

Teeth and occlusal problems of male elite soccer players: risk-factor for re-injuries?

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Injuries of male elite soccer players are not uncommon. One study indicated that, on average, one injury occurs every 106 hours of sport-related activity (Waldén et al., 2005). Another study reported that 65 to 95% of these players had at least one injury every year (Häggglund, 2007). Most injuries are non-contact injuries (e.g. Hawkins, Hulse, Wilkinson et al., 2001). Most (re)injuries in elite football occur in the last 15 minutes of the first and the second half (e.g. Hawkins & Fuller, 1999).

The injury causation model of Bahr and Krosshaug (2005) state that intrinsic and extrinsic risk factors and their interactions 'make players susceptible' for an injury caused by inciting events like 'jumping', 'tackling', 'shooting', etc. For example, in the last 15 minutes of each half soccer players are made more susceptible for an (re)injury by the combination of the intrinsic risk factors, fatigue of the muscles and some damage incurred earlier in the game and the extrinsic risk factor of intense contest.

Knowledge of intrinsic and extrinsic risk factors and of injury events constitute the context of prevention programs. Bahr and Krosshaug (2005) suggested that seven kinds of intrinsic risk factors can be distinguished with male soccer players: 1. Increasing age, 2. Body composition problems (e.g. high BMI), 3. Health problems (e.g. history of previous injury, joint instability), 4. Low fatigue resistance (e.g. muscle strength/power), 5. Anatomic factors (e.g. alignment, intercondylar notch width), 6. Neuromuscular factors (e.g. postural stability), and 7. Psychological factors (e.g. competitiveness, perception of risk).

Previous studies by Engebretsen and colleagues (e.g. Engebretsen et al., 2009) and other research groups (e.g. Arnason et al. 2004; Ivarsson and Johnson, 2010; Östenberg and Roos, 2000) found that increased risk of injury was associated with a restricted number of intrinsic risk factors, notably: increased age, previous injury, joint instability, weak adductor muscles, anxiety-related

personality characteristics, a history of many stressors and few coping resources. Not a single study has examined whether dental and Temporomandibular Joint (TMJ)/occlusal problems are associated with increased risk of (re)injury and/or increase the sports injury susceptibility. However, previous research has shown that dental and TMJ problems contribute to imbalance in posture and movement and to the production of toxic products that may undermine physical fitness. Imbalance and reduced fitness are among the causes of (re)injuries of muscles, tendons and ligaments.

In addition, several prominent football trainers pointed out that dental problems and/or occlusal disturbances are to be regarded as important intrinsic risk factors. Luis Aragonès (at that time trainer of Sevilla) and Francky Dury, trainer of Zulte Waregem sent all A-players to the dentist. They stated that a bad dental status has a negative impact on overall health and fatigue resistance of the player. Dieter Trzolek has supervised the selections of FC Köln and Bayer Leverkusen for more than thirty years. He declared that muscle and tendon problems often originate in the teeth. At AC Milan and at Arsenal FC every player undergoes a periodic dental analysis. A number of players, notably Robin van Persie and Franck Ribery, were recovered from different injuries after a dental treatment.

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This study used a retrospective cross-sectional design to examine whether dental and TMJ problems ought to be added to this list of intrinsic risk factors of male professional soccer players because of correlation with presence and number of re-injuries, especially re-injuries of muscles, tendons and ligaments. We focused on re-injuries because most dental and TMJ problems are chronic and therefore they may be especially associated with re-injuries.

Method

Participants.

Professional male players of 8 premier league clubs in the Netherlands, Belgium and England (N = 184; AFC Ajax, RSC Anderlecht, KRC Genk, AA Gent, KV Mechelen, Roda JC, FC Twente, WestHam United)

and two promises squads of the elite football clubs (N=31; AZ Alkmaar and KRC Genk) participated in this research project. Mean age was 25.3 years (s.d.= 3.9).

Measures.

The Sports Injury Risk Indicator (SIRI), a self-report questionnaire, was used to obtain information from study subjects concerning re-injuries, Dental/TMJ problems, actual physical health, (re)injury anxiety, team cohesion, satisfaction with trainer and staff, psychophysical stress and eating habits. To prevent low response rates, typically associated with questionnaires, we kept the instrument relatively short; questions were simple and straightforward.

Results

The prevalence of the nine Dental/TMJ problems is presented in table 1.

