

Cohort Study

Time to Review Shin Pad Legislation in Soccer: An Observational Cohort Study Considering the use of Lower Leg Personal Protective Equipment in Football

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Abstract

Objective: To review the evidence base for SP use and provide pilot data regarding players' opinions on the use of SPs, whilst also reviewing the type and size of SPs worn as a surrogate measure of protection provided.

Design: Shin pad construction and dimensions and lower leg dimensions were recorded. Structured interviews were conducted to ascertain players' opinions regarding SP usage. Prospective data was collected from all players.

Participants: 22 male first team players at a professional football club in England

Interventions: Shin pads

Main Outcome Measures

Results: The majority (89%) of SPs were constructed of a hard outer surface with a soft foam lining. SP length ranged from 145 to 230 mm providing a mean coverage of 51% (SD 5.7%) of the players' tibial length. Fifty-percent of players believed that SPs helped to prevent minor injuries, though 59% felt that they did not prevent serious injuries. Forty-six-percent were not more confident tackling an opponent when wearing SPs and 55% would not wear SPs if given the option.

Conclusions: There are marked differences in the construction and size of SPs worn by players at this professional football club, with players having limited confidence in their ability to prevent injury. Notably, the majority of players would not wear shin pads given the choice. This pilot study raises the question of whether SP use should remain mandatory in the professional game.

Keywords: Shin Pads; Football; Soccer; Injury; Sport

Abbreviations

SP: Shin Pad

SPs: Shin Pads

Introduction

Soccer (football) is a truly global sport, played in suburban streets or in front of tens of thousands of fans in stadiums. Fédération Internationale de Football Association (FIFA) have estimated that in 2006 there were 265 million people playing football globally and over four million in England. There are nearly one and a half million footballers registered with the English Football Association (FA), with approximately ten percent of the adult population in the UK thought to play at least once a year [1,2].

Injuries are common amongst professional footballers, with prevalence estimated to be 1000 times higher than high-risk industrial occupations.[3] Overall soccer injury rates have been reported to be as high as 191 per 1000 athlete exposures, with the lower extremity accounting for 74 – 87% % of all injuries. [4–6] Of lower limb injuries, contusions are most prevalent (50%), and fractures account for 10% [7].

Tibial fractures can be one of the most serious and traumatic injuries that can befall a professional footballer with over 95% resulting from direct contact with another player, and return to play time in the order of six months or more.[8,9] Transverse diaphyseal fractures (Müller AO Classification 42-A3) are the most frequent and occur in fifty to sixty percent of players studied [9–11].

It is unsurprising therefore that FIFA rules stipulate that shin-guards (more commonly known as shin pads (SPs) in the UK) must be worn during matches that fall under its auspices, in an attempt to protect players from injury. However, there is little elaboration apart from stating that SPs should be of a “suitable material” and “provide a reasonable degree of protection” [12].

A literature review revealed that data on SPs and protection from injury are based on laboratory model based studies alone. The force attenuation offered by SPs appears to vary widely, which suggests that the actual level of protection offered by SPs is unclear.[13,14]

The use of personal protective equipment (PPE) in sports has been met with scepticism and is under constant review. Several high impact sports, such as rugby union, have not emulated the guidance bestowed by FIFA and reasons for this are likely to include both sport-specific and generic considerations such as the limited evidence available regarding protective equipment and the suggestion that they may even promote risk taking behaviour through “risk compensation” by individuals.[15]

Based upon the limited available evidence and anecdotal suggestion that players do not like wearing SPs, an observational cohort study was performed with the aim of investigating the area of protection provided by SPs. A qualitative component based on semi-structured interviews aimed to elicit players’ opinions on SP use more formally.

Materials and Methods

Prospective data was collected from all 22 male first team players at a professional football club in England during November and December 2013, with objective data obtained on players’ tibial anatomy and SP dimensions. Tibial length was measured from the tibial tuberosity to the talocrural joint, using the right leg to ensure a standardised dataset. Shin pad length, width, thickness and construction material were also recorded using an anonymised data entry sheet (Appendix 1).

Players’ opinions and reasoning behind choice of SPs, was obtained via structured one-to-one interviews using a standardised questionnaire (Appendix 2). As no previously validated questionnaire existed a series of open and focused questions were formulated by the research team. Measurements and responses from interviews were anonymized and not shared with coaching staff.

Results for the measurements taken were calculated using Microsoft Excel (2010). Trends were identified in the players’ responses to the structured questionnaire using standard qualitative research methodology. As this was a descriptive study no statistical analysis was attempted.

