loss of function or strength, only a low-grade inflammatory response	Tear of a few muscle fibers, fascia remaining intact	No abnormalities or diffuse bleeding with/without focal fiber rupture less than 5 % of the muscle involved	MRI negative = 0 % structural damage, hyperintense edema with or without hemorrhage	Includes Site of injury: Proximal Middle Distal
Grade II	Tissue damage, strength of the musculotendinous unit reduced, some residual function	Tear of a moderate number of fibers, fascia remaining intact	Partial rupture: focal fiber rupture more than 5 % of the muscle involved with/without fascial injury	MRI positive with tearing up to 50 % of the muscle fibers. Possible hyperintense focal defect and partial retraction of muscle fibers	Pattern: Intramuscular Myofascial Myofascial/perifascial Musculotendinous
Grade III	Complete tear of musculotendinous unit, complete loss of function	Tear of many fibers with partial tearing of the fascia	Complete muscle rupture with retraction, fascial injury	Muscle rupture = 100 % structural damage. Complete tearing with or without muscle retraction	Combined Severity: Comparable to Stoller
Grade IV	X	Complete tear of the muscle and fascia of the muscle-tendon unit	X	X	X

Modified after Mueller-Wohlfahrt et al. [29]

1.3.1 Diagnosis

Our approach is to include the combination of the currently best available diagnostic tools. Careful combination of diagnostic modalities including medical history, inspection, clinical examination, and imaging will most likely lead to an accurate diagnosis, rather than relying on imaging alone.

In accordance with Askling et al. and Järvinen et al., we recommend to start with a precise history of occurrence, circumstances, symptoms, and previous problems, followed by a careful clinical examination with inspection, palpation of the injured area, comparison to the other side, and testing of the function of the muscles [2, 19]. Palpation serves to detect (more superficial and larger) tears, perimuscular edema, and increased muscle tone. An early post-injury ultrasound provides helpful information about any existing disturbance of the muscle structure and reveals if further MR imaging is needed.

1.3.2 Imaging

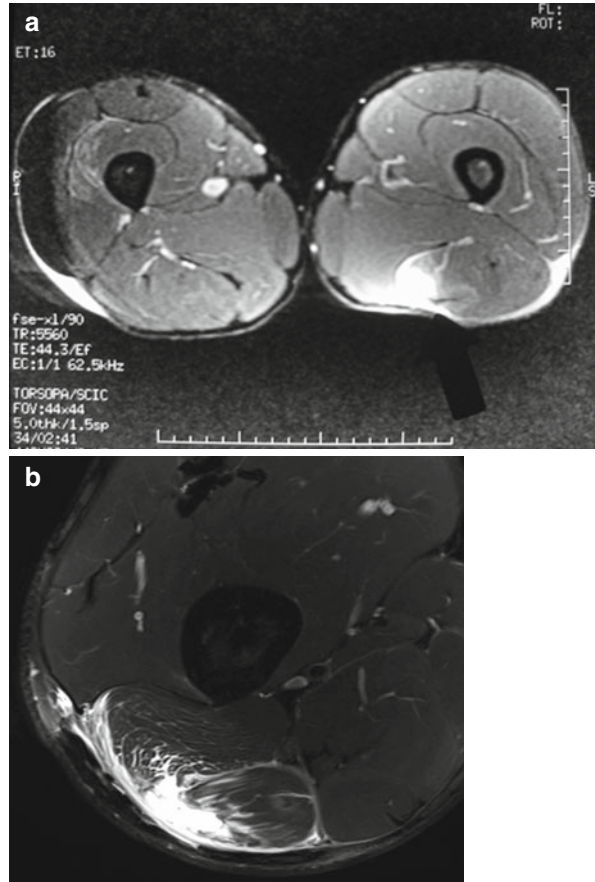
Imaging (ultrasound and MRI) definitely provides additional information about a muscle injury. It helps to localize the site of injury to reveal if there is any hematoma and a defect/tear including its approximate size in the muscle tissue and if the tendon is involved. Especially MRI is helpful to determine edema incidence and pattern. However, diagnosis based only on imaging is not appropriate. Even the best imaging reveals no information about the muscle tone, pain, functional loss, and other information such as previous injuries, which has significant relevance for the management of the athlete.

