

Denture Adhesive and Zinc Toxicity

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ABSTRACT

People using excessive denture adhesive for ill-fitting dentures are at maximum risk of hyperzincemia. Generally it occurs with the use of large amounts of denture adhesive over years. This article focuses on the excessive zinc ingestion from the overuse of denture adhesives and its related adverse systemic effects. So, the dentist should spread the message of denture relining or rebasing to the patient for a better fit and comfort.

KEYWORDS: Denture Adhesive, Zinc, Toxicity

INTRODUCTION

Denture adhesive refers to a commercially available, nontoxic, soluble material that is applied to the tissue surface of the denture to enhance retention, stability, and function.¹ Denture Adhesive use was first reported in 1913, followed by its application in the 1920s and 1930. In 1935 the American Dental Association Council on Dental Materials, Instruments, and Equipment categorized denture adhesives as nonmedical products.^{2,3} Denture adhesives are generally indicated in cases with compromised ridge shapes, tissue resilience, and border attachments which provide insufficient stability and retention; medical conditions such as impaired neuromuscular control; patient's with thin atrophic mucosa vulnerable to irritation in the presence of poor salivary flow; and when the patient desires better retention or stability.⁴ Excessive use of zinc containing denture adhesives may cause bone marrow suppression and polyneuropathy that can result in numbness and paresthesia of the extremities, loss of balance, and walking problems.⁵ The purpose of this article is to discuss the adverse systemic effects of prolonged, excessive ingestion of zinc from denture adhesives.

COMPOSITION OF DENTURE ADHESIVE

Denture adhesives be classified as soluble and insoluble groups. Creams, powders, and pastes comes under soluble category while the insoluble group consists of wafers and pads. Table 1 lists the common constituents of denture adhesives and their respective functions.⁶

ZINC TOXICITY

Various modifications in the compositions of denture adhesives have greatly enhanced biomechanical

Material	Purpose
Methyl vinyl ether-maleic anhydride copolymer	High molecular weight copolymers with adhesive and cohesive Properties
Karaya gum	Thickener
Tragacanth	Water-soluble mixture of polysaccharides that absorbs water to become a gel
Acacia	Preservative
Pectin and gelatin	Gelling agent
Carboxymethylcellulose	Viscosity Suspending and
Mineral oil	Suspending and levigating agent
Antimicrobial agents (for example, ethanol, sodium borate, sodium tetraborate, hexachlorophene)	Antimicrobial
Non-toxic additives	Wetting agents and plasticizers
Flavoring agents (for example peppermint oil, wintergreen oil)	Improves taste

Table 1. Composition of Denture adhesive

properties but still biocompatibility issues have been noticed.

Denture adhesives with zinc salt has been associated with inducing hypozincemia and the development of serious neurologic consequences.⁷ The addition of zinc salts into copolymer mixtures of lower alkyl vinyl ether-maleic acid blends was done to stabilize denture adhesives.⁸

ZINC INDUCED NEUROPATHIES

One of the most common results of denture adhesive zinc toxicity is neuropathy. It is a disorders of the nerves of the peripheral nervous system. Many elderly patients with long-term type 2 diabetics develop neuropathic pain. This

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results from dysfunction of nerves rather than stimulation of pain receptors (Non stroke neuropathy).

It can also be the result of nutritional deficiencies, such as the copper depletion caused by denture adhesive zinc poisoning. The symptoms of denture cream neuropathy include:⁹

- tingling or numbness in the extremities
- loss of ability to move legs, feet, arms, or hands
- poor balance and coordination
- decrease in walking stride
- abnormal blood pressure and heart rate
- reduced ability to perspire
- Constipation and bladder dysfunction.

In patients with this type of neuropathy, high absorptions of zinc in the small intestine prompt amplified expression of metallothioneins, proteins that bind zinc in an ineffective attempt to prevent its excessive absorption into the body. The problem, however, is that metallothioneins have a higher affinity for copper than zinc.¹⁰

Due to the firm attachment of dietary copper to the intestinal cells it cannot be absorbed into the body. While the metallothioneins cannot bind all of the extra ingested zinc, they can bind all dietary copper. The dietary copper bound to metallothioneins is lost in the stool via intestinal epithelial turnover rather than being absorbed as it normally is in the absence of excessive ingested zinc.¹¹ This leads to hypocupremia. Since many critical enzymes in nerves require copper as a cofactor, deficiencies in copper can result in abnormal nerve function.

Recently, the exposure of the high content of zinc in the denture adhesive was identified as a possible dietary source of excessive zinc intake in hyperzincemia patients. Hedera et al¹² reevaluated the hypocupremic subjects and observed that 100% (11 of 11) of the patients with copper deficiency syndrome had ingested large amounts of zinc from denture adhesives.

DISCUSSION

Zinc-containing denture adhesives are facing biocompatibility issues with potential risk of developing neurologic diseases, in the background of hypocupremia and hyperzincemia.¹¹

The estimated zinc intake from denture adhesives was 5-23 times the amount the FDA approves for Wilson's disease (75 mg of zinc per day in 2 or 3 divided doses).¹³ Denture adhesives as a possible source of hyperzincemia was first reported by Nations et al¹² and then later by Spinazzi et al in a letter to the editor.¹⁴

The increased incidence of zinc poisoning due to denture adhesive is primarily due to ill fitting dentures. As alveolar bone resorption is a progressive process, patients with conventional removable dentures may be desirous to use increasing quantities of adhesives to stabilize their ill-fitting prosthesis. To overcome this problem patient should seek professional care. Dentist should propagate

denture relining or rebasing for a better fit and comfort. General public should be better communicated about denture relining and rebasing, along with the dangers of overuse of denture adhesives.

CONCLUSION

People using excessive denture adhesive for ill-fitting dentures are at maximum risk of hyperzincemia. Generally it occurs with the use of large amounts of denture adhesive over years. Dentist should spread the message of denture relining or rebasing to the patient for a better fit and comfort.

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