

## **A QUALITATIVE VISION OF ARTIFICIAL TURF FOOTBALL FIELDS: ELITE PLAYERS AND COACHES**

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### **ABSTRACT**

*This study identified the most important parameters for the design and safety of artificial turf football fields according to professional footballers and coaches. Two semi-structured interviews were conducted. The sample consisted of 32 professional players and 25 professional coaches. The players and coaches emphasised that the main problem with artificial turf was the increased risk of injury. The consensus of the interviewees was that it is essential for artificial turf to be installed gradually in elite competitions, starting with youth football. It would allow players to be slowly acclimatised to the surface through their developmental stages. When they reach elite competitions, they would be able to play comfortably either on natural or artificial turf with fewer problems.*

**Key words:** Sport facilities; Surface; Safety; Satisfaction; Perception.

### **INTRODUCTION**

Recent research on football has tried to answer a major question posed by the football community: What is the ideal surface for playing football? The number of artificial turf football fields the world over has been growing exponentially (McNitt, 2005), so players at all levels from beginners to professionals spend increasing amounts of time competing and practicing on artificial surfaces. The European Synthetic Turf Organisation (ESTO) estimated that in 2008 there were more than 15 000 synthetic pitches in Europe (ESTO, 2008).

Traditionally, the surface for football has been natural turf for top-level competitions and dirt pitches for recreational and leisure use (Felipe *et al.*, 2011). However, in recent years, artificial turf has come to be accepted as the most suitable surface for recreational sport, because it affords much more use than natural turf, with considerably reduced maintenance costs (Simon, 2010; Burillo *et al.*, 2011). Furthermore, artificial turf is being increasingly

used for official first-class competitions, leading it to be considered the primary choice of surfaces (ESTO, 2008; Gallardo *et al.*, 2009).

From its introduction in the 1970s, the first-generation artificial turf was widely rejected by footballers and coaches alike, due particularly to the fact that they perceived more risk of injury and a lower quality of play (Ekstrand & Nigg, 1989; McNitt *et al.*, 2007). Although first studies have investigated the injury pattern on artificial turf and have concluded that the injury risk is higher on previous artificial turf's generation (first and second), than on natural grass, but this disappears with the third generation (Dragoo & Braun, 2010).

However, evaluation over the last three decades has shown that artificial turf does not produce a greater risk of injury for players, and that it provides very similar mechanical properties and ball response to that of natural turf (Steffen *et al.*, 2007; Pasanen *et al.*, 2008; Meyers, 2010). Despite this, official matches on artificial turf are still under the scrutiny of the media and the subject of much discussion in the footballing community (FIFA, 2007).

The construction of artificial turf football fields is a highly positive aspect for encouraging this sport, as it is a large improvement on old dirt pitches and natural turf pitches in bad conditions, and generates higher economic, social and environmental returns (FIFA, 2007). However, one important aspect for the acceptance of artificial turf by players and its use in official competitions is the accreditation of the playing surface. The aims of accreditation are: to ensure the quality and safety of the sport facility being used for recreational sport or top-level competition; to ensure the correct maintenance of the surface; to establish quality standards; to protect the players' health and the environment; and to anticipate low-cost policies (Bartlett *et al.*, 2009).

During the time artificial turf as a football surface has been evolving (1970-2012), several studies have measured the satisfaction of the users with a view to improving this surface (UEFA, 2004; Andersson *et al.*, 2008; Zanetti, 2009; Gallardo *et al.*, 2010; Burillo *et al.*, 2012a), using quantitative methods. Similarly, other studies have attempted to determine the influence of the artificial turf through standardised tests (Willwock *et al.*, 2009; Sandkuehler *et al.*, 2010; Brito *et al.*, 2012; Burillo *et al.*, 2012b). There is no agreement on the general acceptance of artificial turf compared to other surfaces. While Andersson *et al.* (2008) established a negative attitude towards artificial turf other studies (UEFA, 2004; Burillo *et al.*, 2012a), suggest that the negative results are due to a lack of experience on that surface, as experienced players reported positive attitudes toward artificial turf. Andersson *et al.* (2008) argues that it is clear that further studies are needed to investigate in more depth.

However, the relentless progress of the artificial turf fields makes it a dynamic reality. The above quantitative studies offer the reality of the moment, but provide strong constraints towards a future understanding of this surface. Their results are preferably oriented to describe a situation and slightly to the experiences in the vital process of surface-player relationship. There have been no studies published that have measured users' perceptions of and satisfaction with artificial turf football fields using a qualitative and open-ended methodology to uncover the full range of potential problems and responses. The importance of understanding user requirements and receiving product feedback is a vital part of any product design process. Nevertheless, perceptions are formed subjectively and so developing

a method to identify and measure them can be difficult (Dawson-Squibb, 2004; Fleming *et al.*, 2005).

## PURPOSE OF THE STUDY

In order to find out whether artificial turf has reached its optimum quality, similar to that of natural turf, which enables it to be seamlessly integrated into any top-level football competition, it would be helpful to know the opinion of the users, the footballers and the coaches, who have direct contact with both surfaces daily. Therefore, the purpose of the present study was two-fold:

- Firstly, to identify advantages and disadvantages of artificial turf from the point of view of high level footballers and coaches using a qualitative methodological approach, and
- Secondly, to find out the most relevant parameters with regard to the safety and future of artificial turf football fields according to the footballers and coaches.

This methodology supplements other quantitative studies, potentially leading to unexpected discoveries from the explanation and understanding of the causes that lead to satisfaction or dissatisfaction with artificial turf.