Ethical Considerations

Verbal consent was gained.

Results

Measurement data

All 22 first team players had their lower limb dimensions measured.SP data was collected from 21 members of the squad, due to logistical difficulties surrounding competitive matches only 18 provided data on SP thickness.

Shin Pad dimensions: Length ranged from 145mm to 230 mm with a mean value of 183 mm (SD 19mm). Width ranged from 80mm to 184mm with a mean value of 128mm (SD 22mm). Thickness ranged from 4mm to 12 mm with a mean value of 8mm (SD 2.4mm).

Lower leg dimensions: Tibia length ranged from 325mm to

410 mm with a mean value of 359mm (SD 19.3mm). Percentage tibia covered by SP, by length, ranged from 40% to 64% (Mean: 51%) Figure 1.

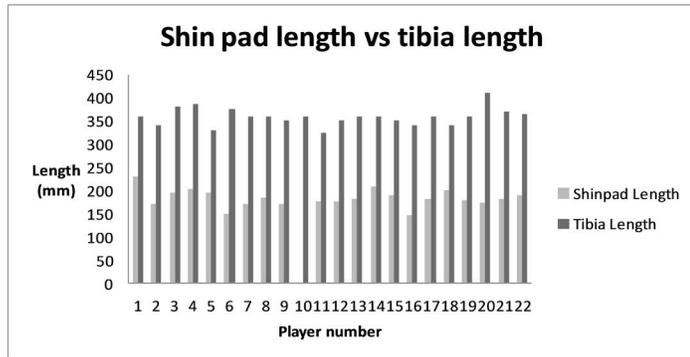


Figure 1. Comparative bar chart showing shin pad length vs tibia length in the cohort.

Shin pad construction

SP construction consisted of a hard outer surface in 89% (67% plastic, 22% carbon fibre) with a soft, often foam, lining. The most frequent alternative construction method was of ridged panels encased in a soft flexible cover.

Four different brands were used; 72% Nike, 11% each Umbro and Adidas and 6% were Puma. Figure 2.

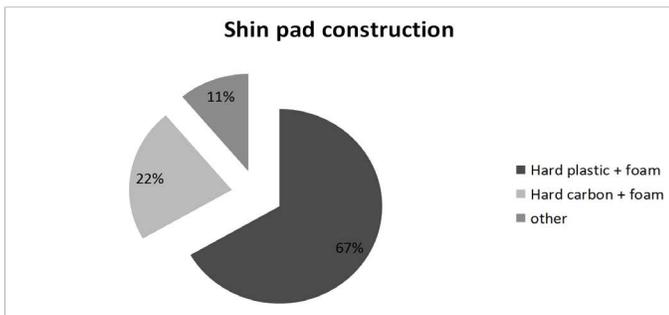


Figure 2. Pie chart showing the construction of the shin pads worn by players.

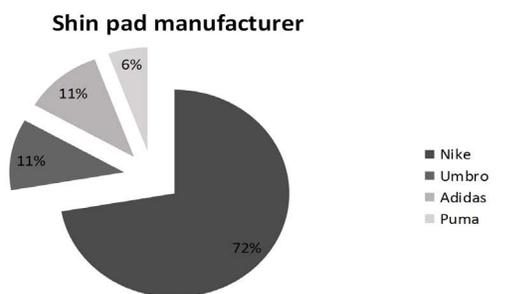


Figure 3. Pie chart showing the manufacturer of the shin pads worn

by the players.

Players’ opinions of shin pads

All 22 players underwent structured interview to provide opinions on SP usage.

Prevention of minor injuries (such as abrasions and contusions): Fifty percent felt that SPs definitely helped, 32% thought that SPs might help and 18% believed they made no difference.

Prevention of serious injuries (such as fractures): 23% of players thought SPs helped, 14% felt SPs might help and 5% of players were unsure. 59% of players did not feel SPs prevented these injuries.

Confidence performing tackles in matches: 36% of players felt more confident when tackling an opponent while wearing SPs, 18% were not sure and 46% of players did not feel any more confident.

All players wore SPs when playing competitive matches with 91% stating their motivation was because this was mandatory (Appendices 3 and 4). Over half (55%) would not wear SPs at all if they were given the option of not doing so. Figure 4.

