The Effect of Passive and Active Smoking on Nasal Mucociliary Clerarance Time

Pasif ve Aktif Sigara Kullanımının Nazal Mukosiliyer Klirens Süresi Üzerine Etkisinin Değerlendirilmesi

Passive and Active Smoking, Nasal Mucociliary Clearance

Gül Soylu Özler[1], Gökçe Özel Şimşek[2], Ercan Akbay[1], Ertap Akoğlu[1]
[1]Mustafa Kemal University, Department of Otorhinolaryngology, Hatay,
[2]Kırıkkale University, Department of Otorhinolaryngology, Kırıkkale, Türkiye

22 Mayıs 2014 tarihinde 10. Türk Rinoloji Kongresi'nde sözlü sunum olarak sunulmuştur.

Özet

Amaç: Bu çalışmanın amacı pasif ve aktif sigara kullanımının nazal mukosiliyer klirens süresi üzerine etkisini yaş ve cinsiyet bakımından benzer sağlıklı bireyler, pasif ve aktif sigara kullanıcılarının sonuçlarını karşılaştırarak araştırmaktır. Gereç ve Yöntem: Yetmiş beş hasta kriterleri karşıladı ve 3 gruba ayrıldı: 25 sağlıklı, aktif ya da pasif kullanımı olmayan olgu, 25 pasif sigara kullanıcısı ve 25 aktif sigara kullanıcısı çalışma grubunu oluşturmakta idi. Ayrıntılı anamnez, kulak burun boğaz muayenesi ve nazal endoskopi sonrasında nazal mukosiliyer klirens süresi ölçüldü ve karşılaştırıldı. Ayrıca, aktif sigara kullanıcısı grubunda sigara tüketim miktarı paket yıl olarak hesaplandı ve nazal mukosiliyer klirens süresi uzaması ile sigara tüketim miktarı arasındaki korelasyon değerlendirildi. Bulgular: Ortalama nazal mukosiliyer klirens süresi pasif ve aktif sigara kullanımı olan gruplarda sağlıklı gruba göre anlamlı derecede daha uzamış olarak saptandı (p=0,0001). Pasif ve aktif sigara kullanımı olan grupların ortalama nazal mukosiliyer klirens süresi istatistiksel olarak farklı bulunmadı(p≥0,05). Aktif sigara kullanımı olan grupta sigara tüketim miktarı ile ortalama nazal mukosiliyer klirens süresinde uzama arasında pozitif korelasyon saptandı(p=0,0001,r=0.433). Tartışma: Bu çalışmada, pasif ve aktif sigara kullanımının nazal mukosiliyer klirens süresini uzattığı saptanmıştır. Tütüne maruziyet astım, kronik rinosinüzit ve alt solunum yolu enfeksiyonları ile ilişkilidir. Bu durum, uzamış nazal mukosiliyer klirens süresi ile ilişkili olabilir.

Anahtar Kelimeler

Pasif Sigara Kullanımı; Aktif Sigara Kullanımı; Nazal Mukosiliyer Klirens Süresi

Abstract

Aim: The aim of this study was to investigate the effect of passive and active smoking on NMC by comparing the results of age and sex matched healthy individuals, passive and active smokers. Material and Method: A total of 75 subjects met the criteria and were divided into three groups: control group (nonsmokers, group 1, n =25), passive smokers group(group 2, n =25), active smokers group (group 3, n =25). NMC of these subjects were measured and compared. Moreover, the amount of cigarette consumption of active smokers group were calculated as package to year and the correlation between NMC and the amount of cigarette consumption. in active smokers group were evaluated. Results: The mean NMC in passive smokers group and active smokers group were significantly longer than the control group (p=0,0001) The comparison of NMC values between the passive smokers group and the active smokers group revealed no statistically significant differences (p≥0,05). There was positive correlation between the increase in NMC and amount of cigarette consumption in the active smokers group (p=0,0001,r=0.433). Discussion: Both active and passive smoking prolonged nasal mucociliary clearance time when they were compared with healthy controls. Tobacco exposure is associated diseases such as asthma, chronic rhinosinusitis, and lower airway infections. It may be related to the direct effect of prolonged NMC.