## METHODS

### Participants

With institutional ethical approval, a total of 32 players, aged between 20 and 38 years ( $M=23.5\text{yr}$ ;  $SD=3.8\text{yr}$ ) and a total of 25 coaches, aged between 27 and 53 years ( $M=37\text{yr}$ ;  $SD=7.6\text{yr}$ ), participated voluntarily in this study. The participants were purposefully selected (Patton, 2002). The players were of three nationalities (15 English, 12 German and 5 Spanish) competing in professional or semi-professional leagues of these countries with a mean of 12.9 years ( $SD=3.7$ ) of regular training and competition on natural turf, and a mean of 6.0 years ( $SD=4.6$ ) on artificial turf. The coaches (all were Spanish coaches) involved in professional and semi-professional leagues in Spanish and international competitions with a mean of 3.4 years ( $SD=5.8$ ) training on natural turf and a mean of 4.5 years ( $SD=3.3$ ) on artificial turf. At the time of the research, all players and coaches were training and competing regularly on artificial turf football fields.

The number of interviewees was deemed appropriate, as it was concluded by all members of the interview and analysis team that after the above interviews were done, a saturation point had been reached with no new information emerging from the on-going data processing (Patton, 2002).

### Measures

Two guides (1 for players and 1 for coaches) were produced that enabled the interviewer to optimise the amount of data obtained and provide a selection of unambiguous questions. This ensured that the 2 interviewees followed a consistent approach. The interview guides were produced with 2 discussion groups. The first for the players was made up of 3 professional footballers in the Spanish league with experience on natural and artificial turf (both groups with an experience of 5 years training and competing on artificial turf and natural grass). The other was for coaches, which were made up of 3 national level coaches in Spain with 5 years'

experience in training on both natural and artificial turf. Once the interview guides had been drawn up, 3 pilot tests were conducted for each group of participants in order to identify any problems regarding the quality of the data concerned. Possible misunderstandings of the questions, as well as discovery of any preconceived attitudes that trainers and players had that might influence their replies, was avoided.

The pilot study allowed the interviewers an opportunity to practise the interview technique and to adjust the questions where needed to avoid any problems. This allowed the principal investigator to ensure the questions were unambiguous and the structure of the interview was clear. An experienced qualitative researcher, who listened to the audio recordings and reviewed the transcripts, provided feedback on the pilot interviews. In order not to influence the participants' answers, the final interview guides contained several questions designed to obtain perceptions without suggesting characteristics of importance. The final interview guides were made up of open-ended questions used to obtain detailed qualitative data. The final interview consisted of 24 questions for players and 21 questions for coaches.

### **Procedures**

Players and coaches were contacted via e-mail and were invited to participate in the study. The researcher then set a date and a venue for the interview with each participant. Participants were assured that their comments would remain anonymous and that the interview data would be treated confidentially. Each interview was recorded ( $M=25.13$  minutes;  $SD=3.10$  minutes) in its entirety and each was tape recorded and transcribed verbatim into text documents for subsequent analysis. The interview was conducted *in situ* before daily training sessions during the initial part of the 2010/2011-season (August-September). All interviews were conducted in English by a single researcher who was trained for it during the pilot tests.

### **Analysis**

The same researcher who conducted the interviews with the subjects performed the process of data analysis. Once all the data had been transcribed, analysing the data involved organising all the information collected (codes) into a series of structured themes by means of an inductive analysis. After the interviews had been coded, they were structured into sub-themes and base-themes and linked to the emergent-themes that arose from the inductive analysis (Patton, 2002). The software used to analyse the information, as well as identify and group each of the codes, was Atlas-ti v 5.0 for Windows.

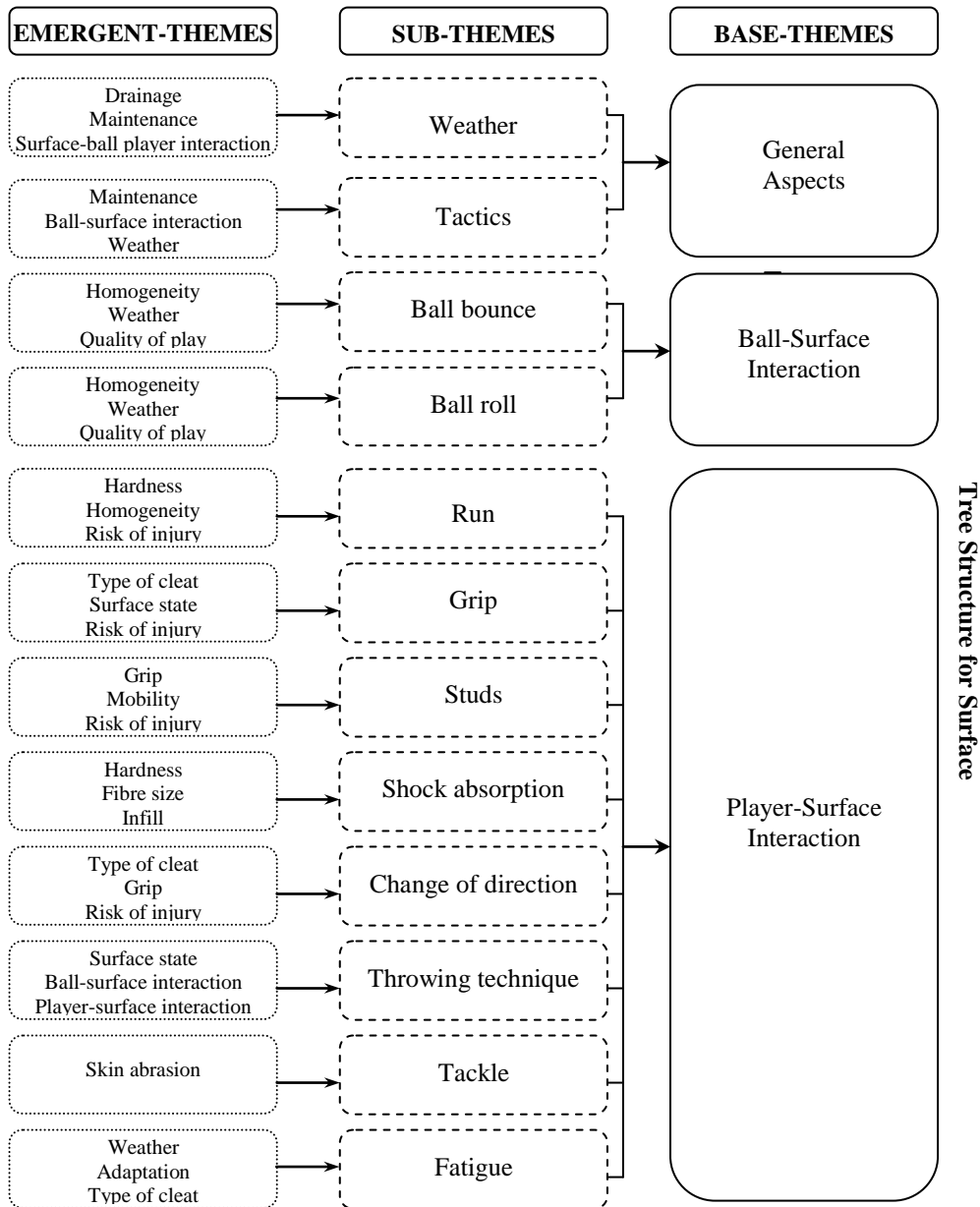
The structuring of the codes into themes was the result of triangulation by the researchers who took part in the designing of the research and data collection (Patton, 2002; Gil *et al.*, 2010). The themes into which the results analysis process was structured were the result of the consensus reached among the research team after several meetings. The interviews were coded separately by each researcher, with the classification of each code agreed on by all, thereby eliminating the possible effects of an individual misinterpretation. This process is known as the 'triangular consensus validation' (Patton, 2002).

