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The Use of Photos from Patch Test Reactions on Day 7 in Professional Ice Hockey Players in Sweden

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Abstract

Background: A survey was undertaken in all ice hockey players in 26 professional teams in Sweden representing the 2 highest divisions. All players answered a questionnaire and the players from 6 teams, 3 from each one of the 2 divisions, were patch tested with 72 test preparations in a baseline series supplemented with a series representing the work environment of the players. For practical reasons, the patch testing and test reading on day 3 (D3) took place in the arenas of the teams. As a traditional dermatologist reading on D7 was impossible to perform in all but one team, the players and coaches were asked to use their mobile phones to take photos of the tested backs of the players on D7 and send to the investigative team. In one team a dermatologist reading took place on D7 independent of the mobile photos.

Aim: The aim of the study was to investigate if photos from mobile phones taken on D7 by the subjects themselves or someone helping them could add positive reactions to those noted from traditional test readings on D3.

Materials and Methods: 107 players in the 6 teams were patch tested and reading on D3 was performed in 103 of them. Mobile photos of the backs of 100 players were taken on D7.

Results: 5 photos obtained from the 100 players available for the second test reading on D7 had too bad quality to allow evaluation. Thus, photos of 95/103 (92.2%) players with a live dermatologist reading on D3 were evaluated. Besides 50 contact allergic reactions noted in 26 players on D3, 7 (14%) more positive reactions were registered in 5 players, in 2 without any reactions on D3. The 7 additional reactions were noted to 7 different sensitizers - oxidized linalool, mercapto mix, mercaptobenzothiazole, PFR-2 (resol resin based on phenol and formaldehyde), paraben mix, imidazolidinyl urea, and methylenedianiline.

Conclusion: 14% more contact allergic reactions were diagnosed when using photos of the tested backs of the players replacing the traditional dermatologist reading on D7.

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Introduction

To trace contact allergy, the International Contact Dermatitis Research Group (ICDRG) recommended patch test reading on day 3 or 4 (D3/4) [1]. However, a substantial number of contact allergies is missed unless an additional reading is performed on D7 [2, 3]. A second patch test reading on D7 is mandatory at the Malmö department since 1992 [4]. A test reading on D7 is also mandatory according to the recent recommendations by the European Society of Contact Dermatitis [5].

In a study on occupational dermatoses in professional ice hockey players in Sweden, patch testing was performed with a baseline series and a series representing the work environment [6]. A second patch test reading on D7 was virtually impossible. The aim of this study was therefore to investigate if photos from mobile phones taken on D7 by the subjects themselves or someone helping them could add positive reactions to those noted from traditional test readings on D3 when the images of tested backs were sent to the investigators for evaluation.

Materials/Method

General Information

The two top leagues of professional ice hockey players in Sweden in the 2009-2010 season constituted 26 teams, 12 teams in the "Elite" series and 14 teams in the second highest league "Allsvenskan" with a total of 658 players according to team charts. 545 could be traced and given a questionnaire, printed on paper, by their team manager. Professional ice hockey players in Sweden have their ice- season from August one year till April the next year. Their work implies practising and playing games 6-7 days a week during 10-11 months a year at various arenas. During the off- ice season they train regularly both indoors and outdoors. The two leagues had similar conditions concerning the players´ equipment, working environment and hygiene routines. Because of logistic reasons not more than 3 teams in each league were possible to patch test during the time period allowed by the team managements. Therefore, randomization of teams out of the 26 was not possible but we had a geographic spread of 1500 km distance from the northernmost ice hockey team in Lulea to the southernmost in Malmö. In the 6 teams selected, 3 from each one of the 2 divisions, there were 148 players eligible. Out of these, 116 players not participating in the national training camp or at leave prior to the patch test were seen by one of the three dermatologist and had a whole body visual examination when any kind of dermatitis and other skin lesions were noted. Some players declined patch testing why 107 remained for this procedure. The investigation was undertaken during the active season of the ice hockey players meaning a tight schedule with frequent exercises and games all over Sweden.

Subjects

107 male ice hockey players with a mean age of 25 years (range 17-39) participated in the study.

Patch Testing

107 players were patch tested with 72 test preparations representing the Swedish baseline series and a series representing the work environment [6]. Chemotechnique Diagnostics in Vellinge, Sweden delivered the Swedish baseline series. The test preparations in the work environment series were made at our laboratory in Malmö. The test system used was IQ chambers (Chemotechnique Diagnostics). 30 mg of each petrolatum preparation or 20 microliter test solution was applied to the chamber and then applied to the participants´ backs. Volatile sensitizers were applied to the chambers immediately before the application on the back of the players [7, 8]. The chambers were removed after occlusion for 48 +/- 2 hours. For practical reasons, the patch testing and first test reading according to the International Contact Dermatitis Research Group (ICDRG) criteria (1, 5) took place in the arenas of the teams. The results of the patch test reading on D3 will be published elsewhere [6].

