# Correlation between Work Environment Control and P53 Level Among Dental Technicians

*by* Puspa Dila Rohmaniar

**Dental Therapist Journal**
Vol. 5, No. 1, May 2023, pp. 18-22
P-ISSN 2715-3770, E-ISSN 2746-4539
Journal DOI: https://doi.org/10.31965/DTJ
Journal homepage: *http://jurnal.poltekeskupang.ac.id/index.php/DTJ*

# Correlation between Work Environment Control and P53 Level Among Dental Technicians

**Puspa Dila Rohmaniar**[1*]

[a] Faculty of Dentistry, Institut Ilmu Kesehatan Bhakti Wiyata, Kediri, Indonesia.

[1] dila.rohmaniar@iik.ac.id*
* Corresponding Author

**ARTICLE INFORMATION**

*History article:*
*Received: June 10, 2023*
*Revised: 14 June, 2023*
*Published: May 31, 2023*

**Keywords:**
P53 Wild
Work Environment Control
Dental Technician

**ABSTRACT**

Dental technicians cannot avoid being exposed to various physical, chemical, and biological agents due to their work environment. Therefore, technicians must control the work environment according to standard procedures to protect themselves from metal exposure in the workplace. Metal exposure can cause a decrease in the wild P53 gene. This study aims to determine the correlation between work environment control and wild P53 level among dental technicians. This was an analytic observational study with a cross sectional approach. There were 40 randomly selected samples. Data were derived through interviews and observation. Wild P53 was examined from saliva by indirect ELISA method. Data were analyzed using the Spearman correlation test with the significance value of $p<0.05$ (95% confidence level). The results showed that there was a significant correlation between work environment control and wild P53 level with a significance value of $p<0.05$. It was further obtained a Spearman's correlation value of 0.436. Such finding indicated a positive correlation value, meaning that the higher the score of work environment control performed by dental technicians while working on metal prostheses, the higher the P53wild level. It can be concluded that there was a significant correlation between work environment control and wild P53 level. The better and more correct the implementation of work environment control, the higher the wild P53 level. Future researchers are recommended to observe the effect of variables with other genotoxic markers on the effect of work environment controls among dental technicians.

## INTRODUCTION

Dental technicians cannot avoid exposure to various physical, chemical and biological agents in the work environment. Such exposure can enter the body through inhalation, ingestion or direct contact (Anusavice, 2013). Exposure to dental technicians may exist in the form of dust or smoke originating from grinding during processing of dental restoration materials (Al-Hourani et al., 2013). In a study conducted by Hariyani et al, 2014 it was reported that there were high concentrations of cobalt, nickel, chromium in the blood of dental technicians in Surabaya by 27 µg/L, 37 µg/L, and 117 µg/L, respectively (Hariyani et al., 2015). Other researcher in Northern Jordan also reported high levels of cobalt and chromium in the blood of dental technicians by 46.18+58.20µg/dL and 2.23 + 6.53 µg/dL, respectively (Al-Hourani et al., 2013).

Metal exposure may result in the potential for lung disease such as bronchial asthma, cancer, mesothelioma and pneumoconiosis depending on the duration of exposure. Petroviü, 2013 reported that the prevalence of contact dermatitis in dental technicians in Australia was 22% and in Denmark it was 43%. Meanwhile, Ergün et al., 2014 further found 10.1% of dental technicians in Ankara were contracted to pneumoconiosis and 16% of dental technicians in Germany experienced contact dermatitis. Fabrizio et al., 2007 similarly reported that 14 of 27 dental technicians in Italy were diagnosed with neuronal disorders such as postural tremor and Parkinson's.

Nickel, chromium, and cobalt have carcinogenic potential in humans and experimental animals. Nickel exposure by inhalation was shown to cause tumors in the respiratory tract of experimental animals and humans (Dunnick et al., 1995). (Lison et al., 2001) reported carcinogenic effects among experimental animals exposed to cobalt for 2 years. In addition, cobalt also had a genotoxic effect. Exposure to genotoxic metals can increase the number of endogenous Reactive Oxygen Species (ROS). Chromium, cobalt, nickel and vanadium metal ions can produce hydroxyl radicals (–OH) through the Fenton and Haber-Weis reactions. These hydroxyl radicals can cause DNA damage (Valko et al., 2005). ROS-mediated DNA oxidative damage plays an important role in various diseases including cancer (Merzenich et al., 2001). Cells that experience exposure to mutagens, carcinogens or ionizing radiation may lead to DNA damage which further activate p53 that plays a role in the process of DNA repair (Prasad, 2012). The P53 gene can be detected in saliva. Saliva is a diagnostic medium for detecting various molecules present in the blood, so that saliva can provide similar information about individual status as obtained from a blood test without taking specimens invasively (Herlia Nur Istindiah, 2003).