## **RESULTS**

The results collected from the opinion of players and coaches are presented in three sections for the purpose of clarity: surface; safety; and satisfaction.

**Surface**

In the surface section, there were three base-themes (Figure 1). The first of these is “general aspects.” Two sub-themes appeared in this base-theme: weather and tactics.



**FIGURE 1: TREE STRUCTURE FOR SURFACE: RELATIONSHIP BETWEEN BASE-THEMES, SUB-THEMES AND EMERGENT-THEMES**

There was consensus among players and trainers that artificial turf is an optimum surface for withstanding adverse weather conditions, such as rain or snow, because it has an ad hoc horizontal drainage system, which slopes so that the water runs off into gutters round the edges. For example, a typical remark was.

*On artificial turf, water drainage is much better than on other surfaces, since no puddles are formed, and a match or training session can be conducted normally when it rains.*

The state of the surface of artificial turf is a determining factor in playing tactics according to the coaches. Depending on the weather conditions, the state of conservation of the surface, the surface comportment of the ball, or the choice of tactics are affected in order to adjust to the requirements of the surface.

*A tactical adjustment is needed depending on the state of the artificial turf or the ball comportment, particularly the bounce and roll. But as well as an adaptation in tactics, a physical adjustment is also needed.*

Within the surface-ball interaction, there are two sub-themes. The first is ball bounce. They consider ball bounce on artificial turf as being excessively high, and sometimes too fast, and this causes unforced errors, since it is usually hard to calculate the trajectory, as well as the height of the bounce.

*The bounce on artificial turf is very difficult for the players, since the ball either sticks or bounces very high depending on the amount of rubber it has.*

However, players and coaches state that the bounce on artificial turf has one advantage over the other surfaces. Regardless of whether the ball bounces too much or too little, the bounce will always be the same in view of the consistency of the surface.

On the other hand, both groups considered the consistency of the ball's roll to be a very positive characteristic of artificial turf. Because the surface is consistent, the ball moves reliably without changes in or diversion of its trajectory. However, if the surface is insufficiently watered, it can cause the ball to stop prematurely.

*On artificial turf the rolling of the ball is perfect, since there is no untoward bounce, and controlling the ball and any other technical action is highly effective and reliable.*

Within the surface-player interaction base-theme, eight sub-themes emerged. The first of these was running off the ball. The interviewees emphasised the consistency of the surface as a positive aspect, because it enabled them to move on it without any problem. However, because of the hardness of the artificial surface, they also indicated that the risk of injury, especially muscle strain, increases considerably.

*Artificial turf is more slippery when running off the ball, as well as being a very hard surface, which causes an increase in muscle strain injuries.*

Something similar occurs with sudden changes of direction. A bad choice of cleats increases the risk of injury with this type of manoeuvre. The type of cleat that is chosen, directly affects the footing on the surface. A bad cleat selection (which should be based on the state of the surface) will increase the risk of injury, as well as produce an imperfect grip.

*Using aluminium cleats on natural turf means that grip is better on this surface, although proper choice of cleats means that a player's grip on artificial turf is satisfactory.*

For players and coaches, one of the aspects that needs improvement on artificial turf pitches is impact absorption. The asphalt sub-base that is usually placed below the pitch produces a surface that is excessively hard, with poor impact absorption. Another aspect rated negatively is the kicking technique. Because the ball sits closer on the surface, it is very difficult for a player to place his foot properly beneath the ball to take a good kick, and thus, the effectiveness of this action is negatively affected.

*Big players, with big feet, have problems in taking a kick on artificial turf, since it is harder to place the foot under the ball.*

However, they emphasise that players develop different kicking techniques for natural and artificial turfs.

