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To,

Widodo

Department of Dental Public Health, Faculty of Dentistry, Universitas Lambung Mangkurat, Banjarmasin,  
Kalimantan Selatan, Indonesia

Dear author/s

I have pleasure to inform you that your following Original Article has been accepted for publication in  
Indian Journal of Forensic Medicine & Toxicology

## **Coal Dust Exposure and Gingival Lead Line in Coal Miners**

**Widodo<sup>1\*</sup>, Sahdhina Rismawati<sup>1</sup>, Eko Suhartono<sup>2</sup>, R. Darmawan Setijanto<sup>3</sup>**

<sup>1</sup>*Department of Dental Public Health, Faculty of Dentistry, Universitas Lambung Mangkurat,  
Banjarmasin, Kalimantan Selatan, Indonesia*

<sup>2</sup>*Department of Medical Chemistry/ Biochemistry, Faculty of Medicine, Universitas Lambung  
Mangkurat, Banjarbaru, Kalimantan Selatan, Indonesia*

<sup>3</sup>*Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga,  
Surabaya, Indonesia*

*\*Corresponding Author: Widodo, Department of Dental Public Health, Faculty of Dentistry,  
Universitas Lambung Mangkurat, Jl. Veteran No. 128B Banjarmasin - Indonesia, email:  
dodowident@gmail.com*

It will be published in Volume 14, No 4, October – December 2020 issue. It is further mentioned for your information that our journal is a double-blind peer reviewed indexed international journal. It is covered by Index Copernicus (Poland), Indian Citation index, Google Scholar, CINAHL, EBSCOhost (USA), EMBASE (Scopus) and many other international databases. The journal is now part of CSIR, DST and UGC consortia. The Journal is index with Scopus and fulfills MCI Criteria as per MCI circular dated 03/09/2015

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Yours sincerely

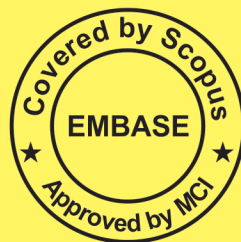
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# Coal Dust Exposure and Gingival Lead Line in Coal Miners

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## Abstract

Coal dust contains less than 1% lead (Pb). This dust can enter the body through breathing, mouth and skin. Lead contained in coal dust can react with Sulfur and form gingival leadline. The study was an observational study with cross-sectional design. The research subjects were coal miners in Sambung Makmur Sub-District, Banjar District, amounting to 100 people. The number of samples was calculated by the Slovin formula and obtained 80 people as samples and determined by simple random sampling technique. The sample obtained then determined the value of the gingival lead line score as done by Sudiby. The degree of gingival lead line is assessed based on the score as follows: 0 = no gingival lead line; 1 = gingival lead line found in 1-2 marginal gingival anterior teeth labial surface; 2 = gingival lead line found at 3-4 marginal gingival anterior teeth labial surface; 3 = gingival lead line at >4 marginal gingival anterior teeth labial surface. In addition, age, working period (tenure), and smoking habits are the variables measured in this study. The data obtained were analyzed using the chi-square test with  $\alpha = 5\%$ . The conclusion is the incidence of gingival leadline of coal miners was related to age, tenure, and smoking habits.

**Keywords:** *gingival leadline, lead, coal dust, coal miners*

## Introduction

Kalimantan Selatan is one of the provinces in Indonesia which has the largest coal mining with locations spread throughout the region. One of the problems arising from mining is the issue of coal dust which can have an impact on health. This is due to the metal content found in coal dust, namely Fe 36.9%; Si 17.9%; Mo 15%; Al 10%; Ca 8.67%; S 4.7%; Ti 3.65%. Some heavy metal content of less than 1% includes K, V, Cr, Mn, Ni, Cu, and Pb.<sup>1</sup>

Coal dust containing metals can enter the body through breathing, mouth and skin. Furthermore,

metals contained in coal dust, especially Lead and Sulfur will accumulate in gum tissue through systemic and local processes, namely direct absorption by the oral mucosa. Lead and Sulfur produce lead sulfate which is deposited in the basement membrane of gum.<sup>2</sup> These deposits provide a picture of the lead line in the gums. Various factors that are thought to influence the occurrence of gingival lead line, such as working period, age, use of personal protective equipment (PPE), smoking habits, etc.<sup>3</sup>

