CONTACT ALLERGY TO MATERIALS USED IN DENTAL PRACTICE; AN UPDATE

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SUMMARY

A wide range of chemicals and procedures is responsible for allergic contact dermatitis (ACD) in the dental profession. Groups of individuals affected include dentists and orthodontists, dental technicians, dental nurses, dental surgery assistants, dental hygienists and patients. Allergic contact dermatitis in dental personnel is predominantly confined to hand dermatitis, while patients with ACD to dental materials tend to experience stomatitis or cheilitis (type IV allergy) or contact urticaria with or without dissemination (immediate type allergy).

Due to changes in dental practice and materials used, 'traditional' allergens previously cited as common causes of allergic contact dermatitis (e.g., local anaesthetics, glutaraldehyde, eugenol) are now being seen less frequently. Increasingly, ACD is seen in association with acrylates, rubber and composite resins. Both public concerns about potential toxicity of metals in oral restorations and greater demand for cosmetic dentistry, have resulted in greater use of acrylics and resins by dental personnel, exposing them to highly allergenic materials.

The aim of the review is to update dental team members about the basic allergy reactions, prevalence of contact dermatitis in dental health personnel, allergy from rubber latex, dental materials; including acrylic and metals and their diagnosis by patch test methods and some basic alternatives to me conditions. It is hoped that the review will help dental team members to learn about ACD, use of alternate methods, materials to protect themselves, their staff and patients from unwanted reactions, leading to a safe dental practice, to improve the quality of care to their patients.

Key words: Dental allergens, Contact dermatitis, Dental materials, Dental personnel, Allergy.

INTRODUCTION

In the dental profession, repeated exposure of the hands to water, saliva, dental materials, and disinfecting agents is a constant to the integrity of the skin barrier. Consequently, glove use is more common in dentistry than most other occupations, and the gloves should offer protection against blood-borne infections, skin irritants and contact allergens. The gloves used at dental clinics have so far been tested mainly for the protection of patients and the dental staff from viral or bacterial cross-contamination. They should, however,

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also provide chemical protection for their users. Dental personnel with hand eczema have a special need for skin protection because of their defective skin barriers.

Allergic reactions to dental materials can affect health, lifestyle, and career of a dental professional. Allergic reactions associated with dental materials are generally delayed hypersensitive reactions. A delayed hypersensitive reaction is not manifested clinically until several hours after exposure. A contact allergy in dentistry is the type of reaction in which a lesion of the skin or mucosa occurs after contact with the allergenic material.

Contact Dermatitis in Dental Health Personnel

Reports of the prevalence of Allergic Contact Dermatitis (ACD) in dental professionals vary considerably. Unfortunately, most prevalence studies have relied on self reporting. That may lead to over-estimation or under-estimation of the extent of the problem. An Australian study found 22% of surveyed dental personnel self-reported hand dermatitis, while a Danish group found 43% of dental assistants reported adverse skin reactions. Self-reporting by American Air Force dental personnel revealed a similar frequency of hand dermatitis (37%), but follow-up clinical assessment and patch testing found most cases to be due to irritants. Overall, the frequency of ACD in dental personnel appears to be increasing. Over a 9-year observation period of dentists in Finland selected from 1982 to 1994, the incidence rate of allergic skin disease (hence excluding irritant dermatitis) increased three-fold. Similar increase have been observed in Germany.

Increased exposure to rubber glove chemicals and greater use of acrylics in dental restoration are thought to be partly responsible for the observed increased rate of sensitization in dentists.

Rubber Latex

It is well known, that many health care workers who routinely wear gloves suffer from contact, or irritant, dermatitis. In contact dermatitis there may be a latent period following first contact with the allergen. Reaction may be immediate, or may take hours to develop and, if severe, may last up to 10 days.

Contact dermatitis is manifested by an itching or burning sensation at the site of contact, followed a short while later by the appearance of erythema and then vesicles. Once the vesicles have ruptured, the erosion may become more extensive, and secondary infection may occur.

The oral manifestations, known as contact stomatitis or stomatitis venenata, include an edematous mucosa, accompanied by a severe burning sensation. Contact stomatitis occurs less frequently than do allergic skin lesions. This can be attributed to the diluting, digestive, and washing effects of saliva.

The increasing number of health care workers and patient with allergy symptoms to rubber latex has been reported. Hypersensitivity to natural rubber latex (NRL) is more likely to develop in persons allergic to certain foods (bananas, kiwi, avocados, chestnuts).

