

2019

Puberty: Is Your Gingiva Having Mood Swings?

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Abstract

Objectives/aim: The purpose of this paper is to explore the effects on the different pathological changes in the oral cavity due to puberty, in both males and females. Hormonal changes caused by menstrual cycles, ovulation, the use of contraceptives, and increased testosterone and estrogen levels.

Methods: This topic will be analyzed by thoroughly reviewing research on articles that relate to the oral health of individuals specifically between the ages of 12-18 years old.

Results: Research presents significant evidence that supports changes occurring in the oral cavity during an individual's stage of puberty. These stages include ovulation, pre-menstruation, menstruation and males transitioning through puberty. During the puberty stage adolescents are more prone to have increased gingival crevicular fluid (GCF), gingival index, and bleeding on probing while research has shown no significant findings on plaque indexes or probing depths. Changes occurring during the menstrual cycle tend to influence the periodontium and induce inflammatory conditions as well. While the periodontium and inflammatory cytokines play a major role in the effects during puberty, changes in diet during this phase can increase the risk of developing caries as well.

Conclusion: When adolescents are transitioning into adulthood, there are multiple changes their body goes through. During the literature review, many changes happen during puberty significantly affecting the oral cavity were discovered. These changes have both positive and negative effects. Variations in hormone levels and diet greatly influence the health of the oral cavity and can be a deciding factor on development or severity of oral disease.

Introduction

As an adolescent, many changes are occurring throughout the body during puberty. Most people are aware of the physical changes, but are they aware of all the chemical changes happening? Puberty plays a role in not only the reproductive system, but in the oral cavity as well. Puberty changes the way one's gingival health appears, and how it presents the oral health as being more prone to having increased gingival crevicular fluid (GCF), gingival index, and bleeding on probing. Sex hormones impact cellular proliferation, differentiation, and growth of tissues. Between the ages of 12 and 18 a female's body is undergoing many changes, the levels of estrogen and progesterone are fluctuating causing physiological changes. These changes cause significant effects to tissues in the oral cavity such as the gingiva, periosteal fibers, fibroblasts and periodontal ligaments. The sex hormones also diminish the action of the epithelial barrier causing it to be less defensive against bacteria. The body's immunological factors are altered by these hormones. (1)

At this age the condition of the oral cavity changes are not only due to intrinsic reasons but extrinsic reasons are responsible as well. For example, children are starting to choose what they eat independently from their parent's and many of these foods are cariogenic.

Signs and Prevention

Main signs to look for at home when an individual is going through puberty include

- Increased inflammation
- Increased bleeding
- Redness
- Increased gingival crevicular fluid

It is important for these patients to regularly attend the dentist to keep their oral cavity healthy and prevent disease. Steps to take at home include

- Brushing for two minutes each, twice a day towards the gingival margin
- Flossing in a "C" shape to ensure adequate removal of bacteria and debris
- Using a mouth rinse with fluoride and antimicrobial factors
- Using a toothpaste with fluoride and tartar control ingredients

The Effects on the Periodontium

There is strong evidence supporting fluctuation in the levels of immune cells during pubertal growth. Interleukin-6 (IL-6), interleukin-1 beta (IL-1 β), and tumor necrosis factor alpha (TNF- α) are a few immune cells important to the oral cavity for immune response. These immune cells are affected by sex steroid hormones which in turn affects periodontal tissues, saliva, oral mucosa, wound healing, periodontal disease progression, and bone turnover. Progesterone and testosterone downregulate the synthesis of IL-6 and increase sex steroid hormones causing gingival inflammation. TNF- α has been shown to be another factor involved in gingival inflammation. When looking at the three stages of the menstrual cycle - pre-menstruation day, menstruation day, and ovulation day; the concentration IL-6 and TNF- α levels were highest on pre-menstruation day followed by ovulation day and the lowest concentration of the immune cells was during menstruation day. IL-6 and TNF- α negatively correlated with estradiol levels during pre-menstruation day; in addition, TNF- α negatively correlated with progesterone levels during this stage too. The results of the articles investing the effect of immune cells on oral health found the variation in the concentration levels did not affect plaque index and probing depths. There were significant findings with gingival index (GI) and bleeding on probing (BOP) during the menstrual cycle. GI and BOP negatively correlated with progesterone levels during ovulation day. The result of gingival inflammation is from the increased progesterone levels during ovulation day. The role of progesterone in the body is to enlarge and increase the vascular permeability leading to increase levels of inflammatory cytokines. (2)

