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Original research

Psychosensorial assessment of skin damage caused by a sliding on artificial turf: The development and validation of a skin damage area and severity index

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ABSTRACT

Objectives: Injury prevention is an important reason for the development of performance standards in football. Currently, there is no objective method available to classify sliding induced skin injuries, which includes the perceived sliding friendliness of football pitches. The purpose of this study was to develop a non-invasive method for quantification of the observed sliding induced skin damage and evaluate whether there is a correlation between the subjective perceived skin irritation and sliding friendliness.
Study design: Randomized controlled trial.
Methods: Previously obtained clinical images of sliding induced skin lesions where rated by a dermatologist on the degree of abrasion, erythema and type of exudation. To test the practical feasibility of a proposed Skin Damage and Severity Index (SDASI) to characterize sliding induced skin lesions, a randomized user trial with nine amateur football players was performed. The sliding friendliness of three different grades of infill materials was tested.
Results: The Skin Damage and Severity Index correlates both with the perceived skin irritation ($r = -0.53$, $P = 0.02$) and sliding friendliness ($r = -0.58$, $P = 0.01$).
Statistical analysis of the individual clinical scores showed that perception of skin irritation and sliding friendliness correlate very well with the degree of erythema and abrasion. However, these scores are independent of the size of the lesion and type of exudation. There was no statistical significant difference found between the three evaluated types of infill and their sliding performance.
Conclusions: This study demonstrated that the Skin Damage and Severity Index, which is a tool for quantification of a sliding induced skin lesion, correlates very well with the perceived skin irritation and the sliding friendliness.

1. Introduction

Injury prevention is an important reason for the development of safety and performance standards for soccer pitches. The introduction of artificial soccer pitches and its continuous evolution sets new challenges to develop and improve standards for classification of soccer pitches in terms of quality, performance and safety standards. In the field of injury prevention, important work is performed by the Fédération Internationale de Football Association (FIFA) Medical Assessment and Research Centre (F-MARC).[1] Injury prevention starts with registration of injuries to find possible relations between risk factors, frequencies and characteristics of injuries. The F-MARC developed an injury monitoring assessment system that records the frequency and severity of injuries for each location.[2–4]

The F-MARC definition of a football injury is "any physical complaint caused by football".[5]

The severity of an injury is related to the number of days a soccer player is absent from regular trainings and/or matches. In general skin injuries due to a sliding do not lead to absence during a football training or match. These injuries are therefore qualified as a slight (0 days lost) injury.[6] Although skin injuries are not often severe in their appearance they are more common on artificial turf than on natural grass.[7]

A study performed by Zanetti showed that artificial turf was generally judged to be better than the natural grass surface with the exception of the risk of abrasion caused by a sliding.[8] It was stated that skin abrasion is one of the most critical aspects for artificial

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pitches. According to Ekstrand et al. there might be an underestimation of skin injuries because of their low severity.[9] A method to classify the severity of skin injuries would improve the injury registration. Such a method helps to obtain more detailed information about skin related injuries. Currently, there is no method available to classify sliding induced skin injuries which is also related to the perceived sliding friendliness or perceived skin irritation. By definition the sliding friendliness perception is related to the sport surface and the perceived skin irritation is related to the sensory response of the player caused by a sliding.

The FIFA test 08 or ASTM F1015 test are now applied to evaluate the abrasiveness of soccer pitches.[10,11] Both methods are using skin replacers silicon and foam blocks, respectively. A limitation of both methods is that they do not simulate realistic vertical forces and velocity of a sliding. Another silicone based method to evaluate a sliding was developed by Sanchis et al. They developed a device to test the friction at realistic sliding conditions. This study showed a good correlation between the increased surface roughness of the tested silicone and players perception.[12] The use of skin replacers like silicone or foam blocks provide information about the abrasiveness of the sport surfaces but do not simulate the response of *in vivo* human skin and its biology when exposed to a sliding.

Peppelman et al. conducted a study to evaluate the skin after a sliding on different kinds of soccer pitches at clinical and histological level.[13] They showed the importance of the skin biology to study skin damage caused by a sliding. Currently, an invasive method is relevant to study skin damage at histological level. Due to the invasiveness of such models, they are not ideal in studying skin damage. Therefore, the purpose of this study was to develop and validate a skin damage area and severity index (SDASI) as a non-invasive readout system of the skin based on the clinical appearance of sliding damaged skin.

2. Methods

The proposed method to score the skin damage caused by a sliding is developed, called skin damage area and severity index (SDASI), is based on the commonly used Psoriasis Area and Severity Index (PASI). The PASI is a dermatological tool to measure the severity of Psoriasis.[14,15] The SDASI is defined as the sum of the individual damage characteristics upon abrasion, erythema and type of exudation multiplied by the involved area score.

