

Full Length Research Paper

The relationship between high incidence of deep neck infection and toothbrushing frequency

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Accepted 27 December, 2011

This study aimed to investigate and compare the frequency of toothbrushing and dental health status between deep neck space infection (DNSI) patients with dental origin and healthy population. 64 participants were included in this study in the form of two groups. The first group consisted of 34 DNSI patients with dental onset, and the second group consisted of 30 participants (control group). Study was carried out in two separate categories: the frequency of toothbrushing and assessment of dental health status. Toothbrushing frequency was evaluated with a questionnaire. Dental health status was assessed for periodontal and dental disease by periodontist according to the some widely used indicators; Decayed Missing Filled Teeth (DMFT) scores, Plaque Index score, Gingival Index score and Sulcus Bleeding Index score. Present study showed that the majority had brushed their teeth occasionally. In DNSI group, the percentage of never toothbrushing was very high and regular toothbrushing rate was so low. DNI group has higher scores than the control group and this indicates poor oral hygiene. Our results showed that, oral health was impaired and regular toothbrushing seems to have been neglected in DNSI group. In our opinion, this negligence is a very important contributory factor towards the more occurrence of deep neck abscess.

Key words: Deep neck infection, toothbrushing, dental caries, dental health, decayed missing filled teeth (DMFT).

INTRODUCTION

Deep neck space infections (DNSI) may arise from several focuses of the head and neck. Despite the prevalence and complication incidence of DNSI has been diminished with improved diagnostic techniques and widespread availability of antimicrobial therapy, these infections are still serious and potentially life threatening today as in the past. Some different causes such as tonsillitis and pharyngitis were a little more dominant in the etiology of DNSI formerly, but today, many publications clearly showed that DNSI is closely related to dental decay and local spread of dental infections

(Bakir et al., 2012; Kinzer et al., 2009; Marioni et al., 2010).

Dental caries is the fourth most expensive disease in the oral care (Petersen et al., 2005). Restorative dental treatment is often an expensive method (Topaloglu et al., 2009). In high-income countries, it has been estimated that 5 to 10% of public health spending is allocated to oral healthcare (Petersen et al., 2005). Obviously, the costs exceed the financial resources available in low- and middle income countries. On the other hand, besides these factors, lack of adequate health education should be considered as the most important risk factor for this potentially life-threatening event. In this context, it can be considered that the simplest but probably most importantly education to fight dental caries among preventive oral health measures is toothbrushing.

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Table 1. Plaque index system.

Scores	Criteria
0	No plaque
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
2	Moderate accumulation of soft deposit s within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Toothbrushing is a simple and quite effective method for removing the plaque, which is main etiologic factor in periodontal disease and dental infections, from all surfaces of the teeth (McCracken et al., 2004). It is a well known fact that, brushing teeth significantly reduces the risk of dental caries and as the frequency of toothbrushing decreased, the tooth decay increased (Carvalho et al., 2001; Gibson and Williams, 1999).

According to a recent study (Fujita et al., 2009) lower frequency of daily tooth brushing was related to higher prevalences of diabetes mellitus, hypertension and high triglyceride (TG) and/or low high density lipoprotein cholesterol (HDL-C). Similarly, recently published most reports indicated obviously that odontogenic infections comprise the most common cause of DNSI (Bakir et al., 2012; Kinzer et al., 2009; Marioni et al., 2010).

Although DNSI patients with odontogenic origin have been discussed in many aspects, we did not come across any research about questioning of toothbrushing. It is a fact that, toothbrushing constitutes the basis of dental health and dental health disease is considered to be public health problems. Awareness about toothbrushing might be an important key factor to reduction of DNSI. Therefore, in this article, we aimed to investigate the frequency of toothbrushing and also to evaluate dental, periodontal and gingival condition using the plaque index and gingival index in DNSI patients with dental onset.

MATERIALS AND METHODS

Participants

A total of 64 persons were included in this study in the form of two groups. The first group consisted of 34 patients who were treated for DNSI with dental onset. It was diagnosed through clinical examination, radiologic evaluation and dental consultation. The study was performed while the patients were staying in ENT Department. The second group consisted of 30 participants who were randomly selected among the patients who admitted in ENT outpatient clinic. During the selection, attention was only paid to reasonable distribution of gender and age range.

Questionnaire

Study was carried out in two separate categories: The frequency of toothbrushing and assessment of dental health status.

