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Case Control Study

Awareness, knowledge, and attitudes towards sun protection among patients with melanoma and atypical mole syndrome

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Abstract

BACKGROUND

Patients with atypical mole syndrome (AMS) have a 3- to 20-fold higher risk of developing malignant melanoma (MM) than individuals without. The most modifiable risk factor for developing MM is the ongoing ultraviolet exposure.

AIM

To assess awareness, knowledge, and attitudes towards sun protection among patients with MM and AMS.

METHODS

From January 2020 till December 2021, a written survey was administered to patients with MM and AMS and a control group who attended a specialist mole clinic at the Dermatology Department of the University Hospital of Heraklion in Heraklion, Crete, Greece. Demographic data and photoprotective practices, knowledge, and perceived barriers were collected. Relevant statistical analyses were performed using SPSS IBM 25.

RESULTS

In total, 121 subjects consented and participated in the survey. Their mean age was 43.92 ± 12.55 years. There were 66 (54.4%) females and 55 (45.4%) males. Forty-seven (38.8%) patients had AMS, 26 (21.5%) had a past medical history of

MM, and 48 (39.7%) attended the clinic for a full skin checkup for their naevi without having AMS or MM. Although 104 (86%) participants reported using sunscreen with the majority of them (59/121 = 48.8%) wearing sunscreen with a sun protection factor of > 50, only 22 (18.2%) patients did so every day and only 20 (16.5%) all year round. Approximately 74.4% of patients recalled having received advice on how to protect their skin from sunlight, and 73% were interested in receiving education about sun protection. The most mentioned barriers in photoprotection were concerns over adequate vitamin D and lack of time.

CONCLUSION

Despite mentioning having received adequate education in photoprotection, adherence to photoprotection practices is suboptimal in patients with MM and AMS.

Key Words: Atypical mole syndrome; Dysplastic naevi; Malignant melanoma; Photoprotection; Skin cancer

Core Tip: There are no previous studies assessing awareness, knowledge, and attitudes towards sun protection among patients with malignant melanoma (MM) and atypical mole syndrome (AMS). Our study highlights the importance to raise awareness regarding photoprotection in patients with MM and AMS to prevent skin cancer.

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INTRODUCTION

The term atypical mole syndrome (AMS) refers to people who have multiple naevi (> 100), including some naevi larger than 8 mm in diameter with atypical features[1,2]. Patients with AMS have a 3-20 times higher risk of developing malignant melanoma (MM) than individuals without[3-6]. The most modifiable risk factor for developing MM is ongoing ultraviolet (UV) exposure[7]. Eliminating UV exposure *via* photoprotective practices is an important strategy for reducing MM risk in patients with AMS[8-10].

Through the implementation of a written survey, our aim for this study was to assess awareness, knowledge, and attitudes toward sun protection among patients with MM, those with AMS, and a control group who attended a specialist mole clinic at the dermatology department of a tertiary hospital in Greece.

MATERIALS AND METHODS

From January 2020 through December 2021, we administered a written survey to patients who attended a specialist mole clinic at the Dermatology Department of the University Hospital of Heraklion in Heraklion, Crete, Greece. Having approached 140 patients, we obtained consent from 121 patients (a response rate of 121/140 = 86.42%). The participants completed the surveys in person, and we included all the data in our analysis.

The specialist mole clinic at the Dermatology Department of the University Hospital of Heraklion is a dedicated clinic for patients at high risk of developing skin cancer, such as those who have a past medical history (PMH) of MM, non-melanoma skin cancer, or AMS or who have received immunosuppression (*e.g.*, transplant patients). All these patients undergo annual or biannual full skin checkups and receive photoprotection counselling.

The study was approved by the Ethics Committee of the University Hospital and all participants gave consent for inclusion in the study.