For development of this method, clinical pictures of sliding damaged skin were obtained from 14 male amateur soccer players in the age between 18 and 25 years. These Images were obtained

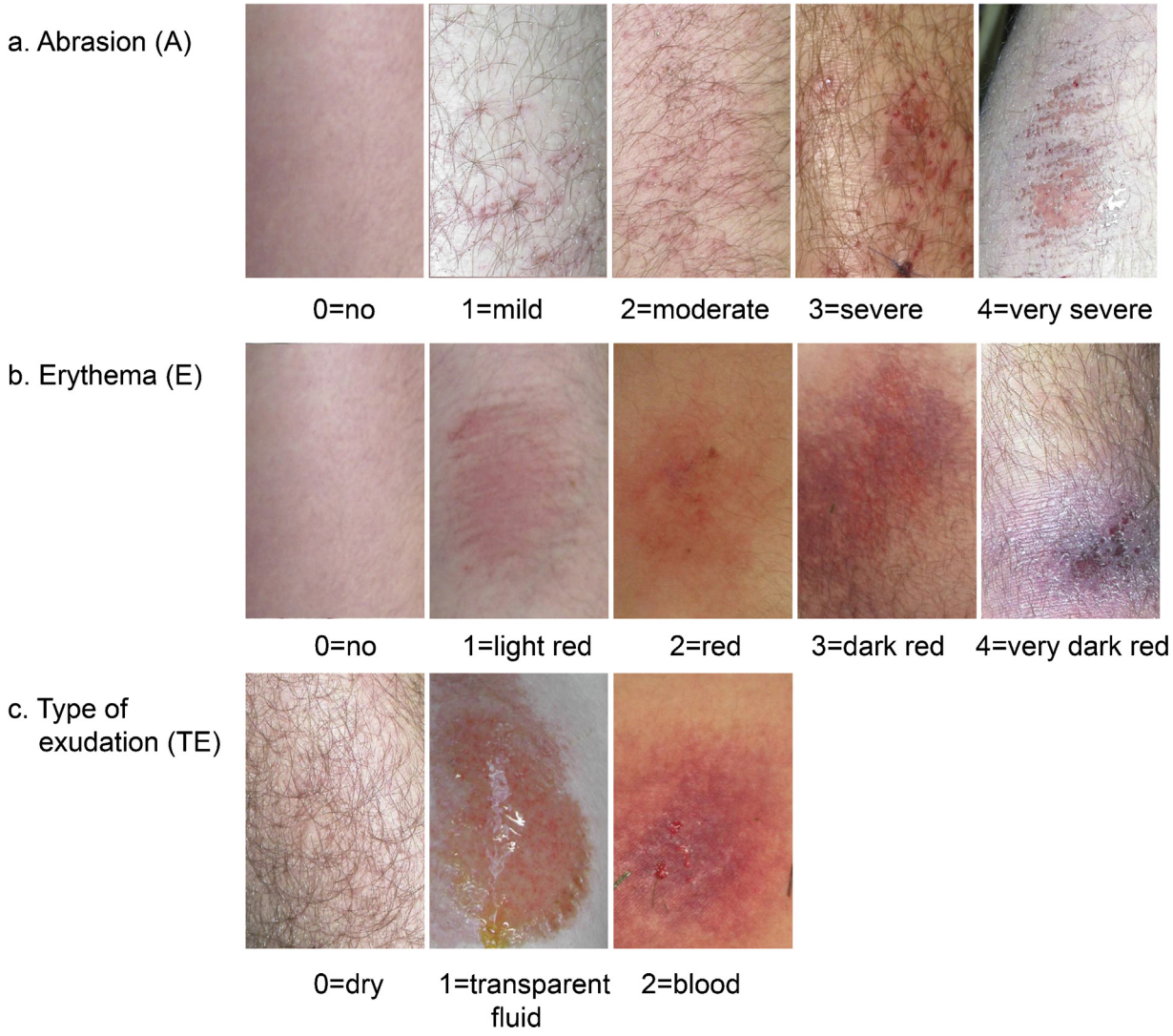

Fig. 1. (a–c) Visual scaling of the clinical parameters used in the SDASI. Abrasion (a) from 0 (no abrasion) to 4 (very severe abrasion) and erythema (b) from 0 (no erythema) to 4 (very severe erythema). The type of exudation (c) is classified as no exudation (0), exudation of a transparent fluid (1) or exudation of blood (2).