Table 1. Prevalence of dental/TMJ problems

Type of problem	Present* %
Toothache without a dental cause	9.8%
Temporomandibular joint problems	21.4%
Periodontitis or retraction of the periodontium	28.8%
One or more restorations (crowns & bridges included)	50.2%
One or more nerve root treatment(s)	34.4%
One or more apex resection(s)	12.6%
Wisdom teeth not removed	74.4%
Past or present orthodontic fixation	30.7%
Bruxism or grinding, clenching	26,5%

*: Sample size=215.

We defined the Sum of Dental/TMJ Problems (SumDental) as 0 = none of the 9 dental/jaw problems (found with 3.3% of the 215 participants), 1 = one problem (with 15.8%), 2 = two or three problems (with 47.4%), 3 = four or five problems (with 30.2%) and 4 = six or more problems (with 3.3%) .

Table 2 presents the prevalence of 6 types of (re)injuries and 3 combinations of types and the

associations with SumDental. We found significant association of SumDental with muscle, tendon, ligament re-injuries and with the presence of any tissue re-injury. We computed the total number of types of re-injuries (TotalReinjuries). To achieve at a normal distribution, the total numbers were transformed into: 0 = no re-injury (14%), 1 = one type of re-injury (39%), 2 = two or three types of re-injuries (39%), and 3 = four or more types of re-injuries (8%).

Table 2. Prevalence of (combined) types of re-injuries

Type of re-injury	Present %	Spearman rank correlation with SumDental
1. Muscle (rupture/tear/strain/cramps)	47.0%	.23***
2. Tendon (rupture/tendinosis/bursitis)	24.7%	.14*
3. Ligament	17.7%	.14*
4. Lesion of meniscus or cartilage	16.3%	n.s.
5. Fractures and bone stress	13.0%	n.s.
6. Other	45.1%	n.s.
One or more tissue re-injury (1,2,3)	63.7%	.22***
One or more non-tissue re-injury (4,5,6)	62.3%	n.s.
TotalReinjuries (1-6), frequencies: 0 : 14.0%; 1: 39.1%; 2-3: 39.1%;, 4-6: 7.9%		.26***

Note: Sample size=215; *: p<0.05; ***: p<0.001.

Prediction of one or more tissue re-injuries.

Univariate and multivariate logistic analyses were used to examine the associations of age, SumDental and the SIRI-scales - except Actual physical health - with one or more tissue re-injuries.

Univariate analyses showed that SumDental and re-injury anxiety have strong associations with the presence of one or more tissue re-injuries (OR=1.77, p<0.001, and OR=1.34, p<0.001, respectively), a significant association was also found for unhealthy eating habits (OR=1.36, p<0.05).

Multivariate logistic analysis was used to examine whether SumDental has a unique contribution, over and above age and the SIRI-scales (except actual physical health), in the prediction of one or more tissue re-injuries. In the first step of the testing procedure we made a prediction model, using age and all SIRI-scales. In the second step we examined whether adding SumDental to the model resulted in a significant improvement of the prediction.

Step 1: The chi-square statistic and Nagelkerke’s R-square indicated that the model with all SIRI scales and age as predictors showed a significant prediction of two or more tissue re-injuries: $\chi^2(6 df)= 33.38, p<0.001, Nagelkerke’s R^2=.20.$

Step 2: adding SumDental to the prediction model resulted in a significant improvement of the model: $\chi^2(1 df)= 11.21, p<0.001, Nagelkerke’s R^2$ raised to .26. As shown in table 3, the final model showed significant Odds Ratio’s (OR’s) for SumDental and re-injury anxiety.

Prediction of total number of re-injuries (TotalReinjuries).

Spearman rank correlations and multiple regression analyses were used to examine the associations with TotalReinjuries (i.e. the transformed total number of types of re-injury). Significant correlations with TotalReinjuries were found for re-injury anxiety (r= .21, p<.005), unhealthy eating habits (r= .14, p<.05), psychophysical stress (r= .23, p<0.001) and SumDental (r= .26, p<.001). Next the same two-step procedure as above was used with the multiple regression analysis:

Step 1: The model with all SIRI scales and age as predictors showed a significant prediction of TotalReinjuries: $F(6,203)=5.56, p<0.001, R^2=.14.$

Step 2: Adding SumDental to the prediction model resulted in a significant improvement of the model: $F(1,202)=9.03 p<0.001, R^2$ raised to .18. As shown in Table 3, the final model showed significant standardized weights for psychophysical stress and SumDental.

