

# Managing Allergic Nickel Dermatitis in Occupational Settings: A Case Report

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## SUMMARY

*Contact dermatitis is a common cutaneous inflammatory condition triggered by exposure to irritant substances or allergens. Nickel is the most prevalent allergen, a metal widely used in accessories, furniture, office materials, and the food industry, with multiple exposure pathways, making it difficult to assess which exposure is causing allergic dermatitis. Here, we report a case of an administrative worker with chronic hand eczema, limited to the radial meta-carpophalangeal region of the left hand, caused by occupational exposure to nickel, confirmed by nickel deposition test on the hand and a positive test with a metallic stapler used at her workplace.*

## 1. INTRODUCTION

Allergic contact dermatitis (ACD) is a common inflammatory skin condition triggered by exposure to specific allergenic substances. It is also the most common cause of occupational dermatitis [1, 2]. Nickel stands out as one of the most prevalent allergens, both in occupational and non-occupational settings [3, 4].

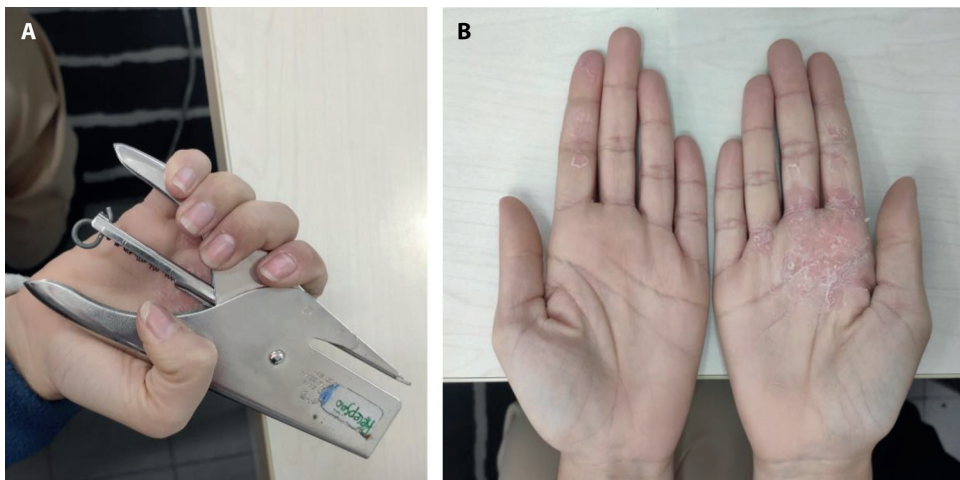
The widespread use of this metal in a vast array of consumer products, ranging from jewelry, clothing, electronic devices, food, medical devices, and industrial components, significantly increases the risk of exposure, sensitization, and development of these dermatoses, making the interpretation and identification of the underlying cause of the allergic reaction challenging at the time of patient observation [1, 4]. Thus, repeated and prolonged exposure

to nickel can elicit an immune hypersensitivity response in susceptible individuals, resulting in a variety of clinical manifestations ranging from mild itching to severe and debilitating eczematous skin lesions, underscoring the importance of being vigilant in these situations, striving to minimize their consequences as much as possible [1, 3].

In this case report, we present a 31-year-old administrative worker diagnosed with allergic nickel contact dermatitis confirmed by a nickel deposition test on the hand. We describe the limitations and workplace changes needed to ensure a safe and healthy working environment for that employee.

## 2. CASE REPORT

A 31-year-old female administrative worker, who has been working for 10 years, presented at



**Figure 1.** (a) Stapler manipulation; (b) Pronounced eczematous lesion in the left radial metacarpophalangeal region, coinciding with stapler use.

the dermatology clinic with contact dermatitis, in January 2024. Symptoms began in 2014, when patient started her current and only job, as an administrative worker, and have been exacerbating since 2017. The eczema started on the left palm and spread to both hands since the onset of exacerbations in 2017, but always with more pronounced symptoms on the left palm. On physical examination we identified chronic vesicular eczema on the palms of both hands, more pronounced in the radial metacarpophalangeal region of the left hand. The patient reports no history of allergic reactions to jewels. The patient also denies a history of atopy, and is unaware of triggering factors, but reports improvement of eczema during vacations and absence from work. Patch testing was performed, including the Standard series from the Portuguese Group for Contact Dermatitis Studies, applied using a 2-day occlusion and IQ Ultra Chambers (Chemotechnique Diagnostics™) on the dorsal region according to European Society of Contact Dermatitis recommendations [5]. The results were read on days (D) 2, D4, and D7, revealing positivity for nickel sulfate (+++).