Toothbrushing frequency was evaluated with a questionnaire. In that questionnaire, toothbrushing frequency was categorized as “more than twice a day”, “twice a day”, “once a day”, “occasionally” and “never”. The same questioning was performed in the control group, too. Also each participant’s age, gender, systemic disease, smoking habit, oral hygiene practices (other preventive procedures like miswak, floss. etc.), periodical dentist control and duration of hospital stay (only DNSI group) was recorded.

Dental health examination

Patients and control group participants were referred to the Department of Oral and Maxillofacial Surgery for other assessments related to dental condition. Dental health status was assessed for periodontal and dental disease and for dental caries according to the Decayed/Missing/Filled/Teeth (DMFT) Index, Gingival Index, Plaque Index and Sulcus Bleeding Index, which have been widely used as indicators of periodontal health, by two experienced periodontist to avoid examination variability. Dental health status was determined by visual examination using a dental probe and dental mirror and calculated using the DMFT index. Periodontal examinations were performed using a dental mirror, explorer and a periodontal probe with William’s markings. To assess the thickness of plaque at the gingival area of the tooth, the teeth were dried and the microbial dental plaque was scraped by a dental explorer then evaluated by the unaided eye (Plaque index were calculated by Silness-Löe, 1964; Table 1). The periodontal condition was examined using the probing pocket depth to measure the distance between the bottom of the pocket and the margin of the gingiva from six sites of each tooth (mesiovestibule, midvestibule, distovestibule, distolingual, midlingual and mesiolingual). A blunt instrument such as a periodontal pocket probe was used to assess the bleeding potential of the tissues in Gingival Index.

Statistical analysis

Kruskal-Wallis and Mann-Whitney U tests were used to determine the relation between oral health status and DNSI. All data were analyzed using the SPSS version 15.0 software package (SPSS Inc., Chicago, IL, USA). Results were considered significant when p was <0.05 .

RESULTS

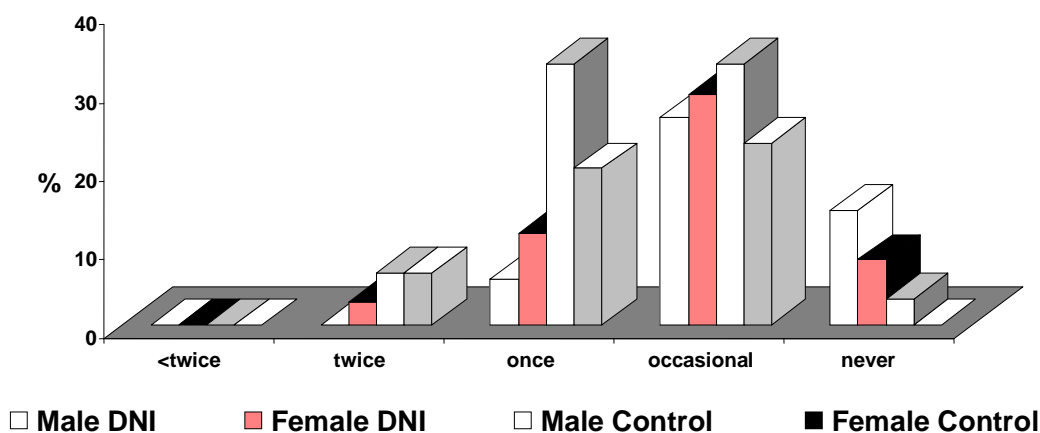
Assessment of participants

In DNSI patients group, there were 16 (47.1%) male and 18 (52.9%) female patients, with a female to male ratio of 1.12/1. The mean age was 28.7 ± 1.2 years (range 8 to

Table 2. Distribution of toothbrushing frequency in DNSI patient group and control group.

Toothbrushing frequency	DNSI patient group						Control group					
	M (n)	M (%)	F (n)	F (%)	T (n)	T (%)	M (n)	M (%)	F (n)	F (%)	T (n)	T (%)
More than 2	0	0	0	0	0	0	0	0	0	0	0	0
Twice a day	0	0	1	2.9	1	2.9	2	6.7	2	6.7	4	13.3
Once a day	2	5.9	4	11.8	6	17.6	2	6.7	6	20	8	26.7
Occasionally	9	26.5	10	29.4	19	55.9	10	33.3	7	23.3	17	56.7
Never	5	14.7	3	8.9	8	23.5	1	3.3	0	0	1	3.3
Total	16	47.1	18	52.9	34	100	15	50	15	50	30	100

M: Male; F: Female; T: Total.