The working period (tenure) affects the incidence of gingival lead line, because the working period shows the length of time someone is exposed to coal dust. The longer the exposure time, the incidence of gingival lead line will be more severe. Likewise, increasing age causes the detoxification rate to slow down, resulting in a buildup of lead from coal dust. This incident gingival lead line will be more severe.<sup>4</sup>

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### Corresponding Author:

**Widodo,**

Department of Dental Public Health, Faculty of Dentistry, Universitas Lambung Mangkurat, Jl. Veteran No. 128B Banjarmasin - Indonesia, email: dodowident@gmail.com

Previous research has revealed that the working period has a relationship with the incidence of gingival lead line in traffic police.<sup>4</sup> Other studies have also revealed that the workshop workers have a risk of gingival lead line, because every day they are exposed to fumes that contain lead.<sup>5</sup> Coal miners are a group at risk of developing gingival lead lines. This is due to his daily exposure to coal dust containing lead and sulfur. However, not many studies have revealed this. Therefore in this study we will examine the relationship of working period, age, and smoking habits to the incidence of gingival lead line of coal miners.

### Materials and Method

The study was an observational study with cross-sectional design. The research subjects were coal miners in Sambung Makmur Sub-District, Banjar District, amounting to 100 people. The number of samples was calculated by the Slovin formula and obtained 80 people

as samples and determined by simple random sampling technique.

The sample obtained is then determined by the value of the gingival lead line score as done by Sudibyo.<sup>6</sup> The degree of gingival lead line is assessed based on the score as follows:

0 = no gingival lead line

1 = gingival lead line found in 1-2 marginal gingival anterior teeth labial surface

2 = gingival lead line found in 3-4 marginal gingival anterior teeth labial surface

3 = gingival lead line at >4 marginal gingival anterior teeth labial surface

In addition, age, working period, and smoking habits are the variables measured in this study. The data obtained were analyzed using the chi-square test with  $\alpha = 5\%$ .

### Findings and Discussion

This study involve 80 male who were willing to be sample in the study. The lowest age is 19 years and the highest is 45 years. The existence of gingival lead line can be seen in Figure 1.



Figure 1. Normal gum looks reddish (a) and gingival lead line (b)

Gingival leadline, also called Burtons's Line, is a pigment in the form of gray-blue lines at the border between teeth and gums.<sup>7,8</sup> Leadline occurs due to a reaction between lead and sulfur ions released by the bacterial oral cavity, leading to lead sulfid at the tooth and gingival surface.<sup>8</sup>

### Relationship between age and gingival lead line

The relationship between age and the gingival lead line is presented in table 1. Gingival lead line is found in >4 marginal gingival anterior teeth labial surfaces. It is found more at the age of 30-45 years.

**Table 1. Relationship of Age with Gingival Lead Line**

Age (years)	Gingival Lead Line Score			
	0	1	2	3
15-30	15%	23.75%	7.5%	6.25%
30-45	7.5%	8.75%	15%	16.25%

Based on the results of the chi-square test obtained  $p = 0.005$  ( $p < 0.05$ ), it was concluded that age was associated with the incidence of gingival lead lines in coal miners. The relationship between age and gingival lead line caused by in the young age more sensitive to lead activity. It is closely related to organ development and function are not perfect. In the old age the sensitivity is higher, this is caused by the activity of the biotransformase enzyme decreases with increasing age and the resistance of certain organs decreases to the effects of coal dust containing lead. The older the person, the higher the amount of lead accumulated in the body tissues.

On the other hand, the activity metaloprotein (metal-binding protein) in the oral cavity will slowly decrease the

activity. This causes lead contained in coal dust can not be transported optimally by metalloproteins. As a result, lead reacts with sulfur in the oral cavity and leadline is formed. The results of this study are in accordance with the study by Vera<sup>9</sup>, which states that the age of street vendors in the city of Semarang affects the incidence of gingival leadline.

