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HEAVY METALS IN THE ORAL CAVITY OF METALWORKING ENTERPRISE WORKERS

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ANNOTATION: Occupational exposure to heavy metals remains one of the major factors affecting the health of workers in metalworking enterprises. Continuous contact with metal dust and aerosols containing lead, cadmium, chromium, nickel, copper, and zinc contributes to their accumulation in biological media, including oral fluid. This study evaluates the concentration of heavy metals in the oral cavity of metalworking enterprise workers and assesses their influence on oral health. The results indicate a significant increase in heavy metal concentrations in saliva, accompanied by deterioration of periodontal tissues, increased prevalence of gingivitis, and reduced local immunity. Monitoring heavy metal levels in oral fluid may serve as an effective method for early diagnosis and prevention of occupational oral diseases.

Keywords: heavy metals, oral cavity, saliva, metalworking industry, occupational hazards, periodontal diseases, oral hygiene.

АННОТАЦИЯ: Металлга ишлов бериш корхоналарида меҳнат қилаётган ишчилар соғлиғига таъсир этувчи асосий омиллардан бири оғир металлар ҳисобланади. Қўрғошин, кадмий, хром, никель, мис ва рух сақловчи металл чанги ва аэрозоллар билан доимий контакт ушбу элементларнинг оғиз суюқлигида тўпланишига олиб келади. Ушбу тадқиқотда металлга ишлов бериш корхоналари ишчилари оғиз бўшлиғида оғир металлар миқдори ва уларнинг стоматологик ҳолатга таъсири баҳоланди. Натижалар оғиз суюқлигида оғир металлар концентрациясининг ошиши, пародонт тўқималари ҳолатининг ёмонлашиши ва маҳаллий иммунитет пасайиши билан боғлиқлигини кўрсатди.

Калит сўзлар: оғир металлар, оғиз бўшлиғи, сўлак, металлга ишлов бериш саноати, касбий зарарли омиллар, пародонт касалликлари.

АННОТАЦИЯ: Воздействие тяжелых металлов является одним из ведущих профессиональных факторов риска для работников металлообрабатывающих предприятий. Постоянный контакт с производственной пылью и аэрозолями, содержащими свинец, кадмий, хром, никель, медь и цинк, способствует накоплению этих элементов в ротовой жидкости. Целью исследования явилась оценка содержания тяжелых металлов в полости рта работников металлообрабатывающих предприятий и изучение их влияния на стоматологический статус.

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Установлено, что повышение концентрации тяжелых металлов в слюне сопровождается ухудшением состояния тканей пародонта, увеличением распространенности воспалительных заболеваний и снижением местной иммунологической защиты.
Ключевые слова: тяжелые металлы, полость рта, слюна, металлообрабатывающие предприятия, профессиональные вредности, заболевания пародонта.

Introduction

The rapid development of industrial technologies has led to increased occupational exposure to heavy metals. Workers employed in metalworking enterprises are regularly exposed to airborne particles and aerosols containing toxic metals. Heavy metals such as lead (Pb), cadmium (Cd), chromium (Cr), nickel (Ni), copper (Cu), and zinc (Zn) possess cumulative properties and can adversely affect multiple organs and systems.

The oral cavity serves as one of the first biological barriers encountering harmful industrial pollutants. Oral fluid is considered a highly informative biological medium reflecting metabolic and toxicological changes occurring in the body. Accumulation of heavy metals in saliva may contribute to oxidative stress, impaired local immunity, inflammatory periodontal reactions, and disturbances of oral microbiocenosis.

The study of heavy metal concentrations in oral fluid is important for the development of preventive measures aimed at reducing occupational dental morbidity among industrial workers.

Aim of the Study To evaluate the concentration of heavy metals in the oral cavity of workers employed at metalworking enterprises and determine their influence on oral health status.

Materials and Methods

The study included 120 workers of metalworking enterprises aged 25–60 years. The control group consisted of 40 healthy individuals not exposed to industrial hazards. Clinical dental examination included:

Assessment of oral hygiene index (OHI-S);

PMA index;

Community Periodontal Index (CPI);

Evaluation of dental caries prevalence.

Samples of unstimulated saliva were collected in the morning. Concentrations of lead, cadmium, chromium, nickel, copper, and zinc were determined using atomic absorption spectrophotometry. Statistical analysis was performed using SPSS 26.0 software. Differences were considered statistically significant at $p<0.05$.

Results

Analysis of oral fluid demonstrated significantly elevated concentrations of heavy metals among workers compared with controls.

Average concentrations of heavy metals in saliva:

Metal Workers (µg/L)

Control group (µg/L)

Lead-18.6±1.2

Cadmium-4.8±0.3

Chromium-10.5±0.7

Nickel-12.8±0.9

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Copper-22.4±1.5
Zinc-85.7±4.6

Clinical examination revealed:

Chronic generalized gingivitis in 62.5% of workers;
Initial and moderate chronic periodontitis in 48.3%;
Increased dental plaque accumulation;
Xerostomia complaints in 36.7%;
Metallic taste sensation in 28.3%.

A positive correlation was observed between heavy metal concentration and periodontal inflammation severity ($r=0.69$; $p<0.05$).

Discussion

Heavy metals can accumulate in oral tissues due to chronic occupational exposure. Lead and cadmium are capable of inducing oxidative stress and suppressing immune responses. Chromium and nickel may trigger inflammatory and allergic reactions in the oral mucosa.
The elevated concentrations detected in saliva indicate continuous absorption of toxic elements through inhalation and oral routes. These findings correspond with reports from occupational medicine studies demonstrating higher prevalence of periodontal diseases among industrial workers exposed to metal aerosols.The oral cavity may therefore serve as an accessible diagnostic site for monitoring occupational intoxication and assessing the effectiveness of preventive programs.

Conclusion

Workers of metalworking enterprises exhibit significantly higher concentrations of heavy metals in oral fluid compared with non-exposed individuals.Elevated heavy metal levels are associated with deterioration of periodontal tissues and increased prevalence of inflammatory oral diseases.

Salivary analysis may be used as a non-invasive biomarker for occupational exposure assessment.Regular dental monitoring and preventive measures should be included in occupational health programs for metalworking industry workers.

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