In daily practice ultrasound is sufficient in many cases to localize the site of injury and to exclude higher grade of injury. Ultrasound is easily available and cost-effective which makes it superior to MRI for follow-up examinations. However, it must be pointed out that examination of skeletal muscle takes time. With a little practice, the examiner can distinguish a *functional muscle disorder* without evidence of structural damage from a *structural injury* with a tissue defect. We recommend to use a 7.5 or 10.0 MHz transducer and to start with a transversal section. A complete scan through the muscle should be performed to obtain anatomical orientation. The longitudinal section is added on locations where a disturbance of the muscle structure or a gap is suspected. Ultrasound can also assess the need for further investigation by MRI. We recommend MRI in every case that is suspicious for *structural injury*.

High-resolution imaging is required for precise diagnosis. However, quality of MR imaging differs a lot since many radiologists choose a large field of view demonstrating, for example, both thighs including the pelvis in one examination (even though the clinical question is, e.g., only to search for a partial muscle tear in the biceps femoris muscle). Combination with clinical examination is critical to make MRI more sensitive.

The argument that large field-of-view MRI is the best initial test in order not to miss some muscle injuries is only relevant if no clinical and ultrasound examination

Fig. 1.1 Demonstrates clearly how important resolution and field of view are for interpreting MR imaging (Reprinted with permission of UEFA [41]). In (a) it is not possible to judge from the images if there is a structural defect or not, due to overlaying bright signal. (b) Performed in high-resolution technique (3 T, coil, limited field of view, 3 mm slice, etc.) demonstrating more clearly the actual defect in the muscle structure



was done before MRI, what usually should not happen. With clinical examination, the field of view can easily be limited. This will lead to a much higher spatial resolution.

We recommend a high field strength with a minimum of 1.5 or better 3 T, the use of surface coils, a limited field of view based on clinical examination and ultrasound, the use of skin markers to localize the center of injury, and a multiplanar orientation. Three millimeter slices must be postulated for MR imaging in muscle injuries. Otherwise smaller tears could be missed. With a limited field of view in MRI, this does not cause additional examination time.

But even in best quality, MRI alone is not sensitive enough to measure the extent of muscle tissue damage accurately. For example, it is not possible to judge from the scans where edema/hemorrhage (seen as high signal) is obscuring muscle tissue that has not been structurally damaged (Figs. 1.1 and 1.2).

Imaging technology to detect muscle injuries continues to evolve, and future techniques may allow for more sensitive and specific visualization of muscle injury and pathology.

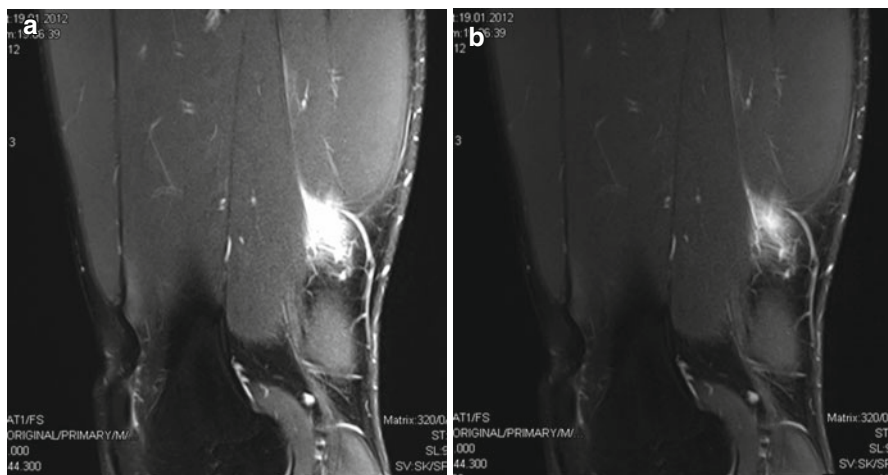


Fig. 1.2 Demonstrates that contrast and brightness (adjustable on the radiological monitors) play a crucial role for interpretation of muscle injuries (Reprinted with permission of UEFA [41]). (a) High brightness and little contrast demonstrating a large muscle tear. (b) After adjusting contrast and brightness, the actual defect in the muscle appears much smaller