According to Suma'mur, 1996, an increase in the use of chemicals in the work environment in order to increase the products has also led to an increase in exposure to chemicals among workers. The high risk of disease among dental technicians is not only due to the process involved in making dentures or orthodontic appliances but also due to poor working conditions in the dental laboratory and inappropriate shielding (Petrović et al., 2013). Therefore, it is important for dental technicians to comply with standard procedures and work safety. Such standards state that dental technicians must wear personal protective equipment including work uniforms, protective masks, protective gloves and goggles. Besides that, it is also necessary to control the work environment including workplace ventilation. Good and appropriate ventilation, exhausters, or filters will be able to reduce the levels of chromium, cobalt and nickel in the air (Annusavice, et al., 2013). This study aims to determine the correlation between work environment control and wild P53 level among dental technicians.

## METHOD

This was an analytic observational study with a cross sectional approach. There were 40 randomly selected samples. Data were derived through interviews and observation. Wild P53 was examined from saliva by indirect ELISA method. This study was conducted among dental technicians in Surabaya, East Java.

Work environment control refers to the condition of the work environment assessed through the presence of air filters, exhaust fans, and room ventilation while working on metalcontaining prostheses. The data were obtained using a questionnaire and scoring was performed.

Salivary serum sample collection method: Whole saliva was collected by letting the saliva accumulate and the subject was instructed to spit into a tube. The collected whole saliva was further centrifuged at 3.000g for 15 minutes at 4oC to obtain a supernatant. Salivary serum was examined using the Human TP53 (Tumor protein p53) ELISA kit (Elabscience Biotechnology Co., Wuhan, Hubei, China).

Data were analysed using the Spearman correlation test with the significance value of p<0.05 (95% confidence level).

## RESULTS AND DISCUSSION

**Table 1.** Description of P53wild levels among dental technicians.

| | **P53 level** |
|---|---|
| N | 40 |
| Mean±SD | 0.27±0.28 |

Table 1 showed that the mean standard deviation of P53 levels in the saliva among dental technicians working on metal in Surabaya was 0.27 ± 0.28.

**Table 2.** Description of work environment control scores among dental technicians work environment control score.

| | **Work Environment Control Score** |
|---|---|
| N | 40 |
| Mean±SD | 7.22±2.281 |

Table 2 showed that the mean standard deviation of work environment control scores among dental technicians working on metal in Surabaya was 7.22 ± 2.281.

Before the correlation test was conducted, the homogeneity and normality tests were previously conducted using the Levene test and the Kolmogorov Smirnov test, respectively. Based on the result of the homogeneity test, it was found that the P53 level and the work environment control variables had a significance value of >0.05 so that those variables were homogeneous. The normality test results show that the significance value of P53 was >0.05, sit can be said that the data were normally distributed. On the other hand, the significance value of work environment control was <0.05, so it can be said that the data were not normally distributed. Furthermore, the Spearman correlation test was carried out.

**Table 3.** Correlation analysis of work environment control scores on P53wild levels.

| **Independent variable** | **Dependent variable** | **P** | **R** |
|---|---|---|---|
| Work environment control score | P53wild level | 0.005 | 0.436 |

Table 3 showed that the significance value regarding the effect of dental technician's work environment control score while working on metal prostheses on P53 levels was 0.005. The significance value of p<0.05 indicated a significant correlation. It was obtained a Spearman's correlation value of 0.436, which indicated a positive correlation value. Thus, the higher the work environment control score performed by dental technicians while working on metal prostheses, the higher the P53 levels (Kumar, et al., 2010). Work environment control referred to in this study was the use of air filters, ventilation and exhaust fans in the dental laboratory while working on dental prostheses.

Based on the results of statistical test between work environment control score and P53 level among dental technicians in Surabaya, it was obtained a positive and significant correlation between work environment control and P53 level among dental technicians in Surabaya. Therefore, the better the dental technicians controlled the work environment, the higher the P53 level (Kumar, *et al*., 2010).