Three types of hypersensitivity to latex are known: contact dermatitis, type IV hypersensitivity (mild), and type I hypersensitivity (most severe, may proceed from a generalized rash to anaphylaxis through conjunctivitis, rhinitis, bronchospasm, and hypotention). In a dental office, NRL can be found in protective gloves, rubber dam, gutta-percha points, rubber on both ends of the anesthetic carpule, tubing and some other items.
Acrylic Resin Materials

Acrylic resin has been reported to occasionally induce an allergic hypersensitivity when used as a denture base or as a restorative material. The patient is exposed to the free monomer in acrylic resin, which may cause a toxic reaction. Acrylic resin hypersensitivity may develop shortly after insertion of the denture or may be delayed.6

Acrylic acid is the parent group of a variety of organic aliphatic compounds, which can form esters (acrylates). Additional compounds such as methyl or cyanide groups can be added to form various acrylic monomers. Acrylic resins also known as acrylies, are made by polymerization of acrylates or other monomers containing the acrylic group. Polymerization can occur at room temperature via a chemical reaction (self-cured, or cold-cured), through heat curing (usually by placing in boiling water for several hours) or light-curing (at ultraviolet or blue visible light).12. The cured polymers in the final product do not, in themselves, cause ACD. Acrylic monomers, however, are potent sensitizers and have frequently been reported as causing ACD in dental personnel13. In addition, acrylic monomers can cause irritant contact dermatitis. Dental technicians are most often exposed to monomers because they are primarily responsible for the manufacture of dentures and other prostheses. Although orthodontists may frequently come into direct contact with acrylic monomers when fashioning plates and using adhesives, generalist dentists and patients seldom contact acrylic monomers directly.12.

Resin Composite Materials

It has been reported that resin composite materials could trigger the development of lichenoid reactions in the oral mucosa. It may be related to formaldehyde formed in resin composite restorations. Formaldehyde causes more than one third of all allergic reactions caused by dental materials.14

Impression Materials

Polyether impression material has been known to cause allergic problems in the past, but since its composition has changed the problem has been eliminated. The material should be mixed thoroughly, and contact of the aromatic sulfuric ester catalyst paste with the skin or mucosa should be avoided, because it may elicit adverse tissue reactions.15

Eugenol-containing Materials

Eugenol is a derivative of clove oil. It is used in dentistry in combination with zinc oxide inside the tooth as a dressing, in toothache drops and an impression material. It can cause irritation in addition to ACD. Eugenol has been reported previously as a common cause of ACD in dental professionals.1

Eugenol is highly soluble and is continuously released from zinc oxide-eugenol, which can lead to saturation of the oral environment with eugenol in a concentration sufficient to cause cytotoxicity. This is why eugenol periodontal packs, which used to be applied to open mucosal wounds, are no longer popular.1

The inflammatory response caused in mucosal tissue by eugenol should not, however, be confused with hypersensitivity reaction.16,17

Local Anaesthetics

The ester group of local anaesthetics (e.g., benzocaine, tetracaine, procaine) was previously in widespread use by dentists and their sensitizing potential is well known. In 1983, it was reported that tetracaine was the most frequent contact allergen for dentists18. The newer amide local anaesthetics (lignocaine, mepivicaine, prilocaine, bupivicaine) currently used by dentists are less likely to cause allergy, both type IV and, arguably, type 1. A retrospective review of occupational hazards in dentistry demonstrated the virtual disappearance of reactions to local anaesthetics during the late 1980s1.

Metals

Although rare, allergy to mercury as well as copper in amalgam has been reported to cause skin and mucosal disorders19. In some cases, electrogalvanism may enhance the allergic reaction as a transmitter of reactive ions20.

Pure gold is generally regarded as an inert and safe material, but allergic dermatitis to a gold alloy wedding ring (14K or 18K) has been reported. Also, stomatitis caused by a gold dental restoration has been
In general, nickel is regarded as one of the most common causes of allergic contact dermatitis. Dermatitis due to contact with nickel was first reported at the end of nineteenth century among workers in the nickel plating industry and was recognized as an allergic response in 1925. Allergy to nickel is found more frequently among women than among men. About 10% of females are sensitive to nickel, and the majority become allergic through jewelry. Nickel dermatitis of the earlobe usually occurs in nickel-sensitive females. The percentage of nickel-sensitive males is very low (only 1% to 2%). The signs and symptoms of nickel sensitivity also often manifested when nickel-containing gold jewelry is worn. Nickel makes for between 64% and 78% of the composition of some nickel-based metal alloys, and it has been known to produce more contact dermatitis than all other metals combined. Clinical reactions to nickel include edema of the eyelids, swollen and fissured lips, and chronic eczema of the cheeks and palms. See Table 1. In general, we are trying to get away from the nickel-based alloys in dentistry. Severe intra-oral manifestations of nickel allergy are thankfully rare, although extra-oral reactions are more common. Stainless steel orthodontic wires, brackets and auxiliaries appear to be safe. However, high content nickel-titanium wires should be avoided in nickel-sensitive patients, as nickel-free alternatives are available and should be considered for these patients.

Although allergic reactions resulting from contact with chromium-containing alloys do occur, such allergies are usually due to some other metal in the alloy, usually nickel. Reported cases of platinum hypersensitivity are even more rare than chromium allergy.

