The correlation between the use of personal protective equipment and level wild-type p53 of dental technicians in Surabaya

by Puspa Dila Rohmaniar

Submission date: 08-Feb-2019 10:52AM (UTC+0800)
Submission ID: 1074784671
File name: 4073-12495-4-PB.pdf (464.04K)
Word count: 3092
Character count: 16670

Dental Journal
Majalah Kedokteran Gigi

Dental Journal
(Majalah Kedokteran Gigi)
2017 March; 50(1): 19–22

Research Report

The correlation between the use of personal protective equipment and level wild-type p53 of dental technicians in Surabaya

Puspa Dila Rohmaniar,[1] Titiek Berniyanti,[2] and **Retno Pudji Rahayu[3]**
[1]Department of Dental Public Health, Faculty of Dentistry, Insitut Ilmu Kesehatan Bhakti Wiyata, Kediri - Indonesia
[2]Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga, Surabaya – Indonesia
[3]Department of Oral Pathology and Maxillofacial, Faculty of Dental Medicine, Universitas Airlangga, Surabaya - Indonesia

ABSTRACT

Background: *Exposure of metals among dental technicians that come from the working environment can lead to the formation reactive oxygen species (ROS). ROS can cause mutations in the p53 gene (p53). The mutation is transversion mutation Guanine-Thymine. p53 mutations can lead to low expression of the wild-type p53 protein (p53). Wild-type p53 involved in many biological processes such as regulation of genes involved in cell cycle, cell growth after DNA damage, and apoptosis. However, exposure to metals among dental technicians can be prevented through the use of personal protective equipment (PPE) during work.* ***Purpose:*** *The purpose of this study was to analyze the correlation between the use of personal protective equipment to wild-type p53 protein levels among dental technicians in Surabaya.* ***Method:*** *This study was observational analytic with cross sectional approach. 40 samples were taken by random sampling. Data were retrieved through interviews and observations. Wild-type p53 was analyzed from saliva with indirect ELISA method. Analysis of data used Kolmogorov Smirnov normality test and a Pearson correlation test. Value significance was p<0.05 (95% confidence level).* ***Result:*** *There was a significant association between the use of personal protective equipment with wild-type p53 levels with p=0.002* ***Conclusion:*** *The use PPE properly is positively correlated with the wild-type p53 protein levels of dental technicians in Surabaya.*

Keywords: *personal protective equipment; dental technician; P53 wild*

Correspondence: Titiek Berniyanti, Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga. Jl. Mayjend. Prof. Dr. Moestopo no. 47 Surabaya 60132, Indonesia. E-mail: berniyanti@gmail.com

INTRODUCTION

Dental technician should be exposed to various physical agents, chemical, and biological derived from the work environment. That exposure by inhalation, ingestion or skin contact.[1] Exposure of dust or smoke to the dental technician are coming from grinding of dental restoration materials during processing.[2] There is a study that reported high concentrations of cobalt metal, nickel, chromium in blood of dental technicians in Surabaya, such as: levels of cobalt: 27 g/ L, nickel 37 g/ L, and chromium 117 mcg/ L.[3] Other research in northern Jordan also reported high levels of cobalt and chromium in blood of dental technicians. [2] Exposure may result in potential lung diseases such as bronchial asthma, cancer, mesothelioma and pneumoconiosis depends on the duration of exposure.[4] The prevalences of contact dermatitis among dental technicians are 22% in Australia and 43% in Denmark.[5] The prevalence of pnumoconis among dental technicians in Ankara is 10.1% and the prevalence of dermatitis kontakta of the dental technicians in Germany is 16%.[4]

It is important for dental technicians to obey the standards and safety procedures. Dental technicians must wear personal protective equipment (PPE) including work wear, protective mask, protective gloves and goggles, and ventilate the workplace. If ventilation, exhauster, adequate and adequately filter will reduce the level of chromium, cobalt, and nickel in the air.[1]

Genotoxic metal exposure may increase the number of reactive oxygen species (ROS). The metal ions of chromium, cobalt, and nickel can produce hydroxyl radicals (OH) through the Fenton and Haber-Weis reaction. The

Dental Journal (Majalah Kedokteran Gigi) p-ISSN: 1978-3728; e-ISSN: 2442-9740. Accredited No. 56/DIKTI/Kep./2012.