**Figure 1.** Toothbrushing frequency in DNSI patient group and control group.**Table 3.** Evaluation of Smoking and non-smoking group.

Group	Smoking	Non-smoking	P value
DNSI group	19	15	0.019
Healthy group	8	22	

51 years). In the control group; there were 15 (50%) male and 15 (50%) female participants with ages ranging from 12 to 46 years (The mean age: 29.9 ± 1.4 years).

Assessment of questionnaire

In DNSI group, no patient brushed their teeth more than twice a day. Twice a day and once a day toothbrushing rate was 2.9 and 17.6%, respectively. The toothbrushing twice a day was found 0% in male, whereas 2.9% in female and the toothbrushing once a day was found 5.9% in male, whereas 11.8% in female. Regular toothbrushing (more than twice, twice and once a day) rate was 20.5%. Occasionally toothbrushing was higher in both sexes (26.5% male, 29.4% female, 55.9% total). In male group,

14.7% patient never brushed their teeth, whereas this rate was 8.9% in female patient group. In total, 23.6% patient never brushed their teeth (Table 2 and Figure 1). The mean duration of hospital stay was 8.2 ± 5.7 days (ranged 5 to 22 days). Smoking rate was found to be 55.9%. Two patients had a systemic disease (one of them tuberculosis and the other one diabetes mellitus). DNSI was more commonly seen in smoking group than non-smoking group (Table 3).

In control group, regular toothbrushing (more than twice, twice and once a day) rate was 40%. Only 13.3% brushed their teeth twice a day and 26.7% brushed once a day, whereas no participant brushed their teeth more than twice a day like DNSI patient group. The toothbrushing twice a day was found to be 6.7% in both male and female. Once a day, toothbrushing rate was

Table 4. Periodontal evaluation of DNSI and control group.

Periodontal parameter	DNSI group (n=34)	Control group (n=30)	P value
Plaque index score	1.45±0.51	1.20±0.38	0.34
Gingival index score	1.10±0.46	0.90±0.36	0.45
Probing depth (mm)	2.71±0.47	2.48±0.35	0.30
Sulcus bleeding index score (%)	23.47±5.65	20.42±5.68	0.36

Table 5. Dental evaluation of DNSI and control group.

Dental parameter	DNSI group (n=34)	Control group (n=30)	P value
Decay/tooth status (%)	5.75±2.20	2.51±1.12	0.000
Filling/tooth status (%)	2.74±1.55	1.56±1.01	0.227
DMFT Index score	10.17±1.85	6.96±2.18	0.000

higher in female (20%) than male (6.7%). Occasionally (irregularly) toothbrushing rate was found to be higher (56.7%) in both male (33.3%) and female (23.3%) like DNSI group. In male, 3.3% of participants never brushed their teeth whereas this rate was 0% in female. In total, 3.3% of patients never brushed their teeth in control group (Table 2 and Figure 1). Smoking rate was 26.7%. No patient had a systemic disease.

Assessment of dental health

In DNSI patients group, 14.7% had never visited a dentist before, whereas in control group, each participant had a visit to the dentist at least once before. The mean DMFT was 10.17±1.85 in DNSI patients group and 6.96 ± 2.18 in control group. Plaque Index Score was 1.45 ± 0.51 in DNSI group and 1.20 ± 0.38 in control group. Gingival Index Score was 1.10 ± 0.46 in DNSI group and 0.90 ± 0.36 in control group. Sulcus Bleeding Index score was 23.47±5.65% in DNSI group and 20.42 ± 5.68% in control group. Probing Depth was 2.71± 0.47 mm in DNSI group, whereas 2.48 ± 0.35 mm in control group (Tables 4 and 5).