Survey contents

The written survey that we administered included basic demographic data, Fitzpatrick skin phototypes, medical histories, comorbidities, and collected information regarding awareness and knowledge of

Table 1 Demographic and clinical characteristics of 121 patients who were included in our study

	Patients with a PMH of MM, *n* = 26/121 (21.5%)	Patients with AMS, *n* = 47/121 (38.8%)	Control group, *n* = 48/121 (39.7%)	All participants, *n* = 121	*P* value
Mean age (± SD)	45.65 (± 12.61)	43.21 (± 12.61)	43.67 (± 12.65)	43.92 (± 12.55)	0.88
Gender, *n* (%)					0.39
Male	10/26 (38.5)	25/47 (53.2)	20/48 (41.7)	55/121 (45.5)	
Female	16/26 (61.5)	22/47 (46.8)	28/48 (58.3)	66/121 (54.5)	
Employment Status, *n* (%)					0.40
Student	2/26 (7.7)	3/47 (6.4)	2/48 (4.2)	7/121 (5.8)	
Employed	16/26 (61.5)	36/47 (76.6)	33/48 (68.8)	85/121 (70.2)	
Unemployed	2/26 (7.7)	4/47 (8.5)	7/48 (14.6)	13/121 (10.7)	
Retired	5/26 (19.2)	3/47 (6.4)	3/48 (6.3)	11/121 (9.1)	
Housewife	1/26 (3.8)	1/47 (2.1)	3/48 (6.3)	5/121 (4.1)	
Educational level, *n* (%)					0.61
Elementary school	9/26 (34.6)	1/47 (2.1)	3/48 (6.3)	4/121 (3.3)	
High school	0/26 (0)	20/47 (42.6)	21/48 (43.8)	50/121 (41.3)	
Technical studies	6/26 (23.1)	8/47 (17)	5/48 (10.4)	19/121 (15.7)	
University level	11/26 (42.3)	18/47 (38.3)	19/48 (39.6)	48/121 (39.7)	
Fitzpatrick skin phototype, *n* (%)					0.81
Skin type I (Always burns, does not tan)	0/26 (0)	2/47 (4.3)	2/48 (4.2)	4/121 (3.3)	
Skin type II (Burns easily, tans poorly)	10/26 (38.5)	14/47 (29.8)	15/48 (31.3)	39/121 (32.2)	
Skin type III (Tans after initial burn)	14/26 (53.8)	24/47 (51.1)	22/48 (45.8)	60/121 (49.6)	
Skin type IV (Burns minimally, tans easily)	2/26 (7.7)	7/47 (14.9)	9/48 (18.8)	18/121 (14.9)	
BMI (± SD)	25.07 (± 4.06)	26.92 (± 5.12)	25.58 (± 5.20)	25.99 (± 4.96)	0.281
Eye colour, *n* (%)					0.466
Dark	1/26 (3.8)	2/47 (4.3)	5/48 (10.4)	8/121 (6.6)	
Brown	16/26 (61.5)	31/47 (66)	31/48 (64.4)	78/121 (64.5)	
Blue	3/26 (11.5)	9/47 (19.1)	5/48 (10.4)	17/121 (14)	