Keywords

Passive Smoking; Active Smoking; Nasal Mucociliary Clearance Time (NMC)

DOI: 10.4328/JCAM.2614 Received: 09.06.2014 Accepted: 27.06.2014 Printed: 01.03.2016 J Clin Anal Med 2016;7(2): 149-51
Corresponding Author: Gül Soylu Özler, Mustafa Kemal University,Department of Otorhinolaryngology, Hatay, Türkiye.
T.: +90 3262293323 GSM: +905053980778 E-Mail: soylugul@yahoo.com

Introduction

Mucociliary clearance of respiratory mucosa is the primary defense mechanism in the human airways. Mucociliary activity of the nose helps to remove foreign particles, pathogens, and toxins by transporting the mucus layer that covers the nasal epithelium towards the nasopharynx and it also helps to keep the mucosal surfaces moist by mucous gland secretions to obtain normal nasal physiology[1]. Nasal mucociliary clearance time (NMC) can be affected from some rhinological pathologies (allergic rhinitis, sinusitis, nasal polyposis), trauma, sinonasal surgery[2,3]. It has also been shown that NMC can be affected from toxins, drugs, environmental heat, smoking, pressure, pH, and so on.

The association of smoking and NMC has been studied; however, the correlation of passive smoking and NMC has not been clearly documented yet. Although many studies have investigated the association of smoking and NMC[4-6], there is only one study investigating the relationship between passive smoking and NMC[7].

Because of insufficient data about the relationship between passive smoking and NMC, we aimed to investigate the effect of passive and active smoking on NMC by comparing the results of age and sex matched healthy individuals, passive and active smokers.

Material and Method

Study Design

This study was conducted between January 2014 and April 2014 in the otorhinolaryngology Department of Mustafa Kemal University. Ethics committee approval was obtained and the study was conducted adhering to the Declaration of Helsinki. Informed consent was obtained from all subjects.

Study Population

One hundred ten voluntary subjects who referred to our clinic for symptoms other than rhinological diseases were enrolled in the study. The evaluation of subjects revealed detailed history, ear, nose and throat examinations and nasal endoscopic evaluations in every patient. At least 3 years of smoking history or passive smoke exposure time was required in order to be included to our study. Subjects those having a history of allergy or asthma; upper respiratory tract infection during the previous 2 months; a nasal pathology causing nasal obstruction such as sinusitis, septum deviation, nasal polyposis or bullous concha; having a history of nasal or paranasal operation; history of any medication; history of any systemic disease were excluded from the study. A total of 75 subjects met the criteria and were divided into three groups: control group (nonsmokers, Group 1, n =25), passive smokers group(Group 2, n =25), active smokers group (Group 3, n =25). NMC of these subjects were measured and compared. Moreover the amounts of cigarette consumption of active smokers group were calculated as package to year and the correlation between NMC and the amount of cigarette consumption in active smokers group were evaluated.

Measurement of NMC

Nasal mucociliary clearance times were evaluated with the saccharin tests performed by the same clinician at otorhinolaryngology clinic who was unaware of state of the subjects. Patients were asked to blow their nose and not to consume any food or drink 1 hour before the test. Patients were allowed to rest for 30 min before the measurement. While the patient was sitting in an upright position, a saccharin tablet having a diameter of approximately 1.5mm (1/4 saccharin tablet) was placed into the medial aspect of the lower concha using a bayonet forceps. Patients were asked not to sneeze, sniff or wipe their noses during the test. Until the time of saccharin taste after placement of the tablet, patients were instructed to swallow at 30-second intervals and to inform about the time when they taste saccharin. The time taken by the subjects from placement of particle to the perception of the sweet taste was measured by a chronometer and recorded as NMC.

Statistical analysis

Statistical analysis was performed using the SPSS (Statistical Package for the Social Sciences) 13.0 Evaluation for Windows. One-way ANOVA test was used to compare the data between group in quantitative parameters showing normal distribution, and the Turkey HSD test was used for the determination of the group responsible for the difference. The Kruskal-Wallis test was used in the assessment of parameters according to groups. The Mann-Whitney U test was used for the evaluation of differences. The statistically significant level was accepted as a p value<0.05.

Results

Demographic data

The control group consisted of 9 women and 16 men, with a mean age of 41.32±7.26 years ; the passive smoking group consisted of 10 women and 15 men, with a mean age of 42.96±8.07 years; the active smoking group consisted of 8 women and 17 men, with a mean age of 38.92±7.16 years. The groups were similar in terms of sex and age (p=0.069, p=0.046).