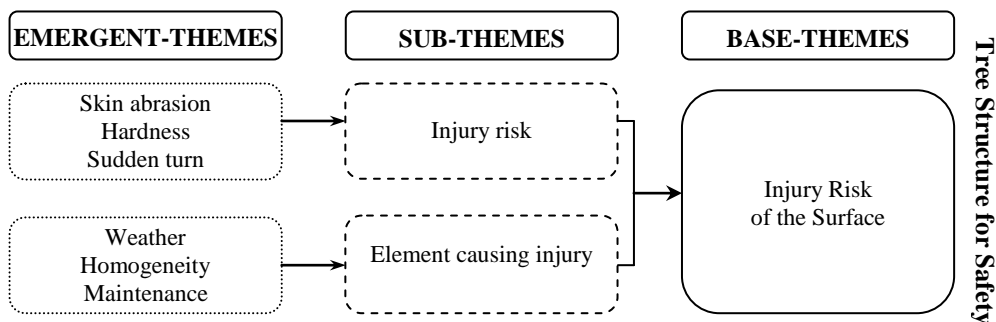
Tackling on artificial turf is undoubtedly the aspect that is most problematic and most criticised. Players state that they try to avoid this type of technical manoeuvre as much as they can in order to avoid skin abrasions caused by sliding on this type of surface.

Artificial turf is less tiring than other types of surface, because it is better equipped to cope with bad weather conditions. The fact that it does not have puddles or muddy areas is a decisive factor in avoiding the physical strain that comes with these circumstances.

*The surface of artificial turf is wholly consistent, and given its system of drainage, there are no puddles, which mean that physical effort is reduced.*

## Safety

The safety section produces just one base-theme; risk of injury from the surface. In turn, it is divided into two sub-themes: risk of injury; and element causing the injury (Figure 2).



**FIGURE 2: TREE STRUCTURE FOR SAFETY: RELATIONSHIP BETWEEN BASE-THEMES, SUB-THEMES AND EMERGENT-THEMES**

The risk of injury on this surface is primarily due to factors such as skin abrasion after a fall or a tackle on the harder surface, often caused by a lack of maintenance, upturned or disjointed seams in the sections that make it up, or by the way the pitch has been constructed. Furthermore, there is a major risk of injury to the knee ligaments because with an

inappropriate choice of cleat type, as mentioned above, the knee can remain rooted after a manoeuvre involving a turn or sudden change of direction.

*Experience tells me that if the artificial turf is not well combed or if it is cold and the ground is hard, when you play with cleats it is fairly dangerous and harmful to the knees and ankles.*

On the other hand, there is no single element that is directly responsible for increasing the likelihood of sport injuries on artificial turf. For footballers and coaches, it is a set of factors, such as the way the facility is constructed or weather conditions that increase or lessen the risk of injury.

*The substratum used for artificial turf pitches, such as cement, makes the surface harder, thereby increasing the risk of injury.*

### **Satisfaction**

Two base-themes arise from the satisfaction section: the present; and future of artificial turf. These are divided into six and three sub-themes, respectively (Figure 3).

The sensations that the player has about artificial turf, as well as the surface-player interaction produced (grip, movement, kicking technique, etc.), cause certain misgivings when choosing this surface to train or play on regularly. However, they believe that it allows intensive use of the turf, in view of the consistency and the opportunity; it is the surface that best meets the needs of both high level and lower-grade football.

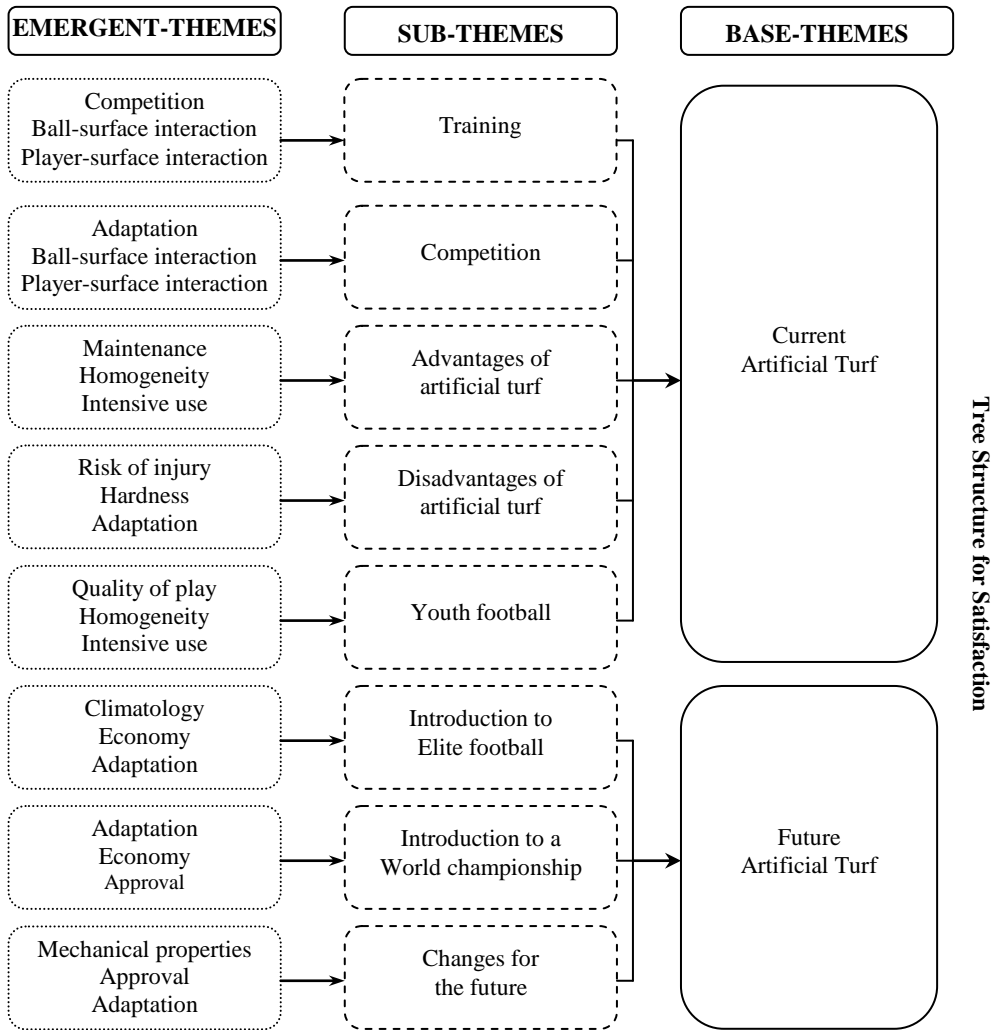
*Artificial turf is the ideal surface for reinforcing learners' technical skills, thanks to its consistency.*

For example, the principal advantages of a synthetic surface include: the consistency of a pitch, the resistance to adverse climate conditions compared to natural grass, the possibility of intensive use, and an affordable maintenance cost. On the other hand, the main disadvantages of artificial turf are a non-adjustment to this surface and a high injury rate, particularly skin abrasion after a tackle.