DOI: 10.20473/j.djmkg.v50.i1.p19-22

hydroxyl radicals can cause DNA damage.[6] Typical damage caused by DNA oxidation is a transversion mutations in guanine.[7] p53 protein is involved in various biological processes such as regulation of genes involved in cell cycle, cell growth after DNA damage, and apoptosis.[8] p53 is considered as the gene most commonly mutated in human malignant tumors. p53 tumor suppressor gene is mutated in 50% of human tumors in various organs. With the development of molecular biology techniques can explain that one of the causes of the malignant process is a failure or inactivation of tumor suppressor genes p53.[7,9] Cells that have mutations or loss of wild-type p53 gene, the p53 protein expression wild does not occur or occurs wild-type p53 protein expression but can not function as activating gene transcription in some target.[10]

p53 protein expressed by tumor suppressor p53 gene can be detected through saliva. Saliva is a diagnostic medium for the detection of various molecules contained in the blood; saliva can provide similar information about the human status as obtained from a blood test without invasive procedures.[11] The purpose of this study was to analyze the correlation between the use of personal protective equipment and wild-type p53 protein levels among the dental technicians in Surabaya.

MATERIAL AND METHODS

The Ethics Committee of the Faculty of Dental Medicine, Universitas Airlangga has approved the implementation of this study, and all respondents in this study had signed a written consent. This study was conducted among 40 dental technicians in Surabaya. Sampling was done by random sampling with sample criteria namely; working on dentures with metal-containing material mixed Ni, Co and, Cr for more than 3 years.[3] All the participants were accepted all procedures such as saliva examination, answering questions and using PPE through a questionnaire. The criteria gender are not differentiated because gender differences have no significant effects on the levels of p53.[12,13]

The use of PPE during working hours by participants is via observations and questions using questionnaires and then do the scoring. Examinations of PPE include the frequency and manner of use of masks, gloves, goggles, laboratories work clothes, and shoes by a dental technician.

Before taking saliva samples, subjects were instructed to not eat, smoke, antiseptic gargle one hour earlier.[14] Each saliva sample was taken between at 10.00 a.m -13.00 p.m.[12] The participants were asked to first collect their saliva and accumulated it in their mouth then instructed to spit 3cc into a tube. Each sample of saliva collected was centrifuged 2000 rpm for 10 minutes in order to obtain supernatan.[12]

The level of p53 wild was analysed at the Institute of Tropical Disease, Universitas Airlangga. p53 saliva levels were checked by indirect ELISA method using Human TP53 (tumor protein p53) ELISA kit (Elabscience Biotechnology Co., Wuhan, Hubei, China). Rating score of PPE based on exposure categories main lines of metal that enters the body. Masks and gloves have the highest percentage due to exposure to the metal enters the body through three main channels; respiratory, oral, and skin.[15] How to score PPE is based on research conducted by Risdayanti.[16] Categories score of PPE usage frequenty score questionnaires are divided into: always, rarely, and never with respective scores of 100, 50, and 0. Categories score of PPE usage procedures are divided into: true, is not always true, and not true with respective scores of 100, 50, and 0. Summing scores PPE usage frequency and usage procedures PPE score. The score was multiplied by the percentage weighting of PPE. The percentages of weighting were 30% for mask , 25% gloves, 20% for goggles, 15% for laboratories work clothes and 10% for shoes.