A workplace visit was conducted, and a dimethylglyoxime (DMG) test for nickel presence was performed on occupationally used products. The DMG test confirmed positivity in the stapler, which coincides geographically with the delineation of the lesion in the metacarpophalangeal region of the left

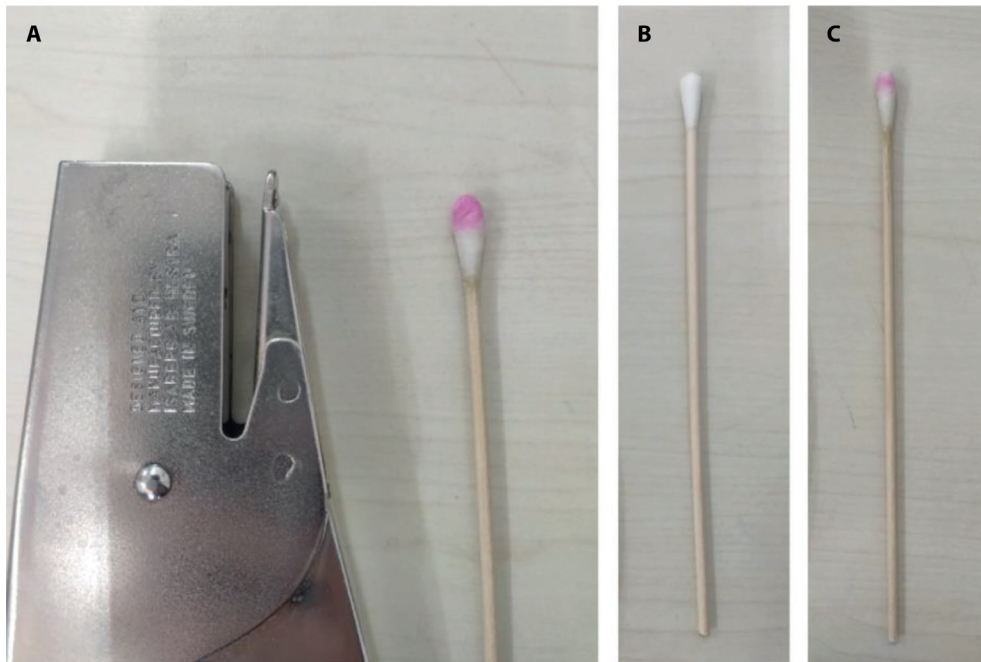
hand in Figure 1. Since starting her job as an administrative worker, she has frequently used a stapler, about 8-10 times per hour.

Nickel presence was tested in the worker's hand lesions using previously published methodologies, as described by Julander et al and Wennervaldt et al [6, 7], at the beginning of the workday and after a 4-hour shift, showing positivity at the end of the shift [6-9] in Figure 2. In this regard, a recommendation was made for her workplace to avoid contact with the metal stapler and switch to a stapler with a plastic coating. Additionally, the patient was advised to avoid contact with jewelry containing nickel, a precaution she was already following.

Actively avoiding the known sources of nickel exposure in her occupation resulted in a notable improvement of her hand eczema, verified at the follow-up appointment after 4 weeks. On physical examination, no eczema was observed. An occupational disease notification was made to the Portuguese Department of Protection against Occupational Risks, and regular follow-up by her occupational physician was requested after 8 weeks.

### 3. DISCUSSION

Nickel is the most common cause of allergic contact dermatitis, predominantly affecting females. It is largely due to early contact with jewelry and



**Figure 2.** (a) Positive DMG test of stapler.; (b) Negative DMG test of hand lesions before work activity; (c) Positive DMG test of hand lesions after a 4-hour shift of stapler manipulation.

clothing incorporating this metal into their composition or other skin contacts with nickel-containing objects. However, occupational exposure should not be overlooked, as it is common in the construction, service, and healthcare sectors [3, 10, 11]. Indeed, allergic contact dermatitis to nickel is one of the most common occupational dermatoses, affecting workers from various fields due to continuous exposure to this allergenic agent in the workplace environment, as it is a metal frequently found in industrial and occupational use products [2, 4, 11].

In the working environment, repetitive exposure to nickel agents can lead to its deposition on the skin, potentially resulting in chronic eczema and allergic contact dermatitis [3, 12]. According to some published studies, the prevalence of occupational dermatitis due to nickel can reach up to 12% of the total number of occupational contact dermatitis [13]. Other studies have found significant associations between nickel allergy and occupational exposure, namely metal/mechanical work among women and agriculture and health care services among men [11]. In this study, we present the case of a worker

diagnosed with nickel contact dermatitis, whose symptoms manifested and worsened in the occupational context.