Green	6/26 (23.1)	5/47 (10.6)	7/48 (14.6)	18/121 (18)	
Natural hair color, *n* (%)					0.649
Red	0/26 (0)	1/47 (2.1)	0/48 (0)	1/121 (0.8)	
Blond	5/26 (19.2)	6/47 (12.8)	8/48 (16.7)	19/121 (15.7)	
Brown	16/26 (61.5)	34/47 (72.3)	28/48 (58.3)	78/121 (64.5)	
Black	5/26 (19.2)	6/47 (12.8)	12/48 (25)	23/121 (19)	
Number of naevi, *n* (%)					0.000
< 25 naevi	9/26 (34.6)	0/47 (0)	23/48 (47.9)	32/121 (26.4)	
25-50 naevi	8/26 (30.8)	2/47 (4.3)	12/48 (25)	22/121 (18.2)	
50-100 naevi	3/26 (11.5)	11/47 (23.4)	7/48 (14.6)	21/121 (17.4)	
100 naevi	6/26 (23.1)	34/47 (72.3)	6/48 (12.5)	46/121 (38)	
Smoking status, *n* (%)					
Current smoker	8/26 (30.8)	15/47 (31.9)	9/48 (18.8)	32/121 (26.4)	0.198
No smoker	15/26 (57.7)	25/47 (53.2)	28/48 (58.3)	68/121 (56.2)	
Ex-smoker	3/26 (11.5)	7/47 (14.9)	11/48 (22.9)	21/121 (17.4)	
Sunburn before the age of 18, *n* (%)					0.000
No	9/26 (34.6)	30/47 (63.8)	40/48 (83.3)	79/121 (65.3)	
Yes	17/26 (65.4)	17/47 (36.2)	8/48 (16.7)	42/121 (34.7)	
Leisure sun exposure, *n* (%)					0.393
No	17/26 (65.4)	31/47 (66)	38/48 (79.2)	86/121 (71.1)	
Yes	9/26 (34.6)	16/47 (34)	10/48 (20.8)	35/121 (28.9)	
Occupational sun exposure, *n* (%)					0.35
No	19/26 (73.1)	27/47 (57.4)	30/48 (62.5)	76/121 (62.8)	
Yes	7/26 (26.9)	20/47 (42.6)	18/48 (37.5)	45/121 (37.2)	
Significant time spent outdoors, *n* (%)					0.356
No	11/26 (42.3)	24/47 (51.1)	28/48 (58.3)	63/121 (52.1)	
Yes	15/26 (57.7)	23/47 (48.9)	20/48 (42.7)	58/121 (47.9)	
Mean weeks of vacation spent before the age of 10 (± SD)	7.35 ± 5.61	6.87 ± 5	7.42 ± 4.36	7.19 ± 4.86	0.7444

Mean weeks of vacation spent before from the age of 11 till 18 (± SD)	6.12 ± 4.27	6.38 ± 4.44	6.94 ± 4.20	6.55 ± 4.29	0.740
Mean weeks of vacation spent after the age of 18 (± SD)	3.92 ± 2.1	4.02 ± 2.77	4.98 ± 4.35	4.39 ± 3.40	0.806

AMS: Atypical mole syndrome; PMH: Past medical history; MM: Malignant melanoma; SD: Standard deviation; BMI: Body mass index.

photoprotection measures and current sun-protective practices. The participants were asked to report any difficulties that discouraged them from practicing photoprotective measures. We administered the survey to patients after they received counseling on photoprotection from the dermatology outpatient mole clinic.

Statistical analysis

Descriptive statistics, ANOVA, Kruskal-Wallis test, *t* tests, and Pearson correlation tests were performed using SPSS version 25.0.

RESULTS

Demographic data

Of the 140 patients that we approached who attended the specialist mole clinic at the Dermatology Department of the University Hospital of Heraklion in Heraklion, Crete, Greece from January 2020 until December 2021, 121 consented to and participated in the study, making our response rate be 121/140. Their mean age was 43.92 ± 12.55 years. There were 66 (54.4%) females and 55 (45.4%) males. Forty-seven (38.8%) patients had AMS, 26 (21.5%) had a PMH of MM, and 48 (39.7%) attended the clinic for a full skin checkup for their naevi without having AMS or MM. The main demographic and clinical characteristics of these 121 patients are summarized in Table 1. There were no statistical differences among the three groups of patients for the following demographics and clinical characteristics: Age; gender; employment status; educational level; Fitzpatrick skin phototype; body mass index; eye and natural hair color; smoking status; leisure and occupational sun exposure; significant time spent outdoors; and mean weeks of vacation spent before the age of 10, from the ages of 11 to 18, and after the age of 18. There was a significant statistical difference among the three groups regarding history of sunburn before the age of 18 ($P < 0.001$). As expected, patients with a PMH of MM more frequently had a history of sunburn before the age of 18 than the group with AMS and the control group.