1.3.3 New Comprehensive Classification System

The presented muscle injury classification is based on an extensive, long-term experience and has been used successfully in the daily management of athletic muscle injuries. The classification is empirically based and includes several original aspects of athletic muscle injuries that have not yet been described in the literature, specifically the frequently observed *functional muscle disorders*. Distinguishing these injuries as separate clinical entities has great relevance for the successful management of the athlete with muscle injury and represents the basis for future comparative studies since scientific data are limited for muscle injury in general.

This advanced comprehensive classification system differentiates between *indirect* and *direct* muscle injuries. *Indirect* muscle injuries are divided into *functional* and *structural* ones. *Functional muscle disorders* (type 1, overexertion-related, and type 2, neuromuscular muscle disorders) describe disorders without macroscopic evidence of fiber tear. *Structural muscle injuries* (type 3, partial tears, and type 4, (sub)total tears/tendinous avulsions) are injuries with macroscopic evidence of fiber tear, i.e., structural damage. Subclassifications are presented for each type.

1.3.3.1 Functional (=non-structural) Muscle Disorders

Functional muscle disorders are multifactorial. They can be grouped into subgroups reflecting their clinical origin: “overexertional” and “neuromuscular” muscle disorders. This is important since the origin of muscle disorder influences their treatment pathway. A spine-related muscle disorder associated with a spine problem (e.g., spondylolysis) will respond better to treatment by addressing not only the muscle disorder itself but also the original back problem. One could argue that this presents mainly a back problem with a secondary muscle disorder. However, this

secondary muscular disorder prevents the athlete from sports participation and will require comprehensive treatment that includes the primary problem as well in order to facilitate return to sport. Thus, a differentiation is important not only because of the different pathogenesis but more importantly because of different therapeutic implications.

1.3.3.1.1 Overexertion-Related Muscle Disorders

Weakened or fatigued muscles absorb less energy and are therefore more likely to get injured [16]. Previous data has shown that muscle fatigue predisposes the athlete to muscle injury [33, Wilson AJ and Myers PT, 2005, unpublished data]. Thus, muscle fatigue due to overexertion and other factors, which frequently presents as firmness of a muscle (bundle or part), must be recognized and treated.

Delayed onset muscle soreness has to be differentiated from fatigue-induced muscle injury [4]. DOMS occurs several hours *after* unaccustomed deceleration movements while the muscle is stretched by external forces (eccentric contractions), whereas fatigue-induced muscle disorder can also occur *during* athletic activity. DOMS resolves spontaneously usually within a week. In contrast, fatigue-induced muscle disorder can – if unrecognized and untreated – persist over a longer time and may cause *structural* injuries such as partial tears.

1.3.3.1.2 Neuromuscular Muscle Disorders

The term *neuromuscular* was chosen by the consensus group to describe the specific pathogenesis of these muscle disorders. Two different types of neuromuscular disorders can be differentiated: a spinal or spinal nerve-related (central) and a neuromuscular end plate-related (peripheral) type.

Muscles act as a target organ and their state of tension is modulated by electrical information from the motor component of the corresponding spinal nerve. Thus, irritation of a spinal nerve root can cause an increase in muscle tone. It is known that back injuries are very frequent in elite athletes [32] and lumbar pathology such as disc prolapse at the L5/S1 level may present with hamstring and/or calf pain and limitations in flexibility, which may result in or mimic a muscle injury [34]. It is logical that this type of injury would require variable forms of treatment beyond simple treatment of the muscle–tendon injuries [18]. Thus, it is important that assessment of muscle injury should include a thorough biomechanical evaluation, especially that of the lumbar spine, pelvis, and sacrum. Negative *structural* findings on the lumbar spine do not exclude nerve root irritation. *Functional* lumbar dysfunctions, like lumbar or iliosacral blocking, can also cause spine-related muscle disorders [28]. The diagnosis is then established through precise clinical functional examination. The spine-related muscle disorder is usually MRI negative or shows muscle edema only [34]. Verrall et al. showed that footballers with a history of lumbar spine injury had a higher rate of MRI-negative posterior thigh injury, but not of actual *structural* hamstring injury [42].