DISCUSSION

Some recent studies have shown that people in developing countries were found to have high caries prevalence for all age groups compared with developed countries (Bolin et al., 1996; Carvalho et al., 2001; Christensen et al., 2003; Gibson et al., 1999; Gökalp et al., 2007; Güçiz and Gökalp, 2008; Sheiham, 2005; Unlüer et al., 2007). According to those studies conducted in a developing country to estimate prevalence and severity of oral and dental health problem, more than half of the individuals had dental caries and the prevalence of normal population without a toothbrush was 15.9%, the toothbrushing rate 2 to 3 times daily was

22.2 and 27.6% in adults and geriatric peoples, respectively (Gökalp et al., 2007; Güçiz and Gökalp, 2008; Unlüer et al., 2007). These results were quite similar to the results of a previous comprehensive study, which was carried out in the same country in 1988 with the support of the World Health Organization (WHO) (Saydam et al., 1990). Unfortunately, these results are very far below the WHO's oral and dental health objectives. This problem can result from national shortcomings such as the insufficiency of primary health care systems and the lower average dentist-population ratio than in developed countries (Agarwal et al., 2007; Topaloglu et al., 2009).

Although the incidence of complications and death after DNSI has reduced since the discovery of antibiotics, DNSI still remain a relatively common and serious problem especially in developing countries. Despite the considerable high prevalence of DNSI with odontogenic origin, and despite the important and significant relation between toothbrushing and DNSI, so far, no study has been reported to investigate the relationship between them. To our knowledge, the present study is the first to examine directly the relationship between toothbrushing habit and the DNSI. To examine, a questionnaire was performed and according to the questionnaire results, a negligence regarding the brushing teeth was clearly observed in both DNSI patients with dental onset and control group. As shown in Table 1 and Figure 1, the majority had brushed their teeth occasionally (irregular) in both DNSI and control group (55.9 and 56.7%, respectively). Regular toothbrushing (daily once, twice and more than twice) rate was 20.5% in DNSI group and 40% in control group. The toothbrushing twice a day was not promising at all, found only 2.9% in DNSI group and 13.3% in control group. No patient brushed their teeth more than twice a day in both group. There is no difference in terms of occasional toothbrushing between DNSI and control group. But regular toothbrushing rate was different between the two groups, although both of

them were lower than expected rates. In our opinion, extremely low rate of the regular toothbrushing might be an important reason for higher prevalence of DNSI in developing countries. In both DNSI and control group, once and twice a day toothbrushing rate was higher in female group than male group. But a female patient, who had a tooth brushing habit twice a day for years, was the most interesting case among the DNSI patients group. Although we could not find anything significant about this particular case, additional pathologies should be considered for differential diagnosis. Difference from never toothbrushing between the DNSI group and control group was remarkable. The percentage of never toothbrushing was 23.5% in DNSI group, whereas this rate was 3.3% in control group (Table 1 and Figure 1). Patients with good oral hygiene (once a day toothbrushing, twice and more than twice toothbrushing group) were excluded. Both occasional (irregular) and never toothbrushing group constituted 80% of total in DNSI group and 60% of total in control group could be considered as a more dangerous region for DNSI. Briefly, regular toothbrushing was not promising, irregular toothbrushing was high and almost equal when DNSI (55.9%) and control group (56.7%) compared, and the percentage of never toothbrushing was found rather high in DNSI group. Our results clearly showed an enormous negligence about regular toothbrushing. In our opinion, this omission is a very important contributory factor towards the more occurrence of deep neck abscess in developing countries. Whereas in developed countries, regular (twice a day) toothbrushing rate and also caries free rate was found quite high compared to developing countries. It seems that, dental problems are rather closely associated in inverse proportion with a community development level (Christensen et al., 2003; Sheiham, 2005).

In questionnaire, besides toothbrushing frequency, we also assessed each patient and participant's age, gender, systemic disease, smoking habit, oral hygiene practices, periodical dentist control and duration of hospital stay. The mean age was 28.7 ± 1.2 years in DNSI group and 29.9 ± 1.4 years in control group. It means that, unfortunately, dental health was deteriorated at an early age in most cases. Smoking, systemic disease such as diabetes especially, and genetic factors have been implicated in periodontal disease pathogenesis (Consensus report, 1996). We did not find any systemic disease in control group, but 2 patients had a systemic disease in DNSI group (one tuberculosis, one diabetes mellitus). Noda et al. (2010) has reported Smoker prevalence was higher in peritonsillar abscess and deep-neck abscess group than in normal healthy subjects (Noda et al., 2010). In our study smoker subjects were higher DNSI than healthy group. Almost all patients and participants had never visited a dentist for periodical control unless dental disease seriously disturbs them. There were high rates of smoking habit in DNSI group

(55.9%). To assess oral hygiene practices, they were questioned about an extra preventive dental habits such as miswak, mouthwash, floss.. etc., but almost no patient responded positively to this question. Our DNSI patients group had a mean length of hospitalization of 8.2 ± 5.7 days (ranged 5 to 22 days). This long duration of hospitalization because of DNSI, naturally leads to a large cost. We can say that toothbrushing is the most cost-effective method to prevent dental problems. Otherwise the cost would be too much, if an infection occurs.

