

Unusual allergic contact dermatitis produced by a transcutaneous electrical nerve stimulator

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M. Llamas, D. Santiago, R. Navarro,
J. Sánchez-Pérez and A. García-Díez

Dermatology Department, Hospital
Universitario de La Princesa, Madrid, Spain

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Transcutaneous electrical nerve stimulators (TENS) are portable devices that transmit low-voltage electrical stimuli through several electrodes attached to the skin by various adhesives. Continuous use is indicated to alleviate chronic pain. Dermatitis related to TENS devices is reported, mostly irritant contact and allergic contact dermatitis (ACD) related to electrode components, such as TENS gel, rubber, or conducting metal (1–3).

We present a case of ACD related to several (meth)acrylates in an adhesive TENS gel, as well as to an α -hydroxyketone (Irgacure® 2959) used as an acrylate polymerization photoinitiator.

Case Report

For 5 months, a 42-year-old woman used TENS (Lifecare®, Tiberias, Israel) for chronic lower back pain resistant to medical treatment. She started using TENS for 2 hr initially, and progressively increased the

application time until reaching 10 hr continuously a month later. After 4 months of continuous usage of the TENS device she noted itchy erythematous papules and scaling where she applied the TENS electrodes. These lesions completely disappeared in 2 weeks when stopped using TENS and taken oral corticosteroids.

She was patch tested with Spanish baseline series and rubber series (Chemotechnique Diagnostics®, Vellinge, Sweden) with positive results at D2 and at D4 to nickel (++) . A use test on her lower back with the TENS device 'as is' for few hours produced an eczematous reaction after 1 day. Some time later, she was patch tested with (meth)acrylates series (Chemotechnique Diagnostics®, Vellinge, Sweden) and TENS components, supplied by Telic S.A. These supplementary series and substances were applied using Finn Chamber® (Epitest Ltd Oy, Tuusula, Finland) fixed with Scanpor tape® (Alpharma AS, Vennesla, Norway). At D2, there were positive reactions to 2-hydroxyethyl methacrylate (2-HEMA) 2% pet. (++), 2-hydroxypropyl methacrylate (2-HPMA) 2% pet. (++), ethylene glycol dimethacrylate (EGDMA) 2% pet. (++), 1,6-hexanediol diacrylate (HDDA) 0.1% pet. (+), her own self-adhesive TENS electrodes 'as is' (++), another self-adhesive electrode (++), 4-(2-hydroxyethoxy)-phenyl-(2-hydroxy2-methylpropyl) ketone 1% pet. (++), and, at D4, the same results were seen as well as HDDA 0.1% pet. (++). Patch testing with 4-(2-hydroxyethoxy)-phenyl-(2-hydroxy2-methylpropyl) ketone 1% pet. in 20 controls was negative.

Discussion

The case presented above is of an iatrogenic ACD caused by direct contact with EGDMA and 4-(2-hydroxyethoxy)-phenyl-(2-hydroxy2-methylpropyl) ketone contained in the self-adhesive electrodes of TENS.

Multiple sensitizations, such as in this case, are frequently reported. EGDMA can be metabolized in the skin to 2-HEMA, making it difficult to determine whether contact sensitization to different methacrylates is concomitant, a cross-reaction or even a reaction to impurities in preparations (4, 5).

A literature review found three reported cases of ACD to (meth)acrylates used as an adhesive in TENS (6, 7). Patch testing results of those cases, as

Table 1. Our case and the other published ACD cases related with acrylates contained in TENS devices

Author	Sex/age (years)	Location	Period of use (months)	Continuous use period (hr)	Symptom latency (months)	Patch testing positivities (PPR)	D2	D4
Marren (6)	♀/35	Low back	18	16	9	TENS ^a 2-HEMA 2% pet. 2-HPMA 2% pet. EGDMA 2% pet.	+? +? + ++ ++ ++ ++ ++ ++	+? +? +
Weber-Muller (7)	♂/50	Low back	21	NR	21	TENS ^a (inner) TENS ^a (outer) TENS gel EGDMA 2% pet.	+ + + + + + + + + - - -	+ + + + + + + + + - - -
Weber-Muller (7)	♂/54	Right thigh	2	NR	2	Ethyl acrylate 0.1% pet. 2-HEA 0.1% pet. TREGDMA 0.1% pet. 2-HEMA 2% pet. 2-HPMA 2% pet.	- - - + + + +/- + +/- + +/- +	+ + + + + + + + + + + + + + +
Llamas	♀/42	Low back	5	10	4	TENS ^a (inner) TENS gel 2-HEMA 2% pet. 2-HPMA 2% pet. EGDMA 2% pet. Irgacure 1% pet. HDDA 0.1% pet	++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ + + +	++ ++

PPR, present positive relevance; 2-HEMA, 2-hydroxyethyl methacrylate; 2-HPMA, 2-hydroxypropyl methacrylate; 2-HEA, 2-hydroxyethyl acrylate; EGDMA, ethylene glycol dimethacrylate; TREGDMA, triethyleneglycol dimethacrylate; HDDA, 1,6-hexanediol diacrylate; pet., petrolatum; NR, non-reported; ACD, allergic contact dermatitis; TENS, transcutaneous electrical nerve stimulators.

^aSelf-adhesive electrodes of TENS.

well as period of use, can be seen in Table 1.

4-(2-Hydroxyethoxy)-phenyl-(2-hydroxy-2-methylpropyl) ketone (CAS No. 106797-53-9; Irgacure 2959[®]) is an α -hydroxyketone that is a highly effective photoinitiator capable of initiating acrylate polymerization when exposed to ultraviolet light. As specified in the material safety data sheet, it is a low-toxicity product, slightly irritating without any evidence of sensitization capacity in guinea pigs. In our patient, 4-(2-hydroxyethoxy)-phenyl-(2-hydroxy-2-methylpropyl) ketone positive patch test was interpreted as an allergy as all the controls were negative. Moreover, we have not found any case of ACD related to 4-(2-hydroxyethoxy)-phenyl-(2-hydroxy-2-methylpropyl) ketone either alone or associated with acrylates.

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Address:
Mar Llamas Velasco
Department of Dermatology
Hospital Universitario de La Princesa
C/Diego de León 62
28006 Madrid
Spain
Tel: +34 915202433
Fax: +34 915202435
e-mail: mar.llamasvelasco@gmail.com