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Beryllium: a hazard to health in the dental laboratory?

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This paper highlights the potential health hazards to dental technicians working with alloys containing beryllium and its compounds emphasizes the importance of effective prevention.

Beryllium

Beryllium is a metallic element with a silver-grey-white colour. It is the lightest of all solids and chemicals. Beryllium occurs naturally mostly as beryllium aluminium silicate (beryl). The naturally occurring element forms a light, hard, noncorrosive metal.

Beryllium was discovered in 1798, and became commercially important in the 1930s. As an alloy, it is used as a construction material for machinery and moulds for plastic, in electrical and electronic parts and sports equipment.

Exposure of workers to beryllium may occur via metal machining, using beryllium products and recycling beryllium from scrap alloys.

A hazard to health

i. Lung disease

Absorption of beryllium is principally via the lungs. Beryllium lung disease is classified as acute or chronic dependant on the duration of disease rather than the duration of exposure.

Acute beryllium disease is a temporary inflammation of the nasal cavity, pharynx, bronchi and lungs, causing severe coughing and tightness of the chest. It usually

does not last more than one year. Avoidance of the causative agent reduces the symptoms of this condition.

Chronic Beryllium disease leads to fibrosis of the lungs and sometimes other organs and is considered a type of *pneumoconiosis*. Symptoms include coughing, breathlessness, chest pain, weight loss and fever. There is no cure for chronic beryllium disease. The management of the condition involves cessation of beryllium exposure and the use of systemic steroid medication to reduce symptoms.

Lung cancer Beryllium has been recognized as a human carcinogen According to the US Environmental Protection Agency (EPA) estimates, long-term exposure to concentrations of beryllium as low as four-one-hundred of a microgram per cubic meter of air can increase the chance of being diagnosed with lung cancer to one in one thousand.

ii. *Local reactions to beryllium*

Beryllium can also get into the body by skin or eye contact with soluble salts of beryllium, or even eating, drinking or smoking in areas where these compounds are used. A single exposure to beryllium and its compounds can cause:

Inflammation of the eyes from splashes

Skin disease (dermatitis and sensitisation)

Corn-like lesions if debris gets into the skin and is not removed soon after.

Beryllium in dentistry

Beryllium is used in dentistry in a nickel alloy as a cheaper alternative to precious metals. Beryllium has also been incorporated into some base metal alloys to improve properties including its castability. Grinding, finishing and polishing beryllium-containing metals will produce small beryllium dust particles and fumes that could be inhaled and lodge in the lungs or provoke irritation in the tissues of the skin or eyes.

The potential risks of beryllium use in the dental industry have been recognized for some time and dental technicians who are exposed to beryllium together with various other dusts and chemicals are at high risk of developing chronic beryllium disease and other lung conditions (Fireman et al, 2006). Further, cases of a dental laboratory technicians with chronic beryllium disease and pulmonary granulomatosis related to exposure to beryllium and aluminium have been described (Kotloff et al, 1993; Brancalone et al, 1998; Deepthi and Rauf 2010).

Prevention

To reduce the risks of developing respiratory disease, specific measures must be taken to decrease the level of dust particles inhaled. The Control of Substances Hazardous to Health (COSHH) Regulations 2002 requires employers to prevent workers being exposed to beryllium and its compounds or, where this cannot reasonably be done, adequately control exposure. Selection of non-beryllium alloys is therefore the primary measure

The main protective measures otherwise available to dental technicians are use of effective ventilation and respirator masks.

Ventilation Systems

Effective ventilation is mandatory to achieve a healthy working environment in the dental laboratory. The Control of Substances Hazardous to Health (COSHH) regulations specify that the concentration of inhalable dust in the workplace should not exceed $4\text{mg}/\text{m}^3$. These levels are easily exceeded without good ventilation systems placed at appropriate locations in the laboratory. Bench suction and lathe extraction are important measures.

Lab technicians should report any defects in extraction equipment or other control measures to their employers.

Respirator Masks

Dental technicians should wear respirator masks when carrying out procedures that cause a high level of respirable dust. The Health and Safety Executive recommends that employees who work with harmful dusts should wear CE-marked disposable respirators to protect from occupational lung disease. FFP2 masks may be considered the minimum protection when working with dusts. Failure to do this predisposes to lung disease. It is advised that these masks should be replaced daily. Paper masks are not recommended as they have shown not to meet basic health and safety requirements.

Other measures

Hands should be washed if they became contaminated with dust. Care should be taken not to touch the face with the contaminated hands or clothing to avoid transferring the respirable beryllium particles to the breathing zone.

Conclusions

Beryllium, like many other materials used in the dental laboratory, is a potential health hazard.

Prevention of beryllium disease is possible through the use of beryllium free alloys.

Otherwise, good practice, including use of effective ventilation and respiration mask protection, should prevent inspiration of harmful levels of the material.

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Using protective personal equipment while grinding alloys