The pathoetiology of periodontal disease, which is an inflammatory disease of the gingiva, the supporting connective tissues and alveolar bone, involves the formation of plaque and subsequent infiltration by microorganisms (Williams, 1990).

It has been suggested that the plaques can act as a bacteria reservoir for development of DNSI, especially in patients with poor oral hygiene. Because it was found that the microbial profiles of periodontal pockets and DNSI share a number of similarities (Consensus report, 1996).

Besides serious negligence about tooth brushing, periodontal health status and dental health status was observed to be impaired in patients with DNSI compared with control group in our study. The plaque index assesses the thickness of plaque at the gingival area, the gingival index evaluates the severity of gingivitis, the sulcus bleeding index records the presence of initial inflammatory gingival disease, probing depth assesses the state of periodontal health and the decayed/missing/filled/teeth (DMFT) score determines the total dental caries experience. Therefore, these indexes give information about oral hygiene status (Schuller and Holst, 2001).

The assessment of oral health status according to DMFT Index, Gingival Index, Plaque Index and Sulcus Bleeding Index revealed that DNSI group have higher scores than control group (Tables 2 and 3). High index score indicates poor oral hygiene and higher dental decay rate. In other words, these results clearly indicated poor oral hygiene and higher dental decay rate in DNSI group. Although dental decay does not seriously affect people unless they cause pain, discomfort and functional limitations. Carious lesions should be treated to prevent DNSI or other complications but more importantly to prevent DNSI originated from tooth. The formation of dental caries or poor oral hygiene must be avoided from the outset. Toothbrushing is the simplest and quite effective way for that. Early childhood is the most appropriate period to gain this habit. For this reason, WHO reported some resolutions to be implemented within a program for the promotion of oral health and prevent oral diseases especially emphasizing children at pre-school and school-age (World Health Organisation, 1998). As a result of some studies undertaken in line with this report showed a resultant 23 to 43% reduction in

carious lesions among the kindergarten and school children (Schwarz et al., 1998). The importance of informing and educating the public about oral and dental care is seen obviously. Most developing countries has not yet developed a regular system and in addition, oral health culture has not been developed sufficiently yet. Our results showed an extremely high need in the field of dental health services. So, an effective dental disease prevention program should be provided in developing countries for the promotion of oral health. Although serious negligence and ignorance about toothbrushing was the most striking result in this report, there are many factors that affect dental health of course. According to recent studies (Agarwal et al., 2007; Sheiham, 2005; Vallejos-Sánchez et al., 2008) socioeconomic factors, illiteracy and poverty have been recognized as important contributory factors towards the high incidence of deep neck abscess in developing countries. We did not assess socioeconomic factors such as educational level, occupational status, living in rural or urban area, low or high socioeconomic status, etc. Because most of our patients and the participants had low socioeconomic and educational level, most of them were living in rural area and most of the cases did not have conditions that are easily accessible to the dentist for periodical dentist control.

Conclusion

Toothbrushing constitutes the basic protective factor against to dental decay unfortunately, our patients and participants were not aware of the dangerous consequences of tooth decay and the relation between dental decay and DNSI. Today, although incidence of the DNSI seems to be reduced relatively to the past owing to the recent improved medical care and effective antimicrobial treatment, DNSI are not rare especially in developing countries and continuing to be a challenging problem for otolaryngologists and maxillofacial surgeons due to potentially lethal complications that may occur. Despite worldwide improvement in dental care, this life-threatening infection continues to occur relatively frequently in patients with poor oral hygiene. We emphasized that irregular toothbrushing may lead to inadequate oral hygiene and inadequate oral hygiene may lead to dental caries and dental caries may lead to DNSI. To prevent DNSI, regular toothbrushing should not be ignored. We hope that, with better education and more health conscious by strengthening the existing primary health infrastructure, there will be an increase in the demand for dental care and a reduction in the incidence DNSI.

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