Cobalt-chromium alloys used in the framework of metal partial dentures, and base metal alloys contain about 60% to 65% cobalt. They are thought of as biocompatible because of the absence of nickel in their composition. Cobalt is, however, listed as a sensitizing metal. Allergic reactions to cobalt used in dentistry are very rare.

Allergy to metals should be considered whenever dental treatments with alloys are planned. For patients with hypersensitivity to metals, it is advisable to avoid the use of mercury, nickel, and other elements with a high sensitization rate.

<table>
<thead>
<tr>
<th>TABLE 1: SIGNS AND SYMPTOMS OF NICKEL ALLERGY</th>
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<tbody>
<tr>
<td><strong>Intra-oral</strong></td>
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<tr>
<td>* Stomatitis from mild to severe erythema</td>
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<tr>
<td>* Papula pert-oral rash</td>
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<tr>
<td>* Loss of taste or metallic taste</td>
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<tr>
<td>* Numbness</td>
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<tr>
<td>* Burning sensation</td>
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<tr>
<td>* Soreness at side of tongue</td>
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<tr>
<td>* Angular cheilitis</td>
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<tr>
<td>Severe gingivitis in the absence of plaque</td>
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<tr>
<td><strong>Extra-oral</strong></td>
</tr>
<tr>
<td>* Generalized urticaria</td>
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<tr>
<td>* Widespread eczema</td>
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<tr>
<td>* Flare-up of allergic dermatitis</td>
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<tr>
<td>* Exacerbation of pre-existing eczema</td>
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**Allergy Testing**

Allergy testing of dental materials consists of epicutaneous patch testing. Readings of skin reactions are made on removal of patches after 48, 72, or 96 hours. The presence of erythema, combined with edema with or without papules or vesicles, is used as the criterion for a positive result.

Patch test series (dental screening) consists of 21 chemicals. The main group of compounds is the methacrylate monomers, which are used in dental resin materials, such as resin composite restorations, pit and fissure sealants, resin bonding materials, resin veneering materials, and denture base materials. Triethylene glycol dimethaerylate (TEGDMA); urethane dimethacrylate (UDMA); ethyleneglycol dimethacrylate (EGDMA), bisphenol A-glycidyl methacrylate (bis-GMA), and also accelerators (N,N-dimethyl-p-toluidine and 2-hydroxy-4-methoxybenzophenone); aromatic sulfuric esters (methyllichorobenzene sulfonate); eugenol; colophony (rosin); nickel-sulfate, and copper sulfate. It is advisable to ask patients questions about possible past hypersensitivity to dental materials. As part of the medical history, each patient should also be asked whether a rash had ever developed following the wearing of earrings or jewelry.

If skin lesions are present, the patient should be referred to a dermatologist for consultation. The patch Described. However, the number of confirmed cases of gold sensitivity is extremely low.
test should be performed by the dermatologist, the allergenic material should be withdrawn.5

Treatment

Several methods of treating allergies have been worked on, including symptomatic treatment, desensitization, and elimination of the allergen. Presently, the most recommended method of treatment may be elimination of the allergen.

CONCLUSIONS

A recent evidence-based review has reported the authoritative conclusions from current literature. For the interest of readers the updated and useful conclusions are presented below:32

• The prevalence of intraoral contact allergy (IOCA) to the materials used in dental practice appears to be relatively low.
• The great majority of allergic reactions to dental materials correspond to type IV delayed hypersensitivity phenomena mediated by T lymphocytes.
• Dental amalgams are the most common origin of IOCA. The current very widespread use of acrylics materials will surely lead to an increase in the number of allergic phenomena.
• In order for a material (metal or otherwise) to induce allergic manifestations, it must first undergo corrosion and particle release. No single or pathognomonic IOCA lesion exists, though lichenoid reactions are the most frequent clinical manifestations associated with the disorder.
• Positive epicutaneous patch testing affords a diagnostic orientation that must be accompanied by clinical manifestations to secure a diagnosis of IOCA. Cutaneous and intraoral hypersensitivity reactions are not always analogous.
• The systematic withdrawal or replacement of restorations containing materials that yield a positive epicutaneous test is not warranted.
• Allergy can be included in the differential diagnosis of many nonspecific or unclear intraoral clinical disorders.

Our body occasionally reacts negatively to chemicals we introduce to it, and the severity of the reaction can vary from mild to fatal. The most important measure to avoid an allergic reaction is its prevention. Dental professional should be able to obtain a detailed medical history of a patient, as well as to be educated of how to recognize signs and symptoms of allergy. That will give us a better perception of how to care for patients with hypersensitivity reactions.

It is hoped that the review will help dental team members to know about ACD, to protect themselves, their staff and patients from unwanted reactions, leading to a safe dental practice, to improve the quality of life and care to their patients.

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