Thus, it seems that in the short term, the introduction of artificial turf for first-class matches, either club or international competitions, would not be very well received by those principally involved (players and coaches). The introduction of artificial turf for first-class competition has only been considered in areas where weather conditions make playing football impossible, or in clubs whose finances do not permit them to maintain a natural turf pitch in perfect condition.

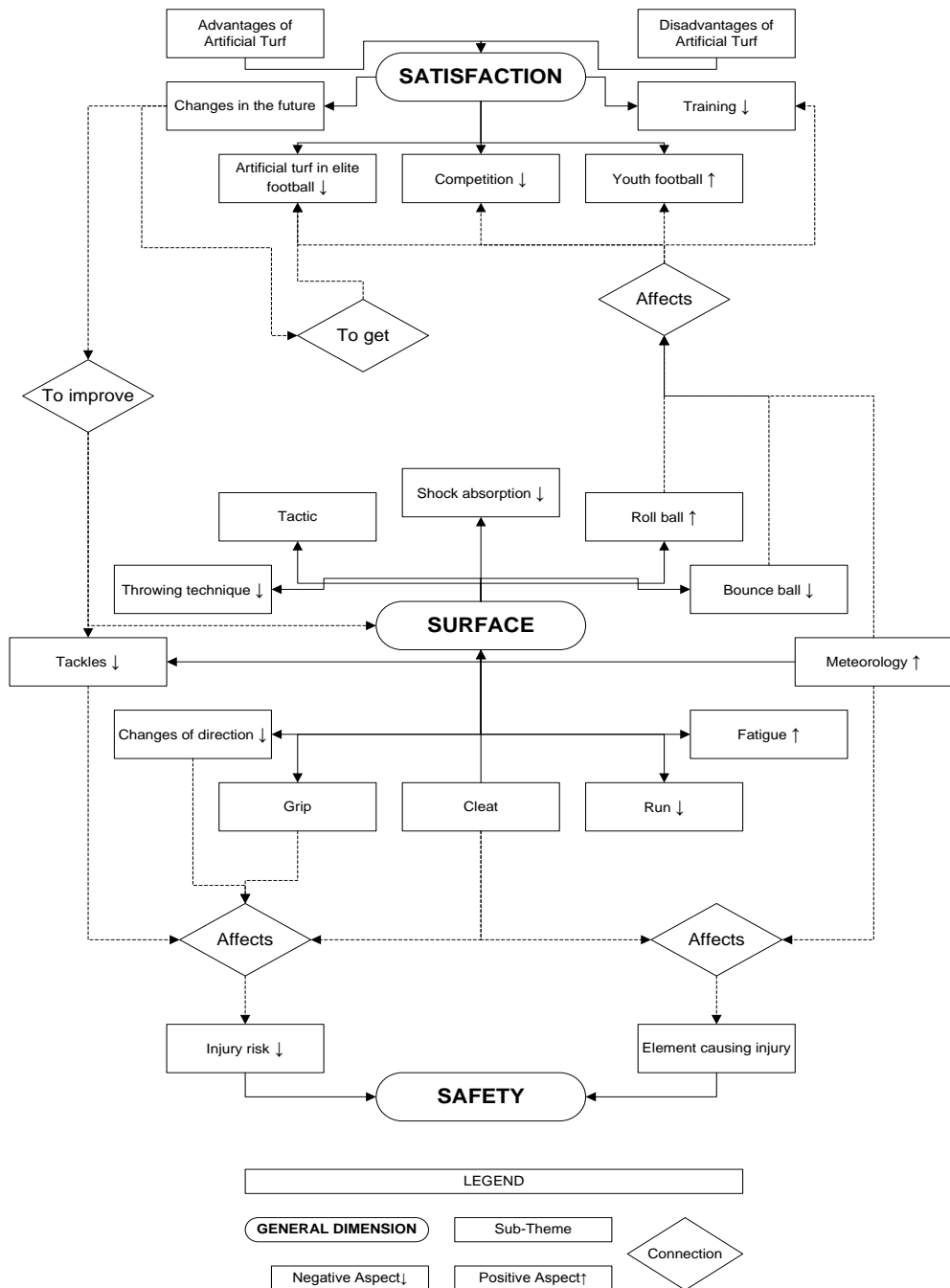
*If you look at the big clubs, like Real Madrid or Barcelona, they do not need artificial turf in their stadiums, but for clubs in Norway, for example, where it is always snowing and is very cold, artificial turf is a good solution.*





**FIGURE 3: TREE STRUCTURE FOR SATISFACTION: RELATIONSHIP BETWEEN BASE-THEMES, SUB-THEMES AND EMERGENT-THEMES**

Finally, the responses indicated that the aspects of artificial turf, which need improvement in the future, are its mechanical properties (particularly with regard to the hardness of the pitch), and the mandatory standardisation at all levels, in order to ensure playing safety and practicality, as well as the players’ adjustment to this surface. Figure 4 shows the inter-dimensional relationship model generated in this study.