The p53 gene is considered to be the most frequently mutated gene in human malignant tumors. The p53 tumor suppressor gene is mutated in 50% of human tumors in various organs of the body (Munir et al., 2007). The p53 gene is a multifunctional tumor suppressor gene and is frequently altered in ovarian cancer and other types of cancer. Under normal condition, p53 interacts with various types of proteins involved in transcriptional regulation, DNA repair, cell cycle, apoptosis, and proteosome-mediated protein degradation (Havrilesky et al., 2003). Cells that experience exposure to mutagens, carcinogens or ionizing radiation may lead to DNA damage, which further activate p53. The target gene of p53, namely p21, acts as a CDK inhibitor which in turn triggers G1 arrest. If the repair process is successful, then the cell will return to normal. The GADD45 target gene plays a role in DNA repair. If the DNA repair is successful, then the cell will return to normal. In contrast, if the DNA repair is not successful, then the process of apoptosis will occur (Prasad, 2012).

Exposure to metals is a free radical which is very reactive so that it can cause further oxidation of the surrounding molecules. If free radicals and oxidation products react with complex molecules in cells, especially chromosomes, the chromosome chain becomes broken and the base arrangement of nucleotides changes. These changes result in damage to the Deoxyribonucleic Acid (DNA) (Aryani, 2009). Further damages as a result of DNA damage include delayed cell division, modification and permanent cell changes and an increase in the speed of cell division so as to induce tumors (Shatiningsih et al., 2015). Typical damage that occurs as a result of DNA oxidation is the transversion of guanine to thymine. This also occurs in p53 (p53 gene) in the form of mutation in guanine (Lu et al., 2005). p53 gene is involved in various biological processes such as regulation of genes involved in the cell cycle, cell growth after DNA damage, and apoptosis (Wang & Shi, 2001).

Exposure to metals in the work environment of dental technicians can be prevented through the use of personal protective equipment as well as environmental control through the use of ventilation, exhausters, and filters. Good and appropriate environmental control and personal protective equipment will be able to reduce the levels of chromium, cobalt and nickel in the air (Annusavice, et al., 2013). If exposure to these metals can be avoided, accumulation of metals in the body can also be prevented. By minimizing exposure to metals in the air through controlling the work environment, ingestive and digestive exposure to metals which can be absorbed by the body can be prevented. Exposure to metals can lead to the formation of Reactive Oxygen Species (ROS). According to Aryani, 2009, one of the targets of ROS is DNA, which can cause DNA mutations. Cells that experience mutation will also experience inactivation of p53 which obstruct the expression of the p53 protein (Kumar, et al., 2010). The limitation of this study was the presence of other variables besides exposure from the work environment which may affect p53 levels. Therefore, it is necessary to conduct more detailed study on the effect of work environment control on other genotoxic markers specific to metal exposure.

## CONCLUSION

There was a significant correlation between work environment control and wild P53 level. The better and more correct the implementation of work environment control, the higher the wild P53 level.

## REFERENCES

Anusavice, K.J.,Shen, C., & H. R. Rawls, H.R. (2013). Phillips' Science Of Dental Materials, 12th Ed. St. Louis: Saunders.

Al-Hourani, Z., Al-Sarhani, M., Student, M. S., & Al-Khatib, A. (2013). Chromium and Cobalt Levels among Dental Technicians in The Northern Jordan. *European Scientific Journal, ESJ*, *9*(21). https://doi.org/10.19044/ESJ.2013.V9N21P

Aryani, R. (2009). Studi Detreksi DNA adduct-8-Hidoksi-2-Deoksiguanosin-sebagai biomarker resiko kanker pada Petugas beberapa SPBU di Jakarta. *Skripsi*. FMIPA:UI.Depok

Dunnick, J., Elwell, M., Radovsky, A., Benson, J., Hahn, F., Nikula, K., Barr, E., & Hobbs, C. (1995). Comparative carcinogenic effects of nickel subsulfide, nickel oxide, or nickel sulfate hexahydrate chronic exposures in the lung. *Cancer Research*.

