Mini-Review

Clinical significance and utility of neck circumference measurement in the dental clinic setting

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There are numerous screening tools and measures used in modern dental care facilities, which are often focused specifically on the identification of oral health and disease markers. A simple screening technique for measuring neck circumference can generate clinical data that is useful for identifying patients who may or may not benefit from mandibular splints and mouth guards for the treatment of sleep apnea. In addition to reducing overall patient costs and improving both efficiency and effectiveness – this biometric measurement is also useful as a systemic health risk indicator for a number of other common disorders including high blood pressure, cardiovascular disease, obesity, diabetes and metabolic syndrome. Based upon this information, the primary goal of this review is to evaluate the evidence to determine if tape measurement of neck circumference will provide additional, specific and quantifiable increases in health risk disclosures and increase patient referrals for additional screening due to elevated risk for undiagnosed health conditions. The evidence regarding this topic strongly supports the theory that incorporation of an additional, non-oral screening tool may prompt discussion of why this procedure is being done and, more specifically, may lead to disclosure of additional systemic health conditions and risks which are not typically disclosed in the traditional dental office screening protocol – this may also influence the number and type of referrals for additional screenings based on the clinical findings and patient discussion. The incorporation of screening for systemic health risk factors in the dental office, such as higher than average neck circumference, may have the potential to advance patient health and wellness in a number of different, but cost-effective, ways.

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Introduction

The modern dental office can be an effective site for interprofessional collaboration and the integration of low-cost clinical screening tools that facilitate risk factor screening for systemic health and disease [1, 2]. For example, periodontitis is often the first clinical sign that a patient has diabetes, showing up before other systemic symptoms appear; several studies have shown that individuals with periodontitis are also at a greater risk of developing cardiovascular disease, relative to control groups [3-5]. For example, several studies have provided clear and convincing evidence that dental professionals may not only play a significant role in the co-management and treatment of patients with sleep apnea – but may also provide the primary sites for screening patients most at risk who have not yet been identified [6,7]. The traditional role of dentists and dental professionals has been limited to the creation of mandibular splints or mouth guards for the clinical treatment of sleep apnea. However, these devices typically provide symptom improvement in only half of all patients due to other independent risk factors that significantly influence patient outcomes, such as neck circumference [8].

The incorporation of screening for systemic health risk factors in the dental office, such as higher than average neck circumference, may have the potential to advance patient health and wellness in a number of different ways [9]. For example, incorporation of this simple, non-invasive tape measuring in the dental office setting may not only be a useful biometric tool for identifying patients at risk for sleep apnea, but may also provide clinical measurements to predict which patients are more or less likely to benefit from mandibular splints and mouth guards thereby improving efficiency and effectiveness and reducing overall patient costs [10,11].

In addition, despite preventive medical care is becoming more prevalent in recent years due to changes in insurance and access to care – many racial and ethnic disparities found in access to medical care may be reduced or absent in routine dental care and dental checkups, which suggests these may be sites where low-cost, effective, expedient biometric measurements may be quickly and easily collected and assessed [12,13].

One cause of sleep apnea is the thickening of the lateral walls of the pharynx due to the increased volume and area of pharyngeal fat and the increased size of the musculature of the pharynx. These enlarged structures and increased subcutaneous fat can cut off the patients airway, leading to sleep apnea [14,15]. Mandibular repositioning devices help to combat sleep apnea by acting to keep the airway open. The splints protrude the mandible slightly; this action increases the upper airway volume, widens the lateral dimensions of the velopharynx, and stretches the tongue muscles to counteract tongue relapse [8,16-19]. Furthermore, measurement of neck circumference is useful not only for identifying patients at risk for

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sleep apnea or the patients more likely to benefit from mandibular splints for the treatment of their apnea -- but may be most useful as a systemic health risk indicator for a number of other disorders. Upper body subcutaneous fat, such as that found in the neck, is more indicative of metabolic risk than is visceral fat. Additionally, subcutaneous fat levels are the primary determinant of the levels of free fatty acid systemic concentration levels in the body; high levels of these are pathogenic risk factors for a variety of health issues, including insulin resistance, oxidative stress, and vascular injury [20-23]. In fact, neck circumference has recently been demonstrated as an independent predictor of fasting blood glucose, low- and high-density lipoproteins, total cholesterol and triglyceride serum concentrations [24]. These results strongly suggest the utility and relevance of incorporating neck circumference measurement into standard practice in both medical and dental settings [6,9,20].