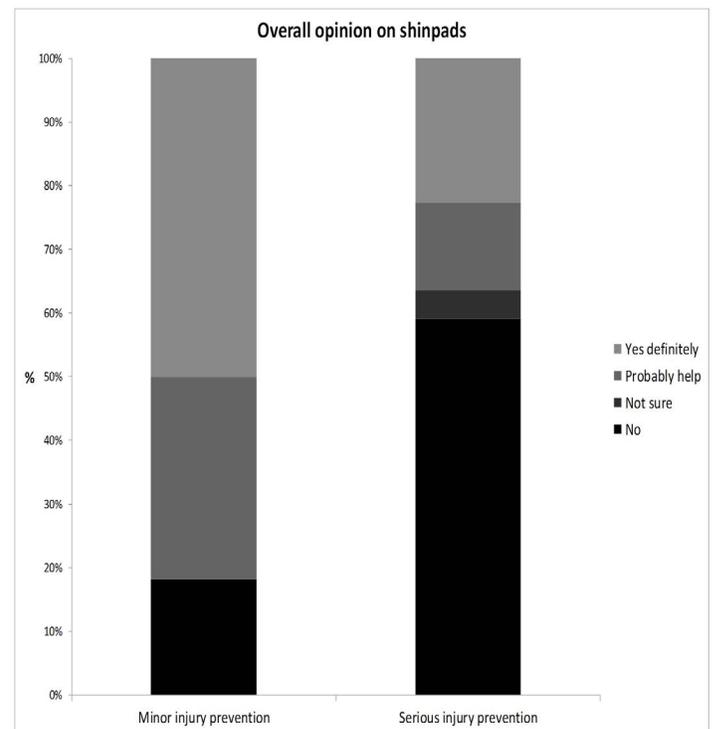


Figure 4. Percentage bar chart showing the opinions of the cohort with regards to the protection offered by wearing SPs.

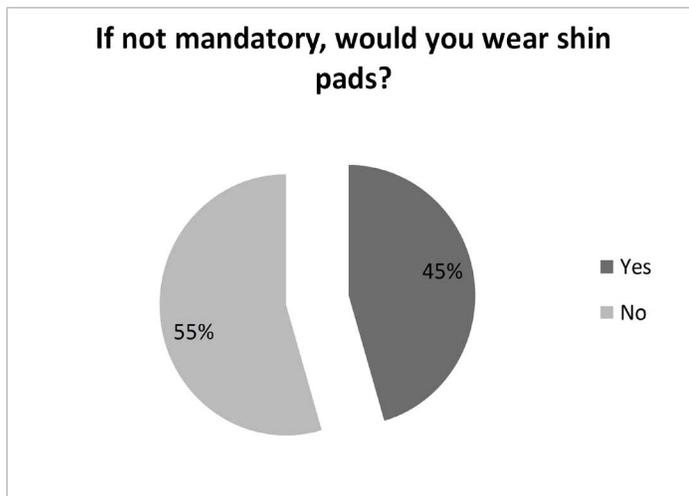


Figure 5. Pie chart showing the study group's opinion on mandatory wearing of SPs.

Discussion

We believe this to be the first study considering the protection offered by SPs used in professional soccer and incorporating the opinions of professional players who are required to use them. Previous work on the role of SPs in football has mainly considered whether injuries can be reduced whilst wearing SPs and the force attenuation achieved in the laboratory setting.[11,13,16]

In our study, shin pads were found to cover 40-64% (mean: 51%) of the anterior tibial length of the footballers examined, invariably covering the mid-portion. They tended to be constructed of a hard plastic outer shell and a softer foam inner lining. Of the footballers interviewed 60% did not consider SPs to provide a definitive form of protection against serious injuries. Half of the players felt SPs might prevent minor injuries and 64% did not play or tackle with more confidence when using SPs. This seems contrary to the "risk compensation" theory proposed elsewhere.[15]. Additionally, they were also unpopular with more than half of this cohort, with the majority using them during matches purely to comply with FIFA legislation rather than for protective purposes.

There exists some epidemiological data on tibial fractures that may suggest a reduction in prevalence of football related tibial shaft fractures, from 24.7% to 17.6% either side of the introduction of mandatory SP use by FIFA in 1990.[17,18] However the significance of this when considering relatively small numbers of football related fractures is questionable. More recently, Chang et al [10] have reported a lower prevalence of

9.6%, though other factors such as rule changes in relation to tackling have also appeared in the interim.