We differentiate muscle-related neuromuscular disorders from the spine-related ones because of different treatment pathways. Dysfunction of neuromuscular

control mechanisms can result in a painful muscle firmness which can prevent an athlete from sportive activities, when inhibition of antagonistic muscles is disturbed and agonistic muscles over-contract to compensate this [6].

It has to be stated that it remains an area for future research to definitely describe the *functional muscle disorders* and other risk factors for muscle injuries.

1.3.3.2 Structural Injuries

1.3.3.2.1 Partial Muscle Tears

Most *indirect structural* injuries are partial muscle tears. Clinical experience clearly shows that most partial injuries can be assigned to one of two types, either a minor or a moderate partial muscle tear, which ultimately has consequences for therapy and absence time from sports. Thus, *indirect structural* injuries should be subclassified. Since previous graduation systems refer to the complete muscle size, they are relative and not consistently measurable. In addition to this, there is no differentiation of grade 3 injuries with the consequence that many *structural* injuries with different prognostic consequences are subsumed as grade 3.

Anatomical facts should be considered while discussing muscle injury and classification: The individual muscle fiber presents a microscopic structure with an average diameter of 60 μm [38]. Therefore, an isolated tear of a single muscle fiber remains without clinical relevance. Muscle fibers are anatomically organized into primary and secondary muscle fascicles/bundles. Multiple secondary bundles constitute the muscle.

The extent of the injury to the anatomic landmarks determines the difference between minor and moderate partial muscle tear. However, it definitely remains a challenge for future studies to determine the exact cutoff.

Besides size, the involvement of adjacent connective tissue (endomysium, perimysium, epimysium, and fascia) distinguishes partial muscle tears from each other. Concomitant injury of the external perimysium seems to play a special role: This connective tissue structure somehow has an intramuscular barrier function in case of bleeding. It may be the injury to this structure (with optional involvement of the muscle fascia) that differentiates a moderate from a minor partial muscle tear.

However, drawing a clear differentiation between partial muscle tears seems difficult because of the heterogeneity of the muscles that can be structured very differently. Technical diagnostic tools today (MRI and ultrasound) are not precise enough to ultimately determine and prove the effective muscular defect within the injury zone of hematoma and/or liquid seen in MRI, which can [19] lead to overestimation of the actual damage. It will remain a challenge for future studies to exactly define the size of the injury which describes the distinction between a minor and a moderate partial muscle tear.

The great majority of muscle injuries heal without formation of scar tissue. However, greater muscle tears can result in a defective healing with scar formation [19] which has to be considered in the diagnosis and prognosis of a muscle injury. Our experience is that partial tears of less than a muscle fascicle usually heal completely, while moderate partial tears can result in a fibrous scar.

Table 1.2 Classification of acute muscle disorders and injuries

A. Indirect muscle disorder/injury	Functional muscle disorder	Type 1: Overexertion-related muscle disorder	Type 1A: Fatigue-induced muscle disorder
		Type 2: Neuromuscular muscle disorder	Type 1B: Delayed onset muscle soreness (DOMS)
			Type 2A: Spine-related neuromuscular muscle disorder
		Type 2B: Muscle-related neuromuscular muscle disorder	
	Structural muscle injury	Type 3: Partial muscle tear	Type 3A: Minor partial muscle tear
		Type 4: (Sub)total tear	Type 3B: Moderate partial muscle tear
B. Direct muscle injury		Type 4: (Sub)total tear	Subtotal or complete muscle tear
			Tendinous avulsion
		Contusion	
		Laceration	

Modified after Mueller-Wohlfahrt et al. [29]

1.3.3.2.2 (Sub)Total Muscle Tears and Tendinous Avulsions

Complete muscle tears with a discontinuity of the whole muscle are very rare. Subtotal muscle tears and tendinous avulsions are more frequent. Clinical experience shows that injuries involving more than 50 % of the muscle diameter (subtotal tears) usually have a similar healing time compared with complete tears.