Table 3. Final Regression models for the Prediction of Soft Tissue Re-injuries and the Prediction of the Total Number of Types of Re-injuries

Predictor Variables	Prediction of Re-injuries	
	Soft Tissue OR (95% CI)	Total Number β
SumDental	2.06 (1.33 – 3.21)***	0.21**
Re-injury Anxiety	1.47 (1.22 – 1.77)***	0.13
Psycho-physical Stress	1.08 (0.96 – 1.22)	0.25**
Age	0.86 (0.66 – 1.10)	0.05
Unhealthy Eating Habits	1.19 (0.93 – 1.52)	0.06
Lack of Team Cohesion	0.90 (0.76 – 1.07)	-0.07
Problems with Trainer / Staff	0.94 (0.80 – 1.10)	-0.01

Note: **: $p < 0.005$; ***: $p < 0.001$; SumDental=Total Number of Types of Dental problems.

Associations of specific dental/TMJ problems

Finally we examined the associations of the 9 types of Dental/ TMJ problems with the (combined)

types of (re)injuries. The results are presented in Table 4.

Table 4. Associations of Dental/TMJ problems with (combined) types of re-injuries

Type of problem	Associations with (combined) re-injury type
Toothache without dental cause	none
Temporomandibular joint problems	none
Periodontitis or retraction of the periodontium	muscle (not cramps)
One or more restorations (crowns & bridges incl.)	muscle, 2+ tissue, 2+ all
One or more nerve root treatment(s)	muscle (mostly cramps), 2+ tissue, 2+ all
One or more apex resection(s)	muscle (mostly cramps), 2+ tissue
Wisdom teeth not removed	none
Past or present orthodontic fixation	none
Bruxism or grinding, clenching.	tendon, ligament, 2+ tissue, 2+ all

Note: 2+ tissue= two or more of the tissue re-injuries; 2+ all= two or more of all types of re-injuries.

It was also investigated whether addition of the position of the football player (an extrinsic factor) contributes to the predictions. It did so in both cases but in the final model remained SumDental the most significant predictor.

Conclusion

The main conclusion of this study is that it may be suspected that the presence of a large number of dental / TMJ (occlusal) problems is one of the most important intrinsic risk factors for sports (re) injuries in professional football players.

The validity of this conclusion is supported by a negative result, namely that no correlation was found between SumDental and non-tissue (re) injuries. Obviously, further research is needed in which dental / TMJ problems and (re-)injuries are recorded by our experts. Also important is research into the effects of improving dental / TMJ problems on the risk of (re) injury. Such a clinical research has already started at KRC Genk (B) and Zulte Waregem (B).

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APPENDIX A

Summary content of SIRI and information on certain scales:

Re-injuries. Re-injuries were assessed by the question 'Which of the following types of injuries have you had more than once (more responses possible)?' with the response options of 'muscle injury, muscle cramps, Achilles tendon injury, Groin injury, sprain / ligament injury, fracture, knee injury, back injury, other, none'. The SIRI also contains a set of control questions concerning (re)injuries. We found only a few inconsistent responses.

Dental / TMJ problems. Nine SIRI questions concern the actual or past presence of specific dental particulars, for example the presence of wisdom teeth, toothache while the dentist could not find a cause, periodontitis or retraction of the periodontium, nerve root treatment, bruxism.

Actual physical health (7 items), with items from the Short Form 36 Health Survey Questionnaire (SF-36)(Ware, J.E., & Sherbourne, C.D., 1992). Cronbach's alpha 0.61.

Re-injury anxiety (5 items), modelled after the Tampa Scale for Kinesiophobia (Kori et al., 1990; Miller et al., 1991) e.g. 'I'm afraid that an injury occurs during training'. Cronbach's alpha=0.54

Team cohesion (6 items), items came from the 'team integration' and 'team social contribution' scales of the Athlete Satisfaction Questionnaire (ASQ; Riemer & Chelladurai, 1998), e.g. 'I am satisfied with my social status on the team'. Cronbach's alpha 0.62.