Photoprotective practices

Although 104 (86%) participants reported using sunscreen, with most of them (59/121 = 48.8%) reporting wearing sunscreen with a sun protection factor (SPF) of > 50, only 22 (18.2%) patients did so every day and only 20 (16.5%) did so all year round. Of all participants, 89 (73.6%) reported wearing sunscreen only during the summer and 94 (77.7%) only in direct sunny weather. Fifty-two patients reported reapplying sunscreen while outdoors and only a minority (37/121 = 30.58%) reported

Table 2 Sun protection practices in patients with malignant melanoma, those with atypical mole syndrome, and controls

	Patients with a PMH of MM, *n* = 26	Patients with AMS, *n* = 47	Control group, *n* = 48	All participants, *n* = 121	*P* value
Do you use sunscreen? *n* (%)					
No	5/26 (19.2)	7/47 (14.9)	5/48 (10.4)	17/121(14)	0.461
Yes	21/26 (80 .8)	40/47 (85.1)	43/48 (89.8)	104/121 (86)	
If yes, which SPF sunblock rating do you use? *n* (%)					
< 30	2/26 (7.7)	5/47 (10.6)	9/48 (18.8)	16/121 (13.2)	0.222
≥ 30	7/26 (26.9)	10/47 (21.3)	14/48 (29.2)	31/121 (25.6)	
≥ 50	12/26 (46.2)	25/47 (53.2)	20/48 (41.7)	57/121 (47.1)	
No sunscreen use	5/26 (19.2)	7/47 (14.9)	5/48 (10.4)	17/121 (14)	
How frequently do you use sunscreen? *n* (%)					
Everyday	5/26 (19.2)	6/47 (12.8)	11/48 (22.9)	22/121 (18.2)	0.663
Most days	4/26 (15.4)	13/47 (27.7)	10/48 (20.8)	27/121 (22.3)	
Occasionally	11/26 (42.3)	18/47 (38.3)	18/48 (37.5)	47/121 (38.8)	
Rarely	1/26 (3.8)	3/47 (6.4)	4/48 (8.3)	8/121 (6.6)	
No sunscreen use	5/26 (19.2)	7/47 (14.9)	5/48 (10.4)	17/121 (14)	
During which seasons do you apply sunscreen? *n* (%)					
Only during the summer	17/26 (65.4)	37/47 (78.7)	30/48 (62.5)	84/121 (69.4)	0.353
All year-round	4/26 (15.4)	3/47 (6.4)	13/48 (27.1)	20/121 (16.5)	
No sunscreen use	5/26 (19.2)	7/47 (14.9)	5/48 (10.4)	17/121 (14)	
In which of the following weather conditions do you apply sunscreen? *n* (%)					
Only in direct sunny weather	17/26 (65.4)	38/47 (80.9)	34/48 (70.8)	89/121 (73.6)	0.606
Both sunny and cloudy weather	4/26 (15.4)	2/47 (4.3)	9/48 (18.8)	15/121 (12.4)	
No sunscreen use	5/26 (19.2)	7/47 (14.9)	5/48 (10.4)	17/121 (14)	
While outdoors, do you reapply sunscreen? *n* (%)					
No	16/26 (61.5)	21/47 (44.7)	33/48 (68.8)	70/121 (57.9)	0.31
Yes	10/26 (38.5)	26/47 (55.3)	15/48 (31.3)	51/121 (42.1)	
Do you reapply sunscreen after swimming or perspiring heavily? *n* (%)					
No	14/26 (53.8)	20/47 (42.6)	28/48 (58.3)	62/121 (51.2)	0.139
Yes	12/26 (46.2)	27/47 (57.4)	20/48 (41.7)	59/121 (48.8)	
Wearing UV-protective sunglasses, *n* (%)					
Everyday	13/26 (50)	21/47 (44.7)	12/48 (25)	46/121 (38)	0.303
Most days	5/26 (19.2)	10/47 (21.3)	16/48 (33.3)	31/121 (25.6)	
Occasionally	2/26 (7.7)	7/47 (14.9)	13/48 (27.1)	22/121 (18.2)	
Rarely	1/26 (3.8)	4/47 (8.5)	4/48 (8.3)	9/121 (7.4)	
Never	5/26 (19.2)	5/47 (10.6)	3/48 (6.3)	13/121 (10.7)	
Wearing a broad-brimmed hat, *n* (%)					
Everyday	5/26 (19.2)	3/47 (6.4)	3/48 (6.3)	11/121 (9.1)	0.535
Most days	1/26 (3.8)	6/47 (12.8)	6/48 (12.5)	13/121 (10.7)	
Occasionally	6/26 (23.1)	14/47 (29.8)	13/48 (27.1)	33/121 (27.3)	
Rarely	7/26 (26.9)	13/47 (27.7)	6/48 (12.5)	26/121 (21.5)	