Although more detailed and expensive methods such as computer-aided tomography exist, the most common technique for measuring neck circumference can be done with minimal training using inexpensive and readily available tape measures [25,26]. Large scale studies, such as the National Health and Nutrition Examination Survey (NHANES) and the Framingham Heart Study describe the standardized measuring procedures that could be incorporated into a periodic dental exam. Neck circumferences can be measured by applying tape measures perpendicular to the long axis of the neck, midway between the midcervical spine and midanterior neck, just below the laryngeal prominence [27] (Fig. 1). This data provides preliminary data that allow for categorization into low- (<34/38 cm for women/men) and high-risk (>34/38 for women/men) groups based on this single measurement [28,29].
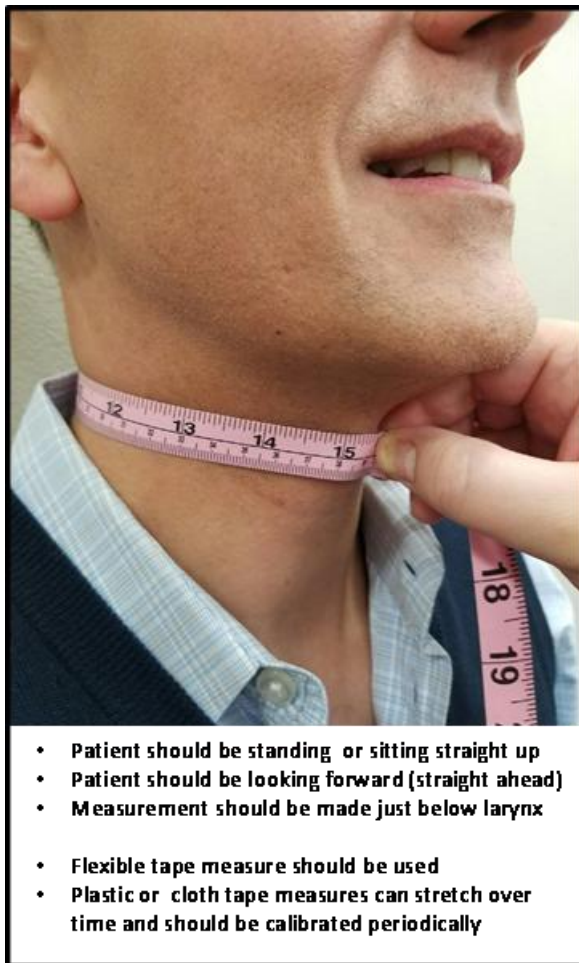
Figure 1. Measurement of neck circumference. Standard measuring tapes provide easy, inexpensive measurements of patient neck circumference without the invasive or expensive equipment or tests. Measurements should be made near or just below the larynx.

More specifically, large scale studies of neck circumference have demonstrated neck circumference of males averages between approximately 37.4 to highs around 40.5 cm +/- 3 and from 32.46 to 34.2 cm +/- 2.5 among females [24,27]. Although more precise linear correlations were found to establish escalating risk in groups, simple measurement of neck circumference above 38 cm for men and 34 cm for women was associated with increased risk for cardio-metabolic risk factors and was predictive for most of the systemic health risks previously discussed [23,30]. Moreover, these measurements provide reliable, inexpensive data to determine which obstructive sleep apnea patients might not benefit from expensive and unnecessary procedures, such as polysomnography due to

excessive compartmental neck fat accumulation [6, 8,31].

Health Prompt

Obesity and metabolic syndrome has become a very real problem in the US, even costing an estimated $147 billion in 2008 in obesity related medical expenditures [32]. Obesity is a leading risk factor for many conditions such as diabetes, atherosclerosis, fatty liver disease, and other cardio-metabolic syndromes. However, testing for obesity levels can be easy done with simple anthropometric tests such as measuring neck circumference that can act as early predictors for obesity and these kinds of conditions. One study even concluded that neck circumference was a significant risk factor for

fatty liver disease regardless of BMI, which is a commonly used determinant of obesity [28].

Conclusions

Many people fail to realize that dentists are also doctors, (and have a scientific understanding for human anatomy and physiology outside of the oral cavity) and that the doctors they think of when they go to get a check-up are physicians. In part, this is because of the perception that dentists only work with teeth and are clueless to the rest of the human body. In reality, the oral cavity is a very complex part of the body which often shows symptoms of several systemic diseases including diabetes, osteoporosis, some heart conditions, many head and neck cancers and so on, which most dentists are trained to recognize. In fact, there is evidence of links between diabetes mellitus and the susceptibility of the soft tissues and bone supporting teeth, as well as strong evidence of periodontal disease being associated with increased cardiovascular morbidity [33]. Furthermore, routine oral cancer screenings performed during annual dental exams result in reduced mortality rates when oral cancer is detected early [34]. Having dentists do some basic baseline testing such as neck circumference to determine risk for obesity-related conditions would help improve the perception of dentists as more than 'tooth doctors'.

Competing interests

The authors declare that they have no competing interests.

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