RESULTS

Based on observations and questionnaires the use of PPE and p53 levels among dental technician in Surabaya. In Table 1 shows the average score PPE dental technicians in Surabaya is 86.19 ± 27.41. The average P53 wild score

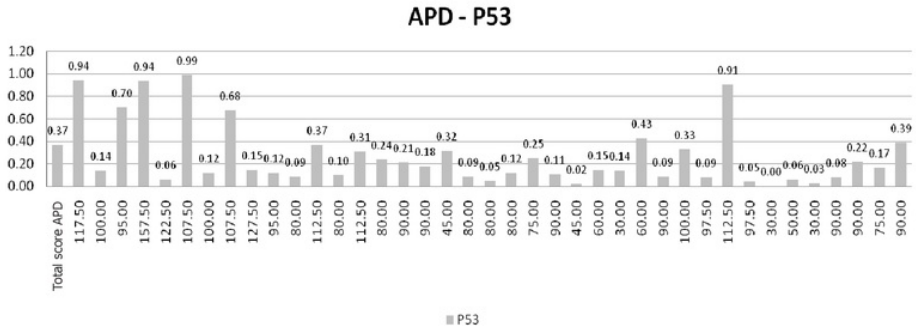

Figure 1. Relationship p53wild levels with a score of use PPE.

Dental Journal (Majalah Kedokteran Gigi) p-ISSN: 1978-3728; e-ISSN: 2442-9740. Accredited No. 56/DIKTI/Kep./2012.

Available at http://e-journal.unair.ac.id/index.php/MKG
DOI: 10.20473/j.djmkg.v50.i1.p19-22

dental technicians is 0.27 ± 0.28. Figure 1 shows that levels p53 increase as increasing score of PPE. Table 2 shows the significance correlation test Pearson between score of PPE and level wild-type p53 saliva among dental technicians is p= 0,002 with significance value of p<0.05. the correlation Pearson value is R = 0.446

DISCUSSION

Based on the results of this study showed there were positive correlation between the levels of wild-type p53 with a score of use of personal protective equipment at the dental technicians in Surabaya. If dental technician used PPE appropriately during work, so the levels of wild-type p53 was higher too. Because protective clothing, protective mask, protective gloves and goggles can prevent metal exposure during work.[1] This metal exposure can increase the number ROS endogenous.[17] Increasing ROS can oxidize DNA and produce 8-hidroksi-deoksiguanosin (8-OH-dG). This products induce transversions mutation guanine into thymin,[18] the same typical mutations occurs in p53 gene. [7] Cells that have mutations or loss of the p53 gene, the expression of p53 (p53 protein) might or might not occur p53 protein expression but if occurred it could not be functioning as an activating gene transcription in some target.[10]

The dental technicians in Surabaya, on average, did not use PPE properly during the work, so the wild-type p53 levels in saliva became lower than normal.[12,19] This occurs because of exposure to the metal derived from a dental technician working environment can not be prevented through the use of personal protective equipments which include the use of masks, gloves, goggles, clothing and lab work, special shoes. When the use of personal protective equipment is adequate then it will reduce the level of chromium, cobalt, and nickel in blood.[1] Masks can minimize the chemical exposure entering the respiratory tract. The results showed that the efficiency of face masks appropriate to reduce exposure to chemicals are inhaled to reach 70% -95%.[20] Disposible latex gloves can inhibit the penetration of chemicals through the skin.[21] .Goggles, protective clothing and shoes can reduce chemical exposure. [22,23,24]

Nickel, chromium, and cobalt can enter to the body through of inhalation, oral and skin contact. Inhalation exposure is exposure to the metal through the respiratory tract. Inhalation exposure become the main route of exposure entry of metal into the human body.[15,25] Digestion and inhalation exposure can accumulate in the oral cavity. The trachea and bronchi are covered by the ciliated epithelium and coated by a thin layer of mucus secreted from goblet cells. Cilia and mucus in the bronchi and trachea epithelial layer can be pushing up the particles that accumulated toward to the mouth surface. Particles that containing mucus then discharged from the respiratory tract with spit or swallow. Some particles fagosited by macrophages, but some are absorbed through the epithelial tissue and then diffuses and circulating into the blood vessel.[26,27] Molecular components in the blood vessels can entry into saliva through transcellular pathway (passive diffusion and active transport) and paracellular pathways (ultrafiltration). The composition of saliva and then is secreted into transport molecules from blood to saliva.[11]