**FIGURE 4: INTERDIMENSIONAL RELATIONSHIP: INTERRELATION BETWEEN GENERAL DIMENSION AND SUB-THEMES**

## DISCUSSION

### Surface

Adverse weather conditions undeniably affect football pitches, no matter what kind of surface they have, although players and coaches perceive that a synthetic surface is affected to a lesser degree. According to Simon (2010), artificial turf can be used even when it snows and, in general, it is not affected by heavy rainfall, thanks to its drainage system. Burillo *et al.* (2012b) suggests that artificial turf has better drainage potential if it is constructed on an impermeable surface (asphalt sub-base), where the water runs into gutters on the perimeter after vertical filtration.

Furthermore, weather conditions have a considerable effect on the risk of injury, including both heavy rain and snowfalls but also high and/or low temperatures. Players and coaches point out that playing in high temperatures is riskier on artificial turf than on natural turf. Meyers (2010) who analysed the data of 24 university football players, believes that there are significantly more injuries on artificial than on natural turf, both in minor, substantial and severe injury incidences.

The quality of on-going play is one of the main benefits of artificial turf, because the turf does not inhibit or divert the trajectory of the ball when it bounces or rolls (Simon, 2010). Even so, there are factors, such as humidity, the compaction of the ground or the density of the filling that produce major differences in the surface-ball interaction on artificial turf pitches (Schmidt, 1999). Players and coaches state that the bounce is higher on artificial turf, but they emphasise the consistency of this surface, because regardless of the fact that the bounce is higher, it is always the same, and it is thus a question of the player adjusting to this circumstance. In this respect, Burillo *et al.* (2012a) states that the vertical bounce of the ball is excessive on 90% of artificial turf pitches, but the users are generally satisfied with this parameter.

On the other hand, the roll of the ball is one of the most highly rated aspects of artificial turf. The main reason is a greater consistency of the surface, which causes the ball to roll without veering from its initial trajectory. Other researchers (Baker & Woollacott, 2005) show that players and coaches are more satisfied with the roll of the ball on artificial rather than on natural turf.

There is no doubt that the type of cleat chosen has a decisive influence on grip and traction, depending on the state of the pitch (Burillo *et al.*, 2012b). Players state that the cleats they use most on artificial turf are rubber cleats, followed by multi-stud boots. Burillo *et al.* (2012a) report that most players and referees use rubber cleats, which provide greater satisfaction as far as grip is concerned, as opposed to shorter cleats (multi-cleat boots). Pasanen *et al.* (2008) found that there is a greater risk of anterior cruciate ligament injury when using rubber cleats, as they increase the friction surface of the boot. Among rubber cleats (multi-ground), the round ones are the safest for players because of a more uniform sole pressure, whereas blade-shaped cleats (elongated) are more dangerous because of the increase of pressure loads on the side of the foot, which can produce injuries in this area (Bentley *et al.*, 2011). Nevertheless,

the ideal solution would be to use multi-stud boots as they provide a better ratio between surface grip and risk of injury (Burillo *et al.*, 2012b).

For most of those interviewed, the impact absorption produced by artificial turf is poor. This is mainly due to the fact that most artificial turf pitches are excessively hard because of the lack of maintenance and because they do not comply with the minimum standards required by the regulations in the matter of impact absorption (Burillo *et al.*, 2012b). However, Ford *et al.* (2006) found that there are no significant differences in impact absorption between natural turf and artificial turf. This aspect has undergone a great improvement with the new generations of artificial turf. Chivers (2008) found that there were more sport injuries in the first part of the season, coinciding with the end of summer and before the start of winter, and he concluded that in this period, the pitch was harder than during the rest of the year.

Players and coaches were undecided when establishing which surface was less risky when carrying out a sudden change of direction. Tscholl *et al.* (2007) report that 14% of football injuries arise when there is no contact with the opponent, in other words, when there is only interaction between the turf and the player. Of these, 16% occur due to sudden changes of direction. The study sample stated that kicking for goal was conditioned by the surface and they emphasised that effectiveness decreased when carried out on a synthetic surface. Potthast and Brüggermann (2009) have found that kicking on natural turf is significantly more accurate and more rapid than on artificial turf. For Andersson *et al.* (2008) professional players have greater difficulty in controlling the ball before kicking it on artificial turf, and furthermore, there are more problems when kicking for goal on the run.

One of the most controversial aspects with regard to artificial turf is the tackle. Players state that they avoid tackling on artificial turf as much as possible. Andersson *et al.* (2008) found that tackling was much less frequent on artificial turf than on natural turf. Various authors (Fuller *et al.*, 2005; Tscholl *et al.*, 2007), have found that in a game of professional football on natural turf, there are between 30 and 36 tackles per player in a game. Andersson *et al.* (2008) point out that on artificial turf there are between 16 and 20 tackles per player in a game. Coaches and players have stated that abrasions caused by a tackle are one of the main causes of sport injury on artificial turf. Several studies (Ford *et al.*, 2006; McNitt *et al.*, 2007; Gallardo *et al.*, 2010), state that skin abrasion is one of the main problems of artificial turf and may cause players to give up the sport.

Meyers (2010) states that the level of injuries caused by skin abrasion is lower on artificial turf (1%) than on natural turf (1.3%). Although abrasion used to be one of the most negatively rated aspects of artificial turf, new studies (Zanetti, 2009; Meyers, 2010; Simon, 2010), have shown that it is becoming less of a drawback. Thus, within a few years, users perhaps will no longer mention abrasion as being one of the negative aspects of artificial turf.

## **Safety**

Artificial turf is the surface that produces the most risk of general injury when playing football. These results are linked to factors such as grip, injuries caused by sudden turns, tackles, or the greater hardness of this type of surface. Coaches and players say that more ACL injuries occur on natural turf, whereas ankle injuries are more common on artificial turf.

Ekstrand *et al.* (2006) found significant differences between the number of ankle injuries occurring on artificial turf compared to natural turf. They also found that the number of knee injuries occurring on natural turf was significantly higher than on artificial turf.