Effects on the menstrual cycle include induced inflammation of the gingiva as well as the gingiva having an erythematous appearance. Bleeding on probing, scaling, brushing and flossing are signs of irritation. These effects lead to increased levels of "interleukin-1beta (IL-1 β) and tumor necrosis factor-alpha (TNF- α) in gingival crevicular fluid and on periodontal clinical parameters, including the gingival bleeding index (GBI) and the modified gingival index (MGI), in periodontally healthy women." (1) GCF is involved in processes of immune response, ion transport, and signal transduction. (3) GCF vitamin D protein is higher during pubertal stage. Studies show both the GBI and the MGI are increased significantly during the menstrual cycle as well as the vitamin D protein in GCF. "GBI and MGI were significantly higher during ovulation day than during menstruation day or pre-menstruation day ($p < 0.001$), but there was no significant change in the simplified oral health index observed during the menstrual cycle ($p = 0.18$)." The levels of IL-1 β and TNF- α increased during the different phases of the menstrual cycle, while the only change found was the TNF- α concentration ($p < 0.05$). (4)

A study reviewed by Kellesarian and others examined the associations of periodontal disease and the levels of testosterone in males. The researchers explored this topic by examining articles from a variety of health and social care databases using headings such as "periodontitis", "chronic periodontitis", "periodontal disease", "testosterone", and etc. The results supported a positive association between lower testosterone levels in serum and decreased periodontal health. Low testosterone levels are associated with increased chronic periodontitis prevalence and severity. Many of the articles that were reviewed demonstrated higher levels of testosterone in subjects without tooth loss as opposed to subjects with tooth loss having lower levels of testosterone. Subjects with hypergonadotropic hypogonadism and chronic periodontitis had significantly higher gingival indexes and bleeding on probing compared to others that did not have this condition. Hypogonadotropic hypogonadism is a disorder that results in lack of sex steroid production ultimately leading to higher levels of gonadotropin. This indicates that testosterone may inhibit inflammation of the gingiva. (5)

Oral contraceptives work by altering the hormones levels of estrogen and progesterone in the body; therefore, oral contraceptives is believed to affect the health of the gingiva. A study explored the effects of oral contraceptives on the periodontium by measuring the gingival index, plaque scores, bleeding on probing, probing depths, and clinical attachment loss. The results presented with increase gingival index scores, increase gingival inflammation, increase bleeding on probing, increase probing depths and clinical attachment loss, and higher amounts of plaque in oral contraceptive users compared to non-users. All these factors correlate to the duration the oral contraceptives are being taken. The study demonstrated the longer the oral contraceptives were taken the more likely these characteristics would present. The research showed consistency between 1.5 and 2 years as being prime time for oral contraceptives to really take effect on the periodontium. (7)

Pubertal Changes in Dentistry



Figure 1: Healthy periodontium

Figure 2: Periodontium during puberty

Conclusion

Studies have shown multiple cases where the microbiological factors play a role in the periodontium. As we have looked into and analyzed the articles, TNF- α and IL-6 levels have shown an increase in inflammation of the gingiva and bleeding on probing, scaling, brushing and flossing, especially while menstruating and ovulating. On the other hand, there has been no significance in probing depths and plaque accumulation affecting the oral health of one in the phases of puberty.

Not only do studies show the effects of the changes in the oral cavity, but systemic changes and conditions as well. Diabetes mellitus is known to have an effect on the periodontium in leading to gingivitis and periodontal disease, but are the effects of the oral cavity increased in a patient who is going through pubertal changes? Yes, research studies have shown higher gingival inflammation and effects on the periodontium in one going through pubertal changes. There is no doubt puberty has a great effect on the oral cavity.

There is an abundant amount of research that supports the different changes that occur in the mouth caused by changes from puberty. Many of the studies that were examined demonstrated a common factor of sex steroid hormones as being one of the many responsible agents leading to a decrease in the oral cavity at this period in life. Other studies stated sex steroid hormones change the microflora of the mouth. The altering of the microflora decreases the immunological ability of the oral cavity making it less able to fight off certain bacteria and increase the amount of anaerobic bacteria in the mouth.

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