The other hand, nickel may activate hypoxia-signaling pathways by mediating transcription factor hypoxia induced factor-1 (HIF-1). Nickel plays a role in inactivating the enzyme prolyl hydroxylase, resulting in hipoksia.[28] HIF-1 is downregulated by tumor suppressor protein p53 homeodomain-interacting protein kinase-2 (HIPK2).[29]

Genotoxic metal exposure can increase the number ROS endogenous. The metal ions of chromium, cobalt, and nickel can produce hydroxyl radicals (OH) through the Fenton and Haber- Weis reaction. Fenton reaction is the reaction of the transition metal ion with H2O2 to generate OH radicals and metal ions are oxidized. Chromium, cobalt and nickel are type reagent Fenton. Haber- Weiss reaction is a reaction consisting of oxidation of the metal ions are reduced by O2 and then react with H_2O_2 to produce OH- radicals.[17]

The hydroxyl radical Fenton reaction and results from Haber-weiss can cause DNA damage.[6] Typical damage caused by oxidation of DNA are guanine transversion into thymine in p53 (p53 gene).[7] Cells that have mutations or loss of the p53 gene, the expression of p53 (p53 protein) does not occur or occurs p53 protein expression but can not function as activating gene transcription in some target.[10] It can be concluded that the use PPE properly was positively correlated with the wild-type p53 protein levels in dental technicians, the use of PPE appropriately during work, prevented metal exposure, and decreased levels of p53. The contribution of PPE on the level of p53 wild on dental technicians was really significant.

Table 1. Mean and standard deviation score the use of PPE and levels of wild-type p53

	Score PPE	p53
n	40	40
Mean ± SD	86.19 ± 27.41	0.27 ± 0.28

Table 2. Relationship scores the use of PPE and levels of wild-type p53 protein among dental technicians in Surabaya

Independent variable	Dependent variable	P	R
Score PPE	Level p53	0,002	0,466

* P<0.05 = significant correlation

Dental Journal (Majalah Kedokteran Gigi) p-ISSN: 1978-3728; e-ISSN: 2442-9740. Accredited No. 56/DIKTI/Kep./2012.
 Available at http://e-journal.unair.ac.id/index.php/MKG
DOI: 10.20473/j.djmkg.v50.i1.p19-22

ACKNOWLEDGEMENT

Gratitude to Higher Education which has provided assistance through the supervisor to facilitate this research and to all dental technicians in Surabaya to participate.