Never	7/26 (26.9)	11/47 (23.4)	20/48 (41.7)	38/121 (31.4)	
Wearing long-sleeved shirts or long plants made from tight fabric weave, *n* (%)					
Everyday	1/26 (3.8)	2/47 (4.3)	1/48 (2.1)	4/121 (3.3)	0.275
Most days	4/26 (15.4)	11/47 (23.4)	9/48 (18.8)	24/121 (19.8)	
Occasionally	7/26 (26.9)	13/47 (27.7)	16/48 (33.3)	36/121 (29.8)	
Rarely	5/26 (19.2)	11/47 (23.4)	12/48 (25)	28/121 (23.1)	
Never	9/26 (34.6)	10/47 (21.3)	10/48 (20.8)	29/121 (24)	
Avoiding the sun during hours of peak sunlight intensity (10:00 am to 16:00 pm), *n* (%)					
Everyday	8/26 (30.8)	9/47 (19.1)	5/48 (10.4)	22/121 (18.2)	0.492
Most days	10/26 (38.5)	20/47 (42.6)	26/48 (54.2)	56/121 (46.3)	
Occasionally	4/26 (15.4)	11/47 (23.4)	13/48 (27.1)	28/121 (23.1)	
Rarely	4/26 (15.4)	5/47 (10.6)	0/48 (0)	9/121 (7.4)	
Never	0/26 (0)	2/47 (4.3)	4/48 (8.3)	6/121 (5)	

PMH: Past medical history; MM: Malignant melanoma; AMS: Atypical mole syndrome; UV: Ultraviolet.

reapplying sunscreen after swimming or perspiring. Photoprotective practices are summarized in Table 2.

Forty-six (46/121 = 38%) patients reported daily use of UV sunglasses. There was a tendency of more frequent daily use of sunglasses in the MM and AMS groups in contrast to the control group, but this was not statistically significant (P = 0.303). Eleven (9.1%) and four (3.3%) patients reported daily use of broad-brimmed hats and long-sleeved shirts, respectively, with no significant difference among the three groups. Only a minority of patients (22/121 = 18.2%) avoided the sun daily during peak hours of sunlight intensity.

Photoprotection education and perceived barriers

Most of the patients, 90/121 (74.4%), had been given advice on how to protect their skin from sunlight, with 86/121 (71.1%) receiving that advice from their family doctor. Photoprotection education is summarized in Table 3.

One third of patients (45/121 = 37%) were given sun protection education from a health-care professional more than three times; half of them (63/121 = 52.1%) were educated from multimedia sources; and most of them (104/121 = 86%) were given written photoprotective advice.

Most of the patients (88/121 = 73%) were interested in receiving education. Eighty-eight patients (72.7%) were interested in receiving sun protection advice from a health-care worker and 74 (61.2%) were interested in receiving photoprotection advice from multimedia sources.

Half of the patients (63/121 = 52.1%) had encountered barriers that discouraged them from practicing sun protection. These barriers are summarized in Table 4. A quarter of them (27/121 = 22.3%) claimed that they did not have time to practice photoprotection measures. Concerns over adequate vitamin D levels and financial concerns were reported by 28.9% and 15.7%, respectively. Only a minority reported appearance concerns (4.1%), difficulty in obtaining materials (5.8%), or previous unpleasant experiences with and bad reactions to sunscreen (7% and 0.8%, respectively). There was no statistical difference among the three groups in our study.