Hand DMG testing has proven to be an efficient method for detecting nickel exposure, making it an option in suspected cases of contact dermatitis, particularly in the occupational setting [7-10]. The applied methodology should be as follows: before a regular workday, the patient's hands are thoroughly cleaned with water and soap, wiped with 1% nitric acid, and washed with deionized water. The patient is instructed to avoid hand washing during work hours. After a work shift, the patient's hands are tested with the DMG test using a swab soaked with the DMG solution and applied to the patient's hands. Finally, the hands are washed thoroughly after the examination [6, 7]. However, hand DMG testing has proven to be an efficient method; we must emphasize the importance of detailed clinical history and patch tests as an initial element in the diagnostic course of these contact dermatitis [1]. A positive DGM test indicates accumulation of  $>0.13 \mu\text{g nickel/cm}^2$ , and probably relevant

occupational nickel exposure, however a negative test does not definitively exclude occupational exposure [4, 6, 10].

This case illustrates not only the clinical relevance of allergic contact dermatitis to nickel but also underscores the importance of providing careful information to workers about potential sources of nickel exposure, as well as prevention strategies to minimize the impact of this condition on their quality of life.

Therefore, the importance of workplace visits is emphasized for the early identification of triggering factors and implementation of preventive measures. Furthermore, this article emphasizes the ongoing need for research and development of diagnostic and therapeutic approaches to improve clinical outcomes and minimize the repercussions related to nickel exposure on the quality of life of the most susceptible workers.

#### 4. CONCLUSION

In our case, hand DMG testing has proven to be an efficient method for detecting nickel exposure in occupational nickel contact dermatitis.

This clinical case aims to increase awareness of the occupational risks associated with nickel exposure and underscore the importance of carefully evaluating work history in patients with allergic contact dermatitis. A detailed exposure history is essential for an accurate diagnosis and successful management.

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#### REFERENCES

1. Li Y, Li L. Contact Dermatitis: Classifications and Management. *Clinical reviews in allergy & immunology*. 2021;61(3):245–81. Doi: 10.1007/BF02914439
2. Diepgen TL, Ofenloch RF, Bruze M, et al. Prevalence of contact allergy in the general population in different European regions. *Br J Dermatol*. 2016;174(2):319–29. Doi: 10.1111/bjd.14167
3. Ahlström MG, Thyssen JP, Wennervaldt M, et al. Nickel allergy and allergic contact dermatitis: A clinical review of immunology, epidemiology, exposure, and treatment. *Contact dermatitis*. 2019;81(4):227–41. Doi: 10.1111/cod.13327
4. Ahlström MG, Thyssen JP, Menné T, Johansen JD. Prevalence of nickel allergy in Europe following the EU Nickel Directive - a review. *Contact dermatitis*. 2017;77(4):193–200. Doi: 10.1111/cod.12846
5. Johansen JD, Aalto-Korte K, Agner T, et al. European Society of Contact Dermatitis guideline for diagnostic patch testing – recommendations on best practice. *Contact Dermatitis*. 2015;73(4):195–221. Doi: 10.1111/cod.12432
6. Julander A, Skare L, Vahter M, Lidén C. Nickel deposited on the skin-visualization by DMG test. *Contact dermatitis*. 2011;64(3):151–7. Doi: 10.1111/j.1600-0536.2010.01856.x
7. Wennervaldt M, Ahlström MG, Menné T, et al. Diagnostic workup of occupational allergic nickel dermatitis in a nurse with multiple nickel exposures. *Contact Dermatitis*. 2019;81(4):311–3. Doi: 10.1111/cod.13301
8. Blaser P, Rothmund B, Schmid P, et al. Nickel release from metal items in contact with skin: a comparison of methods and practical implications for regulation in Europe. *J Environ Sci Health A Tox Hazard Subst Environ*. 2022;57(1):45–51. Doi: 10.1080/10934529.2021.2024058
9. Jensen P, Thyssen JP, Johansen JD, et al. Occupational hand eczema caused by nickel and evaluated by quantitative exposure assessment. *Contact Dermatitis*. 2011;64(1):32–6. Doi: 10.1111/j.1600-0536.2010.01819.x
10. Gawkrödger DJ, McLeod CW, Dobson K. Nickel skin levels in different occupations and an estimate of the threshold for reacting to a single open application of nickel in nickel-allergic subjects. *British J Dermatol*. 2012;166(1):82–7. Doi: 10.1111/j.1365-2133.2011.10644.x

11. Rui F, Bovenzi M, Prodi A, et al. Nickel, cobalt and chromate sensitization and occupation. *Contact Dermatitis*. 2010;62(4):225–31. Doi: 10.1111/j.1600-0536.2009.01650.x
12. Lidén C, Skare L, Nise G, Vahter M. Deposition of nickel, chromium, and cobalt on the skin in some occupations - assessment by acid wipe sampling. *Contact Dermatitis*. 2008;58(6):347–54. Doi: 10.1111/j.1600-0536.2008.01326.x
13. Shum K W, Meyer J D, Chen Y, et al. Occupational contact dermatitis to nickel: experience of the British dermatologists (EPIDERM) and occupational physicians (OPRA) surveillance schemes. *Occup Environ Med*. 2003; 60: 954–957. Doi: 10.1136/oem.60.12.954