Steffen *et al.* (2007) found that there were significantly more injuries occurring during games than in training sessions. Studies conducted, to date, have found that there are no significant differences between the number of injuries occurring while playing on artificial when compared with natural turf (Ekstrand *et al.*, 2006; FIFA, 2007; McNitt *et al.*, 2007; Steffen *et al.*, 2007; Pasanen *et al.*, 2008; Gallardo *et al.*, 2010).

### **Satisfaction with artificial turf**

The players and coaches in this study would not choose artificial turf as their habitual surface for training and playing. The main reason was the players' lack of adaptation to this surface in first-class football, as it is not the predominant surface for top-level competition and, therefore, the manoeuvres and techniques of surface-ball-player interaction are less precise. Andersson *et al.* (2008) found that their subjects had negative impressions regarding artificial turf. They claimed that playing on natural turf was much easier, both physically and technically.

Players and coaches claimed that users are prejudiced and think that artificial turf as a surface is more dangerous and of lower quality than natural turf. This problem may be resolved when younger players, who are now regularly playing and training on artificial turf in the youth squads of major European clubs, arrive at the top level and are presumably more used to this surface and do not mind whether they play on natural or artificial turf.

Most of the players and coaches consider that artificial turf is now ready to be introduced to first-class European football and that they would not mind playing matches on this surface regularly. They also consider it necessary to introduce it in regions with adverse climate conditions and in clubs with a tight budget.

Another positive aspect for the future of artificial turf in first-class football is the fact that most of the professional clubs' youth teams train only on artificial turf, since it is considered by many experts as being the ideal surface for training future professionals (Stiles *et al.*, 2009). Thus, professional football's inhibitions regarding artificial turf may very possibly soon be reduced to a minimum.

Given the above responses and findings across different studies, the major question is how artificial turf may be improved to match or surpass the properties of natural turf in the opinion of players and coaches. The characteristics of the surface need to be modified. These characteristics particularly concern surface-ball and surface-player interactions. To achieve this, the accreditation of the surface at all levels needs to be regulated. FIFA (2009) stipulated that a pitch accredited with its 2-Star certificate has the same quality as that of a natural turf pitch with the same top-class features. Users' preconceived ideas about artificial turf need to be addressed. However, it appears it may be at the point of being resolved. Younger players who are now playing in the first division and youth players who will be doing so in the next few years are fully accustomed to playing and training on a regular basis on artificial turf

pitches, suggesting there would be no problem if, at some stage, they had to play a first division game on this type of surface.

## CONCLUSIONS

To achieve the introduction of artificial turf into first-class football, players need to successfully adjust to this surface. This must be done gradually, from the junior squads upwards, by having the lower levels of all clubs training and playing on artificial turf, so that when they reach the highest levels they are fully adjusted to artificial turf and have no qualms about playing on this surface.

As main limitations of this study, at first sight, the short time available to extract information from key informants has relevance. As they are professional players and coaches, they were interviewed during the team's base camp and time was limited. Another limiting factor was that the results were analysed homogeneously, thus, not classifying them by nationality.

With a view to future research, consideration needs to be given to primarily increasing the group of key informants and analysing according to nationalities. Other target groups of key informants regarding artificial turf football fields are persons like sport managers or architects.

## REFERENCES

- ANDERSSON, H.; EKBLÖM, B. & KRÜSTRUP, P. (2008). Elite football on artificial turf versus natural grass: Movement patterns, technical standards and player impressions. *Journal of Sports Sciences*, 26(2): 113-122.
- BAKER, S.W. & WOOLLACOTT, A.R. (2005). Comparison of the playing performance of "third generation" artificial grass with natural turf used for professional soccer. *International Turfgrass Society*, 10: 15-26.
- BARTLETT, M.D.; JAMES, I.T.; FORD, M. & JENNINGS-TEMPLE, M. (2009). Testing natural turf sports surfaces: The value of performance quality standards. *Journal of Sports Engineering and Technology*, 223(1): 21-29.
- BENTLEY, J.A.; RAMANATHAN, A.K.; ARNOLD, G.P.; WANG, W. & ABBOUD, R.J. (2011). Harmful cleats of football boots: A biomechanical evaluation. *Foot and Ankle Surgery*, 140(3): 140-144.
- BRITO, J.; KRÜSTRUP, P. & REBELO, A. (2012). The influence of the playing surface on the exercise intensity of small-sided recreational soccer games. *Human Movement Science*, 31(4): 946-956.
- BURILLO, P.; BARAJAS, A.; GALLARDO, L. & GARCÍA TASCÓN, M. (2011). The influence of economic factors in urban sports facility planning: A study on Spanish regions. *European Planning Studies*, 19(10): 1755-1773.
- BURILLO, P.; GALLARDO, L.; FELIPE, J.L. & GALLARDO, A. (2012a). "Artificial turf surfaces: Perception of safety, sporting feature, satisfaction and preference of football users". *European Journal of Sport Science*, doi: 10.1080/17461391.2012.713005. In press. [<http://www.tandfonline.com/doi/full/10.1080/17461391.2012.713005#UcMNbefwlsk>]. Retrieved on 10 September 2011.