DISCUSSION

To the best of our knowledge, we have here presented the first study of its kind describing demographic and clinical characteristics and assessing awareness, knowledge, attitudes, and barriers toward photoprotective practices among patients with MM and AMS and a control group. We conducted our study in the city of Heraklion, Crete, Greece, which has a very high UV index and a significantly homogeneous population. Limitations of our study include the small sample of patients and the single-center location.

Our evidence indicates that adapting effective photoprotective practices, such as the daily use of high SPF sunblock, wearing a broad-brimmed hat and a long-sleeved shirt, and avoiding sun exposure between the peak hours of 10:00 a.m. to 4:00 p.m. protect against the development of skin cancer[8-12]. Therefore, assessing photoprotective education and attitudes and providing sun protection education

Table 3 Sun protection education in patients with malignant melanoma, those with atypical mole syndrome, and controls

	Patients with a PMH of MM, *n* = 26	Patients with AMS, *n* = 47	Control group, *n* = 48	All participants, *n* = 121	*P* value
Have you ever been given advice on how to protect your skin from sunlight? *n* (%)					
No	6/26 (23.1)	9/47 (19.1)	16/48 (33.3)	31/121 (25.6)	0.59
Yes	20/26 (76.9)	38/47 (80.9)	32/48 (66.7)	90/121 (74.4)	
Have you ever received sun protection education from a family doctor? *n* (%)					
No	6/26 (23.1)	11/47 (23.4)	18/48 (37.5)	35/121 (28.9)	0.109
Yes	20/26 (76.9)	36/47 (76.6)	30/48 (62.5)	86/121 (71.1)	
On how many occasions have you received sun protection education from a healthcare professional? *n* (%)					
Never	5/26 (19.2)	10/47 (21.3)	14/48 (29.2)	29/121 (24)	0.316
Once	4/26 (15.4)	5/47 (10.6)	6/48 (12.5)	15/121 (12.5)	
Twice	3/26 (11.5)	6/47 (12.8)	8/48 (16.7)	17/121 (14)	
3 times	4/26 (15.4)	5/47 (10.6)	6/48 (12.5)	15/121 (12.5)	
3 times	10/26 (38.5)	21/47 (44.7)	14/48 (29.2)	45/121 (37)	
Have you ever received sun protection education from Media (*i.e.*, television, newspaper)? *n* (%)					
No	11/26 (42.3)	22/47 (46.8)	25/48 (52.1)	58/121 (47.9)	0.546
Yes	15/26 (57.57)	25/47 (53.2)	23/48 (47.9)	63/121 (52.1)	
Have you ever received written advice about sun protection? *n* (%)					
No	21/26 (80.8)	38/47 (80.9)	45/48 (93.8)	17/121 (14)	0.055
Yes	5/26 (19.2)	9/47 (19.1)	3/48 (6.3)	104/121 (86)	
Would you be interested in receiving education about sun protection? *n* (%)					
No	4/26 (15.4)	12/47 (25.5)	17/48 (35.4)	33/121 (27)	0.619
Yes	22/26 (84.6)	35/47 (74.5)	31/48 (64.6)	88/121 (73)	
Would you be interested in receiving photoprotection advice about sun protection from a healthcare worker? *n* (%)					
No	4/26 (15.4)	16/47 (34)	17/48 (35.4)	33/121 (27.3)	0.154
Yes	22/26 (84.6)	31/47 (66)	31/48 (64.6)	88/121 (72.7)	
Would you be interested in receiving photoprotection advice about sun protection from multimedia? *n* (%)					
No	11/26 (42.3)	16/41 (34)	20/48 (41.7)	47/121 (36.8)	0.693
Yes	15/26 (57.7)	31/41 (66)	28/48 (58.3)	74/121 (61.2)	

PMH: Past medical history; MM: Malignant melanoma; AMS: Atypical mole syndrome.

are both important and effective in preventing skin cancer, especially in areas with high UV indexes such as Crete, Greece.