Ergün, D., Ergün, R., Özdemir, C., Öziş, T. N., Yilmaz, H., & Akkurt, İ. (2014). Pneumoconiosis and respiratory problems in dental laboratory technicians: Analysis of 893 dental technicians. *International Journal of Occupational Medicine and Environmental Health*, *27*(5), 785–796. https://doi.org/10.2478/S13382-014-0301-9

Fabrizio, E., Vanacore, N., Valente, M., Rubino, A., & Meco, G. (2007). High prevalence of extrapyramidal signs and symptoms in a group of Italian dental technicians. *BMC Neurology*, *7*. https://doi.org/10.1186/1471-2377-7-24

Hariyani, N., Berniyanti, T., & Setyowati, D. (2015). Effects of Occupational Environmental Controls on the Level of Co, Ni and Cr among Dental Technicians. *International Journal of Environmental Science and Development*, *6*(9), 643–647. https://doi.org/10.7763/IJESD.2015.V6.673

Havrilesky, L., Darcy, K. M., Hamdan, H., Priore, R. L., Leon, J., Bell, J., & Berchuck, A. (2003). Prognostic significance of p53 mutation and p53 overexpression in advanced epithelial ovarian cancer: a Gynecologic Oncology Group Study. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*, *21*(20), 3814–3825. https://doi.org/10.1200/JCO.2003.11.052

Herlia Nur Istindiah, author. (2003). *Penggunaan saliva untuk mendeteksi kanker/Herlia Nur Istindiah, Elza Ibrahim Auerkari*. https://lib.ui.ac.id

Kumar, V., Robbins, & Leonard, S. (2010). Neoplasia In:Robbins & Cotran Pathologic Basis Of Disease, 8th Ed. Philadelphia: Saunders Elsevier, 269-342.

Lison, D., De Boeck, M., Verougstraete, V., & Kirsch-Volders, M. (2001). Update on the genotoxicity and carcinogenicity of cobalt compounds. *Occupational and Environmental Medicine*, *58*(10), 619–625. https://doi.org/10.1136/OEM.58.10.619

Lu, H., Shi, X., Costa, M., & Huang, C. (2005). Carcinogenic effect of nickel compounds. *Molecular and Cellular Biochemistry*, *279*(1–2), 45–67. https://doi.org/10.1007/S11010-005-8215-2

Merzenich, H., Hartwig, A., Ahrens, W., Beyersmann, D., Schlepegrell, R., Scholze, M., Timm, J., & Jöckel, K. (2001). Biomonitoring on carcinogenic metals and oxidative DNA damage in a cross-sectional study. *Cancer Epidemiology, Biomarkers & Prevention: A Publication of the American Association for Cancer Research, Cosponsored by the American Society of Preventive Oncology*.

Munir, D., Lutan, R., Hasibuan, M., & Henny, D. F. (2007). Ekspresi Protein p53 Mutan pada Karsinoma Nasofaring. *Karangan Asli Majalah Kedokteran Nusantara*, *40*(3).

Petrović, D., Krunić, N., & Kostić, M. (2013). Risk factors and preventive measures for occupational diseases in dental technicians. *Vojnosanitetski Pregled*, *70*(10), 959–963. https://doi.org/10.2298/VSP1310959P

Prasad. (2012). Neoplasia – Images and Tables. Robbin's Pathologic basis of disease, Ed 8th.

Shantiningsih, R., Silviana Farrah Diba, dan, Radiologi Dentomaksilofasial, B., Kedokteran Gigi, F., Gadjah Mada, U., & Kepaniteraan, M. (2015). Efek Aplikasi Patch Gingiva Mukoadesif β-Carotene Akibat Paparan Radiografi Panoramik. *Majalah Kedokteran Gigi Indonesia*, *1*(2), 186–192. https://doi.org/10.22146/MAJKEDGIIND.9121

Suma'mur P. K. (1996). Keselamatan Kerja dan Pencegahan Kecelakaan. Jakarta: CV Haji Massagung.

Valko, M., Morris, H., & Cronin, M. (2005). Metals, toxicity and oxidative stress. *Current Medicinal Chemistry*, *12*(10), 1161–1208. https://doi.org/10.2174/0929867053764635

Wang, S., & Shi, X. (2001). Mechanisms of Cr (VI)-induced p53 activation: the role of phosphorylation, mdm2 and ERK. *Carcinogenesis*, *22*(5), 757–762. https://doi.org/10.1093/CARCIN/22.5.757

# Correlation between Work Environment Control and P53 Level Among Dental Technicians

ORIGINALITY REPORT

| 19% | 19% | 7% | 13% |
| --- | --- | --- | --- |
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
| --- | --- | --- |
| 1 | repository.unair.ac.id<br>Internet Source | 14% |
| 2 | ojs.iik.ac.id<br>Internet Source | 4% |
| 3 | jurnal.poltekeskupang.ac.id<br>Internet Source | 2% |

Exclude quotes On
Exclude bibliography On
Exclude matches < 2%