REFERENCES

1. Anusavice KJ, Shen C, Rawls HR. Phillips' science of dental materials. 12th ed. St. Louis: Saunders; 2013. p. 8.
2. Al-Hourani Z. Chromium and cobalt levels among dental technicians in the northern jordan. European Scientific Journal 2013; 9(21): 130.
3. Hariyani N, Berniyanti T, Setyowati D. Effects of occupational environmental controls on the level of Co, Ni and Cr among dental technicians. International Journal of Environmental Science and Development 2015; 6(9): 1-4.
4. Ergün D, Ergün R, Ozdemir C, Oziş TN, Yilmaz H, Akkurt I. Pneumoconiosis and respiratory problems in dental laboratory technicians: analysis of 893 dental technicians. Int J Occup Med Environ Health 2014; 27(5): 785-96.
5. Petroviü D, Kruniü N, Kostiü M. Risk factors and preventive measures for occupational diseases in dental technicians .Vojnosanit Pregl 2013; 70(10): 959–63.
6. Valko M, Morris H, Cronin MT. Metals, toxicity and oxidative stress. Curr Med Chem 2005; 12(10): p. 1161-208.
7. Lu H, Shi X, Costa M, Huang C. Carcinogenic effect of nickel compounds. Mol Cell Biochem 2005; 279(1-2): 45-67
8. Hassan NM, Tada M, Hamada J. Presence of dominant negative mutation of TP53 is a risk of early recurrence of oral cancer. Cancer Lett 2008; 270(1): 108-19.
9. Munir D, Lutan R, Hasibuan M, Henny F. Ekspresi protein p53 mutan pada karsinoma nasofaring. Majalah Kedokteran Nusantara 2007; 40(3): 168.
10. Kumar V, Robbins, Neoplasia LS. In: Robbins & Cotran pathologic basis of disease. 8th ed. Philadelphia: Saunders Elsevier; 2010. p. 269-342.
11. Istindiah HN, Auerkari EI. Penggunaan saliva untuk mendeteksi kanker. Jurnal Kedokteran Gigi Universitas Indonesia 2003; vol 10(Edisi Khusus): 279 -81.
12. Hozzeini FA, Dizgah IM, Zarandi NS. Unstimulated salivary p53 in patients with oral lichen planus and squamous cell carcinoma. Acta Medica Iranica 2015; 53(7): 440-43.
13. Lee JJ, Kuo MY, Cheng SJ, Chiang CP, Jeng JH, Chang HH, Kuo YS, Lan WH, Kok SH. Higher expressions of p53 and proliferating cell nuclear antigen (PCNA) in atrophic oral lichen planus and patients with areca quid chewing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;99(4): p. 471-8. Engelen L, de Wijk RA, Prinz JF, van der Bilt A, Bosman F. The relation between saliva flow after different stimulations and the perception of flavor and texture attributes in custard desserts. Physiol Behav 2003; 78(1): 165-9.
14. Costa M. Molecular mechanism of nickel carcinogenesis. Biol Chem 2002; 383(6): p 69-75
15. Risdayanti A. Perilaku pemakaian alat pelindung diri pada teknisi gigi terhadap paparan bahan kimia di laboratorium gigi surabaya. Skripsi. Surabaya: Fakultas Kedokteran Gigi Universitas Airlangga; 2010.
16. Stephen L, Harris G, Xianlin. Metal- induced oxidative stress and signal transduction. Free Radical Biology and medicine 2004; 37(12): 1921-42.
17. Sudjarwo .8-hidroksi-deoksiguanosin sebagai salah satu indikator infertilitas pria. Berk. Penel. Hayati; 2004; vol 10. P. 43–47
18. Streckfus C, Bigler L, Tucci, Thigpen JT. A preliminary study of cal5-3, c-erbb-2, epidermal growth factor receptor, cathepsin-d, and p53 in saliva among women with breast carcinoma. Cancer Investigation 2000; 18(2): 101-9.
19. Kundie, FAM. Mohamed, SH. Issaid, MA. Omran, A. Evaluation of dental technicians awareness of health and safety rule in dental laboratories at some cities in libya. International Journal of Engineering; 2010: 7(2). P. 126.
20. Phalen, RN. Le, T. Wong, WK. Changes in Chemical Permeation of Disposable Latex, Nitrile and Vinyl Gloves Exposed to Simulated Movement. J Occup Environ Hyg 2014; 11(11): p. 716–721
21. Sunarto. Keselamatan dan Kesehatan Kerja Laboratorium Kimia. Yogyakarta: FMIPA UNY; 2008. p. 3.
22. Tran, TAD. Arnold, M. Schacher, L. Adolphe, DC. Reys, G. Development of Personal Protection Equipment for Medical Staff: Case of Dental Surgeon. AUTEX Research Journal 2015; 15(4): pp. 280-287.
23. Yurdasal, B. Bozkurt, N. Bozkurt, AI. Yilmaz, O. The evaluation of the dust-related occupational respiratory disorders of dental laboratory technicians working in Denizli Province. Annals of Thoracic Medicine; 2015: 10(4). pp. 249-255.
24. Susanto DA. Pnumokoniosis. J. Indon Med Assoc. 2011; 61(12): 503-50.
25. Wirasuta IMG, Niruri R. Buku ajar toksikologi umum. Denpasar: Farmakologi Universitas Udayana; 2010. p. 12.
26. Djojodibroto D. Respirologi. Jakarta: Penerbit Buku Kedokteran EGC; 2007. p. 11-12.
27. Todd Davidson, Qunwei Zhang, Lung Chi Chen, Weichen Su, and Max Costa. The Involvement of Hypoxia-inducible Transcription Factor-1-dependent in Nickel Carcinogenesis. Cancer Research 2003; vol 63: p 3524–3530.
28. Obacz J, Pastorekova S, Vojtesek, and Hrstka R. Cross-talk between HIF and p53 as mediators of molecular responses to physiological and genotoxic stresses. Mol Cancer 2013; 12(93): p 2-7