Our survey highlighted that although most of the patients used sunscreen (104/121 = 86%), and half of them (57/121 = 47.1%) used sunscreen with an SPF of > 50, only a small proportion of them (22/121 = 18.2%) applied it daily, and the majority (84/121 = 69.4%) applied it only during the summer. Many participants reported never having worn a broad-brimmed hat (38/121 = 31.4%), a long-sleeved shirt, or long pants (29/121 = 24%) to protect themselves from sunlight. There was no statistical difference among the three groups regarding sun protection practices.

Most of the patients (90/121 = 74.4%) recalled having received advice on how to protect their skin from sunlight. This shows high recall of receiving photoprotective education (this number has varied

Table 4 Perceived barriers to implementation of photoprotection practices in patients with malignant melanoma, those with atypical mole syndrome, and controls

	Patients with a PMH of MM, *n* = 26	Patients with AMS, *n* = 47	Control group, *n* = 48	All participants, *n* = 121	*P* value
Have any of the following barriers discouraged you from practicing sun protection? *n* (%)					
No	7/26 (26.9%)	27/47 (57.4%)	24/48 (50%)	58/121 (47.9%)	0.656
Yes	19/26 (73.1%)	20/47 (42.6%)	24/48 (50%)	63/121 (52.1%)	
Skepticism ("I do not believe skin cancer is a serious health threat"), *n* (%)					
No	22/26 (84.6%)	43/47 (91.5%)	45/48 (93.8%)	110/121 (90.9%)	0568
Yes	4/26 (15.4%)	4/47 (8.5%)	3/48 (6.3%)	11/121 (9.1%)	
Hassle/lack of time, *n* (%)					
No	21/26 (80.8%)	35/47 (74.5%)	38/48 (79.2%)	94/121 (77.7%)	0.639
Yes	5/26 (19.2%)	12/47 (25.5%)	10/48 (20.8%)	27/121 (22.3%)	
Concerns over adequate Vitamin D, *n* (%)					
No	20/26 (76.9%)	34/47 (72.3%)	32/48 (66.7%)	86/121 (71.1%)	0.486
Yes	6/26 (23.1%)	13/47 (27.7%)	16/48 (33.3%)	35/121 (28.9%)	
Cost/financial concerns. *n* (%)					
No	25/26 (96.2%)	38/47 (80.9%)	39/48 (81.3%)	102/121 (84.3%)	0.810
Yes	1/26 (3.8%)	9/47 (19.1%)	9/48 (18.8%)	19/121 (15.7%)	
Appearance ("I do not like how using sun protection will make me look"), *n* (%)					
No	24/26 (92.3%)	44/47 (93.6%)	48/48 (100%)	116/121 (95.9%)	0.090
Yes	2/26 (7.7%)	3/47 (6.4%)	0/48 (0%)	5/121 (4.1%)	
Difficulty obtaining materials (sunscreen, sunglasses, hats, *etc*), *n* (%)					
No	25/26 (96.2%)	44/47 (93.6%)		114/121 (94.2%)	0.962
Yes	1/26 (3.8%)	3/47 (6.4%)		7/121 (5.8%)	
Sunscreen is uncomfortable or unpleasant, *n* (%)					
No	22/26 (84.6%)	43/48 (91.5%)	47/48 (97.9%)	112/121 (93%)	0.149
Yes	4/26 (15.4%)	4/48 (8.5%)	1/48 (2.1%)	9/121 (7%)	
Previous "bad" reaction to sunscreen (please specify), *n* (%)					
No	25/26 (96.2%)	47/47 (100%)	48/48 (100%)	120/121 (99.2%)	0.765
Yes	1/26 (3.8%)	0/47 (0%)	0/48 (0%)	1/121 (0.8%)	
None/no barriers have discouraged me, *n* (%)					
No	14/26 (53.8%)	21/121 (44.7%)	23/48 (47.9%)	58/121 (47.9%)	0.840
Yes	12/26 (46.2%)	26/121 (55.3%)	25/48 (52.1%	63/121 (52.1%)	