The late dermatologist reading after one week (6-8 days) was impossible to perform in all but one team due to the team schedules and their games at different arenas. All players and coaches had therefore written information on how to use their mobile phones to take photos of the tested backs of the players on D7 (+/-1 day) in a well-illuminated room with neutral background such as a dressing room. Cameras with 3.15 Megapixel or less were used and images from all players in the 6 teams were sent digitally to the investigators.

At the Department of Occupational and Environmental Dermatology the images were projected on a standard 19-inch desk top computer screen and evaluated by two experienced dermatologists together. No image improving tools were used. Erythematous reactions seemingly covering a whole test area were registered. Thereafter the individual protocol of the D3 reading was controlled. If there was no positive reaction (+, ++, +++) noted on D3 for an erythematous reaction seen on the image evaluated, a new contact allergy was registered.

Validation of Image Evaluation

One team with 17 players were available for a live test reading by one experienced dermatologist on D6. The reading took place in the home arena of the team. When the dermatologist had left the arena, photos of the backs of all 17 players were immediately taken by the team coach. The images from the players were sent to Malmö for evaluation.

In Malmö the images were projected on a standard 19-inch desk top computer screen and evaluated by two dermatologists together in the same way as for all other players. The two had not performed the D6 reading. When the evaluation of possibly new contact allergies was finished, a comparison of the evaluation of the images and the live dermatologist reading on D6 was made.

Ethics

The study was approved by the Central Ethical Review Board in Lund, Sweden. The subjects were informed in writing and they gave their written informed consent.

Results

Four subjects out of 107 patch tested were excluded due to too short application time of the tests. Thus, 103 should have sent in photos but photos were obtained from only 100. In 5 players the quality of the photos were too bad to allow evaluation. Thus, photos of 95/103 (92.2%) players were evaluated.

Additional contact allergies were noted to 7 different test preparations in 5 players. 2 of these 5 players did not have any contact allergy diagnosed on D3. One allergic reaction was noted to each one of oxidized linalool, mercapto mix, mercaptobenzothiazole, phenol-formaldehyde resin 2 (PFR-2; a resol resin based on phenol and formaldehyde (9)), methylenedianiline (MDA), imidazolidinyl urea, and paraben mix (Table 1). Contact allergy only detected on the image evaluation was noted to 4 different sensitizer in 2 players, one contact allergy in one player and 3 allergies in another player (Table 1).

Table 1. Additional contact allergies noted in the late test reading from mobile photos in 95 players in 6 Swedish professional ice hockey teams.

Player	Live reading - positive reactions (+/++/+++) on D3	Photo - additional positive reactions on D7
1.	Amerchol L- 101, *Myroxylon pereirae*, Colophony, Fragrance mix I, Skin adhesive mix	Oxidized linalool
2.	None	Phenol-formaldehyde resin (PFR-2)
3.	Amerchol L- 101	Paraben mix
4.	Black rubber mix	Imidazolidinyl urea
5.	None	Mercapto mix, 2-mercaptobenzothiazole, methylenedianiline

(+,++,+++ = allergic patch test reactions; D = day)

The validation evaluation showed agreement between the dermatologist reading and the image evaluation. Doubtful reactions noted on the dermatologist reading on D6 were not registered as positive when viewing the photos without knowledge of the D3 readings. The allergic reactions on the dermatologist reading on D6 were registered as positive at the photo evaluation.

Discussion

The patch test reading after one week based on mobile photos resulted in the detection of 7 additional contact allergic reactions. The contact allergies concerned 7 different test preparations and most likely 6 sensitizers as mercaptobenzothiazole giving a contact allergic reaction also is present in mercapto mix. The first test reading on D3 by dermatologists resulted in 50 allergic reactions [6]. The additional reading thus gave 14% more contact allergic reactions diagnosed. Of all contact allergic reactions detected in the players (57 reactions), the allergies detected after one week constitute 12.3% which is a figure similar to the one for routinely patch tested dermatitis patients at our department (unpublished results).