Tendinous avulsions are included in the classification system since they are biomechanically complete tears of the origin or insertion of the muscle. The most frequently involved locations are the proximal rectus femoris, the proximal hamstrings, the proximal adductor longus, and the distal semitendinosus.

Intratendinous lesions of the free or intramuscular tendon also occur. Pure intratendinous lesions are rare. The most frequent type is a tear near the musculotendinous junction (e.g., of the intramuscular tendon of the rectus femoris muscle). Tendinous injuries are either consistent with the partial (type 3) or (sub)total (type 4) tear in our classification system and can be included in that aspect of the classification.

1.3.3.2.3 Muscle Contusions

In contrast to *indirect* injuries (caused by internal forces), lacerations or contusions are caused by external forces [3, 21] like a direct blow from an opponent's knee. Thus, muscle contusions are classified as acute *direct* muscle injuries (Tables 1.1 and 1.2).

Contusion injuries are common in athletes and present a complex injury that includes defined blunt trauma of the muscular tissue and associated hematoma [3, 21]. The severity of the injury depends on the contact force, the contraction state of the affected muscle at the moment of injury, and other factors. Contusions can be graded into mild, moderate, and severe [37]. The most frequently injured muscles

are the exposed rectus femoris and the intermediate vastus, lying next to the bone, with limited space for movement when exposed to a direct blunt blow. Contusion injury can lead to either diffuse or circumscribed bleeding that displaces or compresses muscle fibers causing pain and loss of motion. It happens that muscle fibers are torn off by the impact or by shear forces, but muscle fibers are not typically torn by longitudinal distraction. Therefore, contusions are not necessarily accompanied by a *structural* damage of muscle tissue. For this reason athletes, even with more severe contusions, can often continue playing for a long time, whereas even a smaller *indirect structural* injury often forces the player to stop at once. However, contusions may lead to persistent intramuscular bleeding and hematoma formation with the potential for severe complications such as acute or delayed compartment syndrome and possible resultant long-term functional limitation [26, 27].

Conclusion

Consensus definitions of the English terminology of athletic muscle injuries as well as a new comprehensive and empirical classification system for acute muscle injuries are presented. Both will help to improve effective communication among medical practitioners and development of systematic treatment strategies and can serve as the basis for future comparative studies to address the continued lack of systematic information on muscle injuries in the literature.

Key component of the new classification system is the differentiation between indirect and direct muscle injuries and within the indirect injuries between *functional muscle disorders* from *structural injuries*. The use of the term *strain* is no longer recommended, since it is a biomechanical term, not well defined, and used indiscriminately for anatomically and functionally different muscle injuries. Instead, we propose the term *tear* for *structural injuries*, graded into (minor and moderate) partial and (sub)total tears, used only for muscle injuries with macroscopic evidence of muscle damage (*structural injuries*). While this classification is most applicable to lower limb muscle injuries, it can be translated also to the upper limb.

Scientific data supporting the presented classification system can be found in the publication “Return to play after thigh muscle injury in elite football players: implementation and validation of the Munich muscle injury classification” by Ekstrand J, Askling C, Magnusson H, and Mithoefer K in the *British Journal of Sport Medicine* [11]. Further scientific data are still missing. We hope that the suggested standardized terminology and the new classification system will stimulate research to prospectively evaluate the prognostic and therapeutic implications of the new classification. Furthermore, future studies have to define the exact size threshold between a minor and a moderate partial muscle tear.

Note: Further information about the consensus definitions and the new classification system can be found in

Mueller-Wohlfahrt HW, Haensel L, Mithoefer K, Ekstrand J, English B, McNally S, Orchard J, van Dijk N, Kerkhoffs G, Schamasch P, Blottner D, Swaerd L, Goedhart E, Uebliacker P. Terminology and classification of muscle injuries in sport. A consensus statement. *Br J Sports Med.* 2013;47(6):342–50.

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