It is important to note that the vast majority of football related tibial fractures occur despite SP use. In one UK hospital orthopaedic department, 96% of football related tibial fractures seen over a five year period occurred despite the players wearing SPs [10], with Boden et al.[19] reporting a figure of 90%, and Cattermole et al 85%.[8]

Two studies specifically considered SP function, albeit using artificial models in the laboratory setting. Both demonstrated force attenuation when using SPs, though the degree varied widely, with Bir et al.[13] reporting a reduction of over 70% (range 40-77.1%) whereas Francisco et al.[14] found a reduction of only up to 21% (range 6-21%). These studies used differing collision methods and differing structures to simulate the lower limb, which could account for their vastly different values of attenuated force. However such disparity casts doubt onto the true level of protection provided, and indeed others have also stated that SPs are unable to withstand the impact force that would cause a tibial fracture [7].

As such, even though SP use remains compulsory, there is no guarantee that they will prevent one of the most serious injuries that can befall a professional football player. However, there is evidence that SPs do reduce minor injuries such as contusions, lacerations and abrasions,[8,20] in keeping with the opinions of this cohort.

Although over half would not wear SPs in matches were it not mandatory, there is a suggestion that the choice may be affected by the individual player's role in the team. In this cohort the footballer with the largest tibial coverage (64%) was the goalkeeper, who also was the only player to choose SPs with built in ankle protection. Conversely the lowest coverage (40%) was noted in an attacking midfielder. This raises the possibility that players may choose their protective equipment based on the perceived risk of their role; the goalkeeper, anticipates high impact forces and wears larger SPs while the player who's main objective is speed and agility wears much smaller lighter SPs to facilitate this.

Thus, despite the fact that their use is a mandatory requirement within the laws of the game, this data suggests that most players prefer SPs that are small and light-weight rather than larger thicker ones which may provide greater levels of protection. It appears that this preference is well serviced by the sporting goods industry who continue to develop lighter boots

and SPs to match demand, with some boots now weighing less than 200g each.[21] Equally, with an average thickness of only 8 mm including soft cushioning, there is very little between the player's shin and significant impact forces, and it appears clear that this "protection" remains insufficient to prevent major traumatic injuries. This seems logical considering that these impact forces can be as much as four times the players body weight and have a torque force close to 680 Nm.[22,23] It is of concern that this preference for low coverage, thin SPs leaves the shin vulnerable to serious injury and raises questions as to whether, by choosing SPs of this design, players are creating a situation almost analogous to one where SPs are not used in the first instance.

There is limited evidence for the use of personal protective equipment (PPE) in sport, with considerable debate about its use in Australian football,[24] rugby union[25] and skiing.[15] In addition to the debatable level of protection provided, there is a suggestion that PPE may actually be counterproductive by encouraging risk-taking behaviour, by so called 'risk compensation'. [15] Furthermore, SPs have been reported to cause allergic reactions ranging from mild contact dermatitis to more serious skin lesions.[26]

There is no evidence at present to confirm the ability of SPs to attenuate force whilst they are being worn in soccer training or match settings. The existing laboratory data is wide ranging, and clinically, serious lower leg injuries remain prevalent.

Therefore we believe that the current legislation on SP use in soccer should be revisited. We ask whether SPs should remain mandatory. If so, evidence-based minimum requirements should be clearly stipulated.

This study was limited by the absence of a validated questionnaire necessitating the development of such a tool by the study group, thus validation of this questionnaire in further research would be beneficial.

This study centred on the use of SPs in competitive situations, however, anecdotally, we believe that footballers often change their habits between matches and training. A future consideration would be to compare SP use in training compared to the competitive setting.

Finally, only male first team professional footballers were included in this study, and as such these findings may not be generalisable to other cohorts such as younger, female or amateur players, groups which may have skeletal and biomechanical

differences. Additionally if it were to be argued that the decision to use SPs is one akin to that of informed consent, at what level of maturity might it be considered that the individual has capacity to make this decision and what information would need to be provided to facilitate the decision making process, especially given the paucity of evidence in this area.

With such high numbers of people engaging in football around the world, along with the risks and injuries associated with this sport, more work needs to be done to ratify the role of SPs. With limited evidence of significant benefit, accompanied by the suggestion that they may even promote risk-taking behaviour, the protective potential of SPs needs to be studied in greater depth and recommendations surrounding their use must be based on research. It may be that their greatest benefit is at a population level rather than at an individual one; however this too needs further discussion.

Overall it appears that players do not hold the ability of SPs to provide protection in very high regard and are using them predominantly to conform with minimum standards in FIFA regulations. With currently available SPs covering a small percentage of the tibia with a thin layer of material, this further brings into question the level of protection conferred.

Ultimately the decision of whether SPs should be mandatory must be based on stronger evidence rather than the current level of research; player opinion suggests that SPs should not be mandatory but used at the discretion of the player. We advocate further study and debate into the value of SPs in professional football, as well as player and coach education based upon the available evidence.

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