Nasal Mucociliary Clearance Time

The mean NMC value in the control group was 11,68 ±2.80; in the passive smoking group, it was 15,08± 3,41; and in the active smoking control group, it was 15,3± 2,34. The mean MMC in passive smoking group and active smoking group were significantly longer than the control group (p=0,0001) (Figure 1). The comparison of NMC values between the passive smoking group and the active smoking group revealed no statistically significant differences (p≥0,05). There was positive correlation between the increase in NMC and amount of cigarette consumption (p=0,0001, r=0.433).

Discussion

Mucociliary clearance is the first defense mechanism of the respiratory tract. Particles that may be harmful are trapped by the mucus blanket and removed from the nasal cavity to the nasopharynx by the movements of cilia[8]. Then, they are either swallowed or coughed up.

While techniques to measure clearance time in trachea and bronchi are time consuming, and expensive, the measurement of NMC using saccharin test is a good alternative to represent the clearance in trachea and bronchi[9]. Various studies state

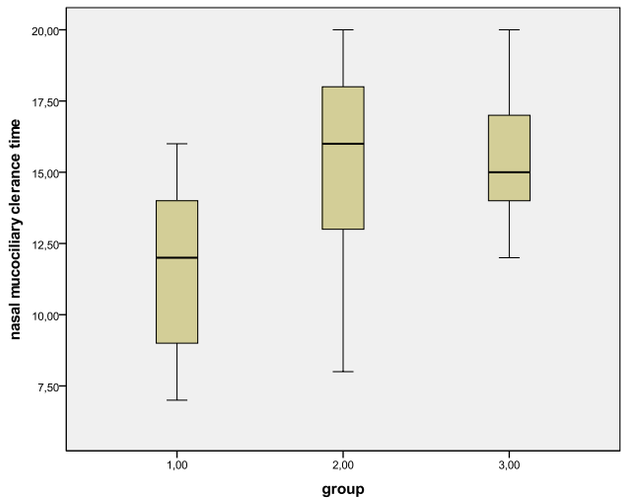

Figure 1. The mean NMC in healthy individuals, passive and active smokers

that the saccharin test is a simple, inexpensive technique to measure NMC with a chance of repeatability[10].

Normal mucociliary transit time in humans has been reported to be 12 to 15 min. Prolonged transit times are considered to be impaired mucociliary clearance that may lead up to long-term respiratory tract diseases, sinonasal and middle ear infections[11].

There are various factors effecting mucociliary clearance time such as temperature, moisture, partial oxygen pressure , pH, cigarette and various inhalation agents; anatomic barriers as septum deviation, adenoid hypertrophy and systemic diseases such as viral infections,

chronic sinusitis, chronic and allergic rhinitis, cystic fibrosis, bronchiectasis, chronic bronchitis and diabetes mellitus[2,3,12]. Smoking is also a well-known factor that could have an effect on NMC. It has been shown that cigarette smoke inhibits ciliary beat frequency[13,14]. Also NMC has been shown to be slower in regular smokers up to the ciliostatic effect of tobacco smoke, decrease in cilia number and changes in the viscoelastic properties of mucus[4,15,16]. However, Quinlan et al. did not observe any such difference in NMC in smokers[17].

However, in the literature, the relationship between nasal MCC and exposure to passive smoking has been neglected. In an animal study by Zayas et al, tissue disruption was shown by scanning electron microscope and mucus transport was significantly reduced, even after exposure to the smoke of one cigarette[18]. There is only one study about the relationship between passive smoking and NMC in the literature. In this study conducted by Habesoğlu et al., they found that both active and passive smoking increased nasal MCC time when compared with healthy controls[7].

In our study, we found that MMC in passive smoking group and active smoking group were significantly longer than the healthy controls. The comparison of NMC values between the passive smoking group and the active smoking group revealed no statistically significant differences. In addition, there was positive correlation between the increase in NMC and amount of cigarette consumption.

Limitations of our study were the small sample size and that we did not measure the amount of tobacco exposure in passive smoking group. Finally, further studies with a larger group of participants will be beneficial.

Conclusion

Both active and passive smoking prolonged NMC when they were compared with healthy controls. According to the literature, tobacco exposure is associated with diseases such as asthma, chronic rhinosinusitis, and lower airway infections[19]. 9 It may be hypothesized that it could be related to the direct effect of prolonged NMC.

Competing interests

The authors declare that they have no competing interests.