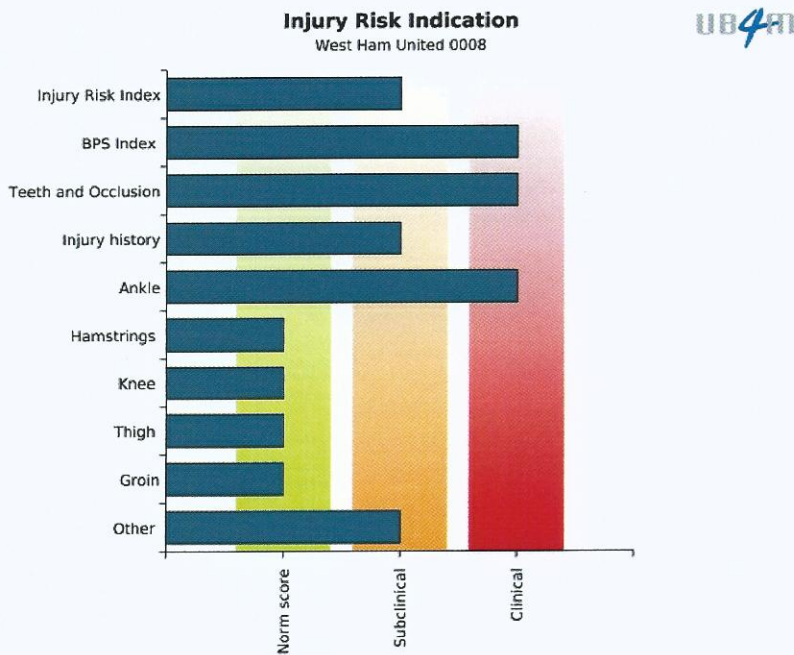
Satisfaction with trainer (4 items), items came from the 'training and instruction' scale of the ASQ, e.g. 'I am satisfied with the recognition I received from my coach'. Cronbach's alpha 0.72.

Psychophysical stress (14 items), with items from the Sport Anxiety Sale (SAS; Smith, R.E., Smoll, F.L., & Schutz, R.W., 1990) and the Langner index (Johnson & Meile, 1981). Cronbach's alpha 0.61.

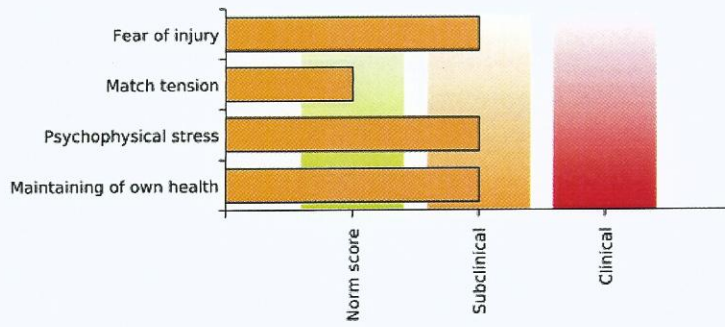
Unhealthy Eating habits (2 items), both questions concern the frequency of eating (un)healthy food.

APPENDIX B

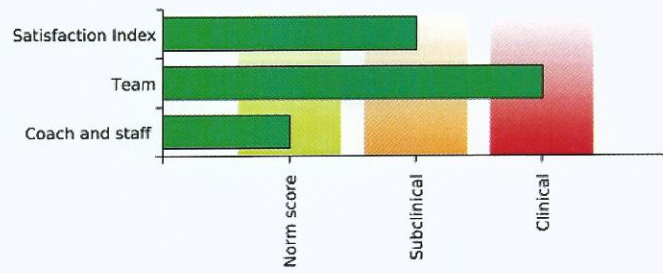
E.g. Individual results of the SIRI©



Biopsychosocial aspect
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Degree of Satisfaction aspect
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RESEARCH ON INJURY SUSCEPTIBILITY

1 BETTER PREDICTOR OF MUSCLE OR TENDON RE-INJURIES

The number of Dental/TMJ problems is a better predictor of muscle or tendon re-injuries of male elite football players than age, psychophysical stress, unhealthy eating habits, and problems with trainer or team-mates.

2 HIGHER RISK

The more types of Dental/TMJ problems and the more re-injury anxiety, the higher the risk of muscle, tendon or ligament (re)injury.

3 MORE TYPES

The more types of Dental/TMJ problems and the more psychophysical stress, the more types of re-injury.

4 BETTER PREDICTOR OF THE TOTAL NUMBER OF TYPES OF RE-INJURIES

The number of Dental/TMJ problems is a better predictor of the total number of types of re-injury than age, re-injury anxiety, unhealthy eating habits and problems with trainer and staff or team-mates.

5 MOST USEFUL AND USER-FRIENDLY INSTRUMENT!

The Sports Injury Risk Indicator[©] is the most useful and user-friendly instrument for scientists and club clinicians to monitor health condition and predict (re-)injuries.



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