DOI: 10.20473/j.djmkg.v50.i1.p19-22

The correlation between the use of personal protective equipment and level wild-type p53 of dental technicians in Surabaya

ORIGINALITY REPORT

19%	17%	11%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	biomed.papers.upol.cz Internet Source	1%
2	Submitted to Collin County Community College Student Paper	1%
3	Miaozong Wu, James McIntosh, Jian Liu. "Current prevalence rate of latex allergy: Why it remains a problem?", Journal of Occupational Health, 2016 Publication	1%
4	www.med.uu.nl Internet Source	1%
5	Charles Streckfus. "A Preliminary Study of CA15-3, c-erbB-2, Epidermal Growth Factor Receptor, Cathepsin-D, and p53 in Saliva Among Women with Breast Carcinoma", Cancer Investigation, 2000 Publication	1%
	ah.mc.ntu.edu.tw	

6	Internet Source	1%
7	www.stanford.edu Internet Source	1%
8	www.aimsci.com Internet Source	1%
9	Submitted to Kaplan University Student Paper	1%
10	www.cqm.rs Internet Source	1%
11	www.aoemj.com Internet Source	1%
12	Amal Mohamed Kamal El Safty, Aisha Mohamed Samir, Mona Kamal Mekkawy, Marwa Mohamed Fouad. "Genotoxic Effects Due to Exposure to Chromium and Nickel Among Electroplating Workers", International Journal of Toxicology, 2018 Publication	1%
13	Submitted to Loma Linda University Student Paper	1%
14	drc.tums.ac.ir Internet Source	1%
15	ojs.unud.ac.id Internet Source	1%

16	journal.bio.unsoed.ac.id Internet Source	1%
17	www.medfak.ni.ac.rs Internet Source	1%
18	etd.ohiolink.edu Internet Source	1%
19	www.jcdr.net Internet Source	1%
20	www.degruyter.com Internet Source	<1%
21	www.mst.dk Internet Source	<1%
22	dent.unhas.ac.id Internet Source	<1%
23	Submitted to Manchester Metropolitan University Student Paper	<1%
24	Seemann, Séverine, Daniela Maurici, Magali Olivier, Claude Caron Fromentel, and Pierre Hainaut. "The Tumor Suppressor Gene TP53: Implications for Cancer Management and Therapy", Critical Reviews in Clinical Laboratory Sciences, 2004. Publication	<1%

25	mit5.meiho.edu.tw Internet Source	<1%
26	ayubmed.edu.pk Internet Source	<1%
27	journal.waocp.org Internet Source	<1%
28	ijomeh.eu Internet Source	<1%
29	anti-agingfirewalls.com Internet Source	<1%
30	repository.usu.ac.id Internet Source	<1%
31	intl-cancerres.aacrjournals.org Internet Source	<1%
32	unair.ac.id Internet Source	<1%
33	intl-ajplung.physiology.org Internet Source	<1%
34	fr.scribd.com Internet Source	<1%
35	Adekunle Ibrahim Musa, Oluseyi A. Orelaja. "Ergonomic Consideration of the Effect of Flour Dust on Peak Expiratory Flow Rate of Bakers in Abeokuta, Ogun State",	<1%

TRANSACTIONS of the VŠB – Technical University of Ostrava, Safety Engineering Series, 2017

Publication

Exclude quotes	On	Exclude matches	< 5 words
Exclude bibliography	Off		

The correlation between the use of personal protective equipment and level wild-type p53 of dental technicians in Surabaya

GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4