In a way, it is again demonstrated that a reading after one week should be mandatory [4]. A reading after one week is also recommended in the guidelines of the European Contact Dermatitis Society [5]. However, do we know that these reactions absent on D3 but appearing on the photos from D7 really represent contact allergic reactions? Actually, we do not know as the ordinary D6 reading of the players in one team did not result in any additional test reactions registered why the performed validation evaluation in this study has a limited value. On the other hand, it is highly likely that the new reactions detected on the images represent patch test reactions. The decisive question is whether they are irritant, doubtful, or allergic. The photos are from the D6/7 reading and not from D2 or D3/4 readings when both doubtful and irritant reactions are more common, particularly if substances/products outside the common test series are tested. All sensitizers detected on the D7 reading in this study are included in our baseline series used for dermatitis patients [6]. According to our experience, we virtually never see irritant reactions to these preparations appearing first on D7 without any reactions at all on the D3 reading. Thus, irritant reactions can be excluded. It is on the other hand difficult to exclude doubtful reactions for the D7 reactions. For sensitizers with a tendency to appear late, even after D7 without being a sign of active sensitization, such as gold, acrylates, and corticosteroids [10-12], may not uncommonly present as a negative reaction on D3/4 followed by a doubtful reaction on D7 (10). Except for the phenol-formaldehyde resin (PFR-2) [9,13], the additional contact sensitizers detected in this study do not belong to those sensitizers having a tendency to appear late but any sensitizer may occasionally appear late, i.e. a doubtful or allergic reaction on D7 following a negative reaction on D3/4. Importantly many of the doubtful reactions appearing first on D7 and with a negative reaction on D3/4 will develop further into an obvious allergic reaction why individuals with such reactions should be read further [10].

Already today mobile photos are used in the dermatology clinics. Patients may show photos of dermatoses which have changed character or disappeared at the time of consultation. Sometimes we ask the patient to take a photo of a test area and send us in case of any reaction.

A more standardized form of tele-dermatology has been used since many years and is increasingly used in various areas of dermatology [14-16]. It has also been used for evaluation of test reactions. A study from Linköping University Sweden published in 2007 compared the inter-expert evaluation from five experienced dermatologists of photographic images to test readings according to ICDRG [17]. Disagreement on ICDRG criteria was found but there was agreement on simplified tripartite reading for positive, negative (including doubtful) and irritant reactions. Unlike our study, the Linköping study investigated test reactions on D3 when both irritant and doubtful reactions are substantially more common than on D7.

Over the years, mobile cameras and frequent digital imaging have become an everyday technique in the population. Since this study was done, mobile phone cameras and computer screens have improved, as they do continuously, which suggests that evaluation of images can be even better performed nowadays and in the future. In addition to this software to improve image quality can be used.

Are there any limitations of using mobile phones and digital imaging for assessment of patch test reactions? In an ideal situation, we would have performed the D7 reading live but this was not possible. Instead of risk missing 10-15% contact allergy, obviously the technique has a place in situations like ours when most teams of ice hockey players were on tours with frequent games when it was time for the second test reading. We think that the technique should first focus on the reading after one week as there are substantially fewer irritant and doubtful reactions confusing the reading at this time point. Hopefully, the technique will in the future allow the mobile camera to detect whether an erythematous test area also is infiltrated/edematous as this according to the ICDRG classification [1] discriminates an allergic test reaction from a doubtful one. A larger validation study than ours is also needed when comparing all reactions noted on D7 when a dermatologist is reading live in the ordinary way and when another dermatologist is performing the reading based on digital images from D7.

As mentioned, mobile photos are already used today for patch test reading. We think that the technique can be used for the D7 or later readings, particularly when limited test areas are involved and the photos are taken according to written advice. It is unlikely that a negative reaction on the photo does not represent a negative reaction. The problem arises when there is a reaction and it might be difficult to conclude whether it is a doubtful or allergic reaction. Occasionally, it might not matter as the tested individual is not exposed to the tested substance/product anymore or it is easy to avoid the substance/product. In this situation it might not be necessary for the individual to come to the clinic for evaluation of the test area. On the other hand, if there is a reaction on the photo where the decision on whether it is an allergic reaction or not is very important, we think that the tested person must come to the clinic for evaluation. Such examples are a possible formaldehyde reaction in any individual as chemical analyses may be required and a possible epoxy reaction in a worker exposed to epoxy professionally, as it may affect compensation and rehabilitation matters.

Conclusion

We found 14% (7/50) additional contact allergies on D7 in mobile photos of patch tested backs of the ice hockey players. Our results showed high compliance to send digital photos and benefit from a simplified two partite method as a late test reading, when an ICDRG reading could not be done. Improvements in mobile photo hard ware and image analyzing techniques in a future test reading situation can be of importance. Further investigations are needed.

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