PMH: Past medical history; MM: Malignant melanoma; AMS: Atypical mole syndrome.

from 27.5% to 96% in previous papers). Our survey highlights that, despite recalling having received adequate photoprotection education, the implementation of sun protective practices in all the three groups remained suboptimal. Our study showed that adherence to photoprotective practices did not correlate with education level. Previous studies have documented that a lack of post-secondary education was correlated with a reduced adoption of sun protective behaviors[13-18].

Several barriers regarding photoprotection have been reported in the literature. In our cohort, the three most-cited barriers were "concerns over adequate vitamin D" (35/121 = 28.9%), "hassle/lack of

time" (27/121 = 22.3%), and "cost/financial concerns" (19/121 = 15.7%). Only the barrier "lack of time" was consistent with previous studies[19-23].

We also found that 72.7% of the subjects expressed interest in receiving photoprotection advice from a health-care worker and 61.2% from multimedia sources. This indicates that patients might prefer receiving verbal advice from a health-care professional, and that electronic devices might also play a crucial role in relevant education[24-27]. However, the use of multimedia methods in educating people on photoprotective practices may be inefficient for older patients.

Our study has both strengths and limitations. A dermatologist assessed all participants, and the questionnaire was not only self-reported but also the patient and the dermatologist completed the questionnaire together at the same time. The dermatologist, who examined the patient, gave more accurate data. Furthermore, the design of our study involves consecutive patients who were recruited during a specific timeline. Limitations include the small sample of patients and the single-center hospital-based nature of the study. We recruited patients and controls consecutively from a tertiary referral mole clinic who were dermatology department patients. These patients might be more motivated toward skin cancer prevention knowledge and photoprotection measures, which may limit the generalizability of our results.

CONCLUSION

Considerable efforts should be made to raise awareness regarding photoprotection practices with the aim to prevent skin cancer in patients with MM and AMS.

ARTICLE HIGHLIGHTS

Research background

Patients with atypical mole syndrome (AMS) have a 3- to 20-fold higher risk of developing malignant melanoma (MM) than individuals without.

Research motivation

The most modifiable risk factor for developing MM is the ongoing ultraviolet exposure.

Research objectives

To assess awareness, knowledge, and attitudes towards sun protection among patients with MM and AMS.

Research methods

A written survey was administered to patients with MM, those with AMS, and a control group who attended a specialist mole clinic in Heraklion in Greece.

Research results

In total 121 subjects participated in the study. Their mean age was 43.92 ± 12.55 years. There were 66 (54.4%) females and 55 (45.4%) males. Forty-seven (38.8%) patients had AMS, 26 (21.5%) had a past medical history (PMH) of MM, and 48 (39.7%) attended the clinic for a full skin checkup for their naevi without having AMS or MM. 104 (86%) participants reported using sunscreen. Approximately 74.4% of patients recalled having received advice on how to protect their skin from sunlight. The most mentioned barriers in photoprotection were concerns over adequate vitamin D and lack of time.

Research conclusions

Despite mentioning having received adequate education in photoprotection, adherence to photoprotection practices is suboptimal in patients with MM and AMS.

Research perspectives

Larger prospective studies could be performed comparing awareness, knowledge, and attitudes towards photoprotection among patients with MM and AMS before and after receiving education in photoprotection.

FOOTNOTES

Author contributions: Koumaki D, Papadakis M, and Krasagakis K contributed to designing the study; Koumaki D

contributed to collecting and analyzing the data, and writing the paper; Papadakis M contributed to analyzing the data; Kouloumvakou S contributed to collecting the data; Koumaki D, Papadakis M, and Krasagakis K contributed to revising and approving the paper.

Institutional review board statement: The study was approved by the institutional review board of the University Hospital of Heraklion, Greece.

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