**Relationship between working period and gingival lead line**

Working period of more than 12 months caused 16% of the study subjects have gingival lead line at >4 marginal gingival anterior teeth labial surface. The relationship between the working period and the gingival lead line is presented in table 2.

**Table 2. Relationship between Tenure and Gingival Lead Line.**

Working period (month)	Gingival Lead Line Score			
	0	1	2	3
<3	12.5%	3.75%	1.25%	1.25%
3-6	5%	7.5%	1.25%	1.25%
6-9	1.25%	6.0%	6.25%	1.25%
9-12	2.5%	2.5%	1.25%	2.5%
>12	1.25%	13.5%	12.5%	16.25%

Based on the results of the chi-square test obtained  $p = 0.000$  ( $p < 0.05$ ), it was concluded that the working period of coal miners was related to the incidence of gingival lead line. The working period shows the length of exposure to coal dust containing lead. Lead as the cause

of many lead lines accumulates in gum tissue through systemic processes or local processes, namely direct absorption by the oral mucosa. This lead will only form a lead line after reacting with sulfur ions produced by anaerobic bacteria in the oral cavity.<sup>10</sup> The results of

the reaction are lead sulfate compounds which are then deposited on the gum basement membrane. These deposits provide a picture of the lead line in the gums. Thus, it can be concluded that indirectly the Oral Hygiene Index (OHI) and Gingivitis Index (GI) are important factors that determine the quality of lead line formation because these two factors are closely related

to the presence of bacteria in the oral cavity.<sup>11</sup>

**Relationship between smoking habit and gingival lead line**

In table 3, the relationship between smoking habits and the incidence of gingival lead line is presented.

**Table 3. Relationship between Smoking Habit and Gingival Lead Line**

Smoking habit	Gingival Lead Line Score			
	0	1	2	3
Not a smoker	7.5%	10.0%	7.5%	1.25%
Smoker	15.0%	22.5%	15.0%	21.25%

Based on the results of the chi-square test obtained  $p = 0.158$  ( $p < 0.05$ ), it was concluded that the smoking habits of coal miners were not related to the incidence of gingival lead lines. The standard of cigarettes taken from tobacco, in the handling process often uses pesticides which also contain basic ingredients of lead (Pb).<sup>12</sup> Thus, research subjects who had a smoking habit of Pb levels increased the amount of Pb exposure both from the contents of the cigarette and from coal dust were also sucked. This can worsen the incidence of gingival leadline.

**Conclusion**

The results of this study concluded that the incidence of gingival leadline in coal miners was significantly related with age, working, and smoking habits. Thus, a comprehensive effort is needed to improve dental and oral health.

**Ethical Clearance:** This research has gone ethical feasibility testing by the Ethical Research Commission of the Faculty of Dentistry, University of Lambung Mangkurat and declared as ethical: no. 28 / KEPKG-FKGULM / EC / IX / 2017.

**Source Funding:** This study was done by self-funding from the authors.

**Conflict of Interest:** The authors declare that they have no conflict interests.

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Prof R K Sharma  
Editor, Indian Journal of Forensic Medicine & Toxicology  
Former Head, Department of Forensic Medicine, A I I M S, New Delhi  
[www.ijfmt.com](http://www.ijfmt.com)

### Address for Correspondence

**Dr R K Sharma**  
**Editor, IJFMT**  
**Institute of Medico-legal Publications**  
Logix Office Tower, Unit No. 1704, Logix City Centre Mall  
Sector- 32, Noida - 201 301 (Uttar Pradesh)

[www.imlp.in](http://www.imlp.in)

**Tel No 91-9971888542**

On Sun, Sep 29, 2019 at 10:53 AM Widodo Widodo wrote:

Dear Editor of **Indian Journal of Forensic Medicine and Toxicology**

I am writing to submit our manuscript entitled, “ **Coal Dust Exposure and Gingival Lead Line in Coal Miners** ” for consideration for publication in IJFMT. It will be important to the vision scientists, researchers, and lecturers who read your journal. This manuscript describes original work and is not under consideration by any other journal. All authors approved the manuscript and this submission.

Thank you for receiving our manuscript and considering it for review. We appreciate your time and look forward to your response.

Best Regards,

Widodo