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Hearing aid materials can occasionally cause allergic contact dermatitis, and the cause of this may not be adequately investigated (1). Allergic contact dermatitis is most commonly caused by 'in-the-ear' hearing aids but can also be caused by other types of hearing aids such as those mounted on spectacles (2) and 'behind-the-ear' models with ear moulds. Surgically fitted hearing devices (bone-anchored hearing aids and cochlear implants) may also cause skin reactions, but the incidence seems to be low (3). A positive patch test has been reported with the 30 density liquid silicone rubber present in the Medel (Durham, North Carolina, USA) nuclear contour-24 cochlear implant but negative with that present in the Advanced Bionic (Bollate - Milano, Italy) device (4).

Allergic contact dermatitis to bilateral in-the-ear hearing aids was first reported in 1978 when patch tests demonstrated that methyl methacrylate monomer was the cause of the dermatitis localized both in the external auditory canals and on the external ears of the patient (5). After topical drugs, the most common sensitizing agents to cause otitis externa have been the chemicals and resins in ear prostheses (6, 7). Our review of the literature shows that acrylates are the most common cause of such reactions (Table 1); contact allergy may occur only after prolonged use of devices. An acrylates' patch test series relevant to hearing aid materials was devised on the basis of results published by Kanerva et al. (8) and by the International Contact Dermatitis Research Group (9) (Table 2).

Allergic contact dermatitis to hearing aids: literature and case reports

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Case Report 1

A 68-year-old woman began to suffer from an exudative otitis externa after having worn a methyl methacrylate in-the-ear hearing aid (Starkey, Cernusco sul Naviglio - Milano, Italy) for 18 months. She underwent baseline patch testing (Italian Society of Allergological, Occupational and Environmental Dermatology – SIDAPA series applied in Finn Chambers[®], 2-day occlusion) and further tests with the specific allergens in Table 2. The tests were positive (++) only for methyl

Table 1. Published reports on allergic contact dermatitis from hearing aids and responsible allergens

Authors	Allergens	Number of Patients
Puri et al. (4)	30 Density liquid silicone rubber	1
Sood and Taylor (10)	Polyethylene glycol dimethacrylate and 2-hydroxyethyl methacrylate	1
O'Donoghue et al. (13)	Gold	1
Shaw (14)	Benzyl alcohol	1
Shono and Kaniwa (15)	Solvent orange 60 (perinone-type plastic dye; CAS 61969-47-9)	1
Lear et al. (12)	Parabens, fragrances, and formaldehyde	3
Matrolonardo et al. (16)	<i>p</i> -Tertiary butyl phenol formaldehyde resin	1
Koefoed-Nielsen and Pederson (17)	Methyl methacrylate monomer	4
Meding and Ringdahl (11)	Methacrylates (methyl methacrylate monomer, triethylene glycol dimethacrylate, and urethane dimethacrylate)	6
Oliwiecki et al. (18)	Ethyl phthalate	1
Dutree-Meulen et al. (19)	Urethane acrylates	1
Cockerill (20)	Methyl methacrylate monomer, polyvinyl chloride, and vulcanite ^a	17
Marshall et al. (5)	Methyl methacrylate monomer	1

^aA mineral used in very old hearing aid devices.

Table 2. Acrylates' patch test series

Compound	Vehicle	Concentration (%)	CAS
Acrylic acid	pet.	1	79-10-7
Methacrylic acid	pet.	2	79-41-4
Ethyl acrylate	pet.	2	140-88-5
Acrylonitrile	pet.	2	107-13-1
Ethylene glycol dimethacrylate	pet.	2	97-90-5
Ethyl methacrylate monomer	pet.	2	97-63-2
2-Hydroxyethyl methacrylate	pet.	2	868-77-9
Methyl methacrylate monomer	pet.	2	80-62-6
Polymeric methyl methacrylate	pet.	2	9011-14-7
Triethylene glycol dimethacrylate	pet.	2	109-16-0

CAS, Chemical Abstract Service number; pet. petrolatum.

methacrylate monomer on D2, D4, and D7. Reactions were scored according to the International Contact Dermatitis Research Group guidelines (9).

The dermatitis improved when she began to wear the same in-the ear hearing aid with new surrounds. As Marshall et al. (5) have already reported, with heat curing of the surrounds, there is increased polymerization of the resin with consequent reduction of allergen exposure.

Case Report 2

A 12-year-old girl developed acute bilateral otitis externa 2 years after she had been wearing a behind-the-ear hearing aid (Phonak, Milano, Italy). We suspected an allergic reaction to hearing aid materials, but her parents refused diagnostic patch tests. Instead, silicone moulds were fitted to the original hearing aid. This caused partial improvement, leaving only severe itching limited to the contact area. It is unknown whether the acute dermatitis was caused by contact allergy or an irritant effect.

Discussion

As a silicone ear mould with a behind-the-ear hearing aid may improve the problem as in our second case report, some patients are advised to try different devices made of different materials without the dermatitis being formally investigated. Patients with hearing aid-associated dermatitis should undergo patch testing (10, 11). As reported by Lear et al. (12), dermatitis can be caused by an irritant effect exacerbated by occlusion of the external auditory canal or may be a localized form of seborrhoeic dermatitis. According to the literature (Table 1), it may be necessary to test a wide spectrum of potential allergens present in plastics/glues when the specific hearing aid components are unknown.

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