References

1.Stannard W, O'Callaghan C. Ciliary function and the role of cilia in clearance. J Aerosol Med 2006; 19(1):110-5.

2.Sakakura Y, Ukai K, Majima Y, Murai S, Harada T, Miyoshi Y. Nasal mucociliary clearance under various conditions. Acta Otolaryngol 1983;96(1-2): 167-73.

3.Maurizi M, Paludetti G, Todisco T, Almadori G, Ottaviani F, Zappone C. Ciliary ultrastructure and nasal mucociliary clearance in chronic and allergic rhinitis. Rhinology 1984;22(4): 233-40.

4.Baby MK, Muthu PK, Johnson P, Kannan S. Effect of cigarette smoking on nasal mucociliary clearance: A comparative analysis using saccharin test. Lung India 2014 ;31(1):39-42.

5.Singh I, Mehta M, Singh J, Yadav J. Nasal mucus clearance in chronic smokers. Indian J Chest Dis Allied Sci 1994;36(3):133-6.

6.Alfaro Monge JM, Soda Merhy A. The comparative test of nasal mucociliary function in healthy subjects, smokers and non-smokers. Acta Otorrinolaringol Esp 1995;46(3):187-9.

7. Habesoglu M, Demir K, Yumusakhuylu AC, Yilmaz AS, Oysu C. Does passive smoking have an effect on nasal mucociliary clearance? Otolaryngol Head Neck Surg 2012;147(1):152-6.

8.Deitmer T. Physiology and pathology of the mucociliary system. Special regards to mucociliary transport in malignant lesions of the human larynx. Arc Otorhinolaryngol 1989;43:1–136.

9.Andersen I, Camner P, Jensen PL, Philipson K, Proctor DF. A comparison of nasal and tracheobronchial clearance. Arch Environ Health 1974;29(5):290–3.

10.Andersen I, Proctor DF. Measurement of nasal mucociliary clearance. Eur J Respir Dis Suppl 1983;127:37–40.

11. Asai K, Haruna S, Otori N, Yanagi K, Fukami M, Moriyama H. Saccharin test of maxillary sinus mucociliary function after endoscopic sinus surgery. Laryngoscope 2000;110(1):117–22.

12.Wanner A. Allergic mucociliary dysfunction. Laryngoscope 1983;93(1):68–70.

13.Vander Top EA, Wyatt TA, Gentry-Nielsen MJ. Smoke exposure exacerbates an ethanol-induced defect in mucociliary clearance of Streptococcus pneumoniae. Alcohol Clin Exp Res 2005;29(5):882-7.

14.Cohen NA, Zhang S, Sharp DB, Tamashiro E, Chen B, Sorscher EJ, et al. Cigarette smoke condensate inhibits transepithelial chloride transport and ciliary beat frequency. Laryngoscope 2009;119(11):2269-74.

15. Proencxa M, Fagundes Xavier R, Ramos D, Cavalheri V, Pitta F, Cipulo Ramos EM. Immediate and short term effects of smoking on nasal mucociliary clearance in smokers. Rev Port Pneumol 2011;17(4):172-6.

16.Stanley PJ, Wilson R, Greenstone MA, MacWilliam L, Cole PJ. Effect of cigarette smoking on nasal mucociliary clearance and ciliary beat frequency. Thorax 1986;41(7):519-23.

17.Quinlan MF, Salman SD, Swift DL, Wagner HN, Jr, Proctor DF. Measurement of mucociliary function in man. Am Rev Respir Dis 1969;99(1):13–23.

18.Zayas JG, O'Brien DW, Tai S, Ding J, Lim L, King M. Adaptation of an amphibian mucociliary clearance model to evaluate early effects of tobacco smoke exposure. Respir Res 2004;20:5-9.

19.Leuenberger P, Schwartz J, Ackermann-Liebrich U, Blaser K, Bolognini G, Bongard JP, et al. Passive smoking exposure in adults and chronic respiratory symptoms (SAPALDIA Study). Swiss Study on Air Pollution and Lung Diseases in Adults, SAPALDIA Team. Am J Respir Crit Care Med 1994;150(5):1222-8.

How to cite this article:

Özler GS, Şimşek GÖ, Akbay E, Akoğlu E. The Effect of Passive and Active Smoking on Nasal Mucociliary Clerarance Time. J Clin Anal Med 2016;7(2): 149-51.