- BURILLO, P.; GALLARDO, L.; FELIPE, J.L. & GALLARDO, A. (2012b). Mechanical assessment of artificial turf football pitches: The consequences of no quality certification. *Scientific Research and Essays*, 7(28): 2457-2465.
- CHIVERS, I. (2008). Turfgrass sports surfaces and their relationship to player injuries. In J.C. Stier, L. Han & D. Li (Eds.), *II International Conference on Turfgrass Science and Management for Sports Fields* (115-132). Beijing: ISHS Acta Horticulturae.
- DAWSON-SQUIBB, J.J. (2004). Perceptions of success among South African soccer players: An exploratory study. *South African Journal in Sport, Physical Education and Recreation*, 26(2): 17-31.
- DRAGOO, J.L. & BRAUN, H.J. (2010). The effect of playing surface on injury rate: A review of the current literature. *Sports Medicine*, 40(11): 981-990.
- EKSTRAND, J. & NIGG, B.M. (1989). Surface-related injuries in soccer. *Sports Medicine*, 8: 56-62.
- EKSTRAND, J.; TIMPKA, T. & HÄGGLUND, M. (2006). Risk of injury in elite football played on artificial turf versus natural grass: A prospective two-cohort study. *British Journal of Sports Medicine*, 40: 975-980.
- ESTO (2008). *Football turf today and tomorrow*. Paper presented at the 1st European Synthetic Turf Organisation Conference, Brussels, 6-7 March.
- FELIPE, J.L.; GALLARDO, A.; BURILLO, P. & GALLARDO, L. (2011). Diagnóstico de la gestión de los campos de fútbol de césped artificial desde el punto de vista de los gestores deportivos [*trans.*: Management analysis of the artificial turf football field by sport managers]. *Kronos*, 10(1): 97-104.
- FIFA (2007). "Big count 2006". [[http://es.fifa.com/mm/document/fifafacts/bcoffsurv/bigcount.statspackage\\_7024.pdf](http://es.fifa.com/mm/document/fifafacts/bcoffsurv/bigcount.statspackage_7024.pdf)]. Retrieved on 10 September, 2011
- FIFA (2009). *FIFA quality concept for football turf: Handbook of requirements*. Zurich: FIFA.
- FLEMING, P.R.; YOUNG, C.; ROBERTS, J.R.; JONES, R. & DIXON, N. (2005). Human perceptions of artificial surfaces for field hockey. *Sports Engineering*, 8: 121-136.
- FORD, K.; MANSON, N.; EVANS, B.; MYER, G.; GWIN, R.; HEIDT, R. & HEWETT, T.E. (2006). Comparison of in-shoe foot loading patterns on natural grass and synthetic turf. *Journal of Science and Medicine in Sport*, 9(6): 433-440.
- FULLER, C.W.; JUNGE, A. & DEAN, G.S. (2005). A six-year prospective study of the incidence and causes of head and neck injuries in international football. *British Journal of Sports Medicine*, 39(1): 3-9.
- GALLARDO, A.; FELIPE, J.L.; BURILLO, P. & GALLARDO, L. (2010). Satisfacción de entrenadores y deportistas con los campos de fútbol de césped natural y artificial [*trans.*: Trainer and player satisfaction in the grass and artificial turf football fields]. *Cultura, Ciencia y Deporte*, 15: 189-199.
- GALLARDO, L.; BURILLO, P.; GARCÍA-TASCÓN, M. & SALINERO, J.J. (2009). The ranking of the regions with regard to their sports facilities to improve their planning in sport: The case of Spain. *Social Indicators Research*, 94(2): 297-317.
- GIL, J.L.; FELIPE, J.L.; BURILLO, P.; GARCÍA-TASCÓN, M. & GALLARDO, L. (2010). Detection of needs in sport installation in high school: Case of province of Ávila. *Journal of Sport and Health Research*, 2(3): 287-304.
- McNITT, A.S. (2005). Synthetic turf in the USA: Trends and issues. *International Turfgrass Society Research Journal*, 10: 27-33.
- McNITT, A.S.; PETRUNAK, D. & HARDNESS, S. (2007). Evaluation of playing surface characteristics of various in-filled systems. *Evaluation*, 9: 20.

- MEYERS, M.C. (2010). Incidence, mechanisms, and severity of game-related college football injuries on FieldTurf versus natural grass: A 3-year prospective study. *American Journal of Sports Medicine*, 38(4): 687-697.
- PASANEN, K.; PARKKARI, J.; ROSSI, L. & KANNUS, P. (2008). Artificial playing surface increases the injury risk in pivoting indoor sports: A prospective one-season follow-up study in Finnish female floorball. *British Journal of Sports Medicine*, 42: 194-197.
- PATTON, M.Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage.
- POTTHAST, W. & BRÜGGERMANN, G.P. (2009). Movement differences in football kicking on natural and artificial turf. *Footwear Science*, 1(1): 100-101.
- SANDKUEHLER, P.; TORRES, E. & ALLGEUER, T. (2010). Performance artificial turf components-fibrillated tape. *Procedia Engineering*, 2(2): 3367-3372.
- SCHMIDT, R. (1999). *Natural and artificial playing fields: Characteristics and safety features*. Philadelphia, PA: American Society of Testing and Materials.
- SIMON, R. (2010). *Review of the impacts of crumb rubber in artificial turf applications*. Berkeley, CA: University of California.
- STEFFEN, K.; ANDERSEN, T.E. & BAHR, R. (2007). Risk of injury on artificial turf and natural grass in young female football players. *British Journal of Sports Medicine*, 1: 1-6.
- STILES, V.H.; JAMES, I.T.; DIXON, S.J. & GUIASOLA, I.N. (2009). Natural turf surfaces: The case for continued research. *Sports Medicine*, 39(1): 65-84.
- TSCHOLL, P.; O'RIORDAN, D.; FULLER, C.W.; DVORAK, J.; GUTZWILLER, F. & JUNGE, A. (2007). Causation of injuries in female football players in top-level tournaments. *British Journal of Sports Medicine*, 41(1): 8-14.
- UEFA (2004). Summary report: Artificial turf. Nyon [Switzerland]: UEFA.
- VILLWOCK, M.R.; MEYER, E.G.; POWELL, J.W.; FOUTY, A.J. & HAUT, R.C. (2009). Football playing surface and shoe design affect rotational traction. *American Journal of Sports Medicine*, 37(3): 518-525.
- ZANETTI, E.M. (2009). Amateur football game on artificial turf: Players' perceptions. *Applied Ergonomics*, 40(3): 485-490.