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Development of an Online Tool for Periodontal Disease Education

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DEVELOPMENT OF AN ONLINE TOOL FOR PERIODONTAL DISEASE EDUCATION

By

Sari Johnston

Graduate Program in Clinical Anatomy

A thesis submitted to Western University in
partial fulfillment of the requirements for the
degree of Master of Science, Clinical Anatomy

The School of Graduate and Postdoctoral Studies
Western University
London, Ontario

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Certificate of Examination

THE WESTERN UNIVERSITY
THE SCHOOL OF GRADUATE AND POSTDOCTORAL STUDIES

CERTIFICATE OF EXAMINATION

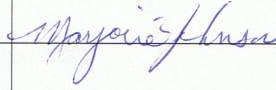
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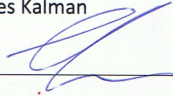
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Dr. Les Kalman



The research project by

Sari Johnston

Entitled :

**DEVELOPMENT OF AN ONLINE TOOL FOR PERIODONTAL DISEASE
EDUCATION**

is accepted in partial fulfillment of the
requirements for the degree of
Master of Science, Anatomy & Cell Biology
Division of Clinical Anatomy

Abstract

Worldwide research has indicated that 50-90% of the population suffers from gingivitis, a mild form of periodontal disease (Armitage, 2000). Recently it has become hypothesized that not only is gum disease, or periodontal disease, detrimental to one's oral health but may also have systemic consequences (Watt & Petersen, 2012). According to Bedgley (1994), when patients see, hear and participate in patient learning the retention of knowledge increases up to 80%. Computer based learning is now commonplace and has the potential to reach the masses. Thus, computer-based patient education could be highly effective in decreasing periodontal disease rates. Therefore, creation of an online periodontal disease educational tool could be effective in decreasing periodontal disease and promoting proper oral hygiene. The online tool was created using Articulate Storyline software with assistance from the Informational Technology Resource Center at Western University. The online tool consists of 4 modules: what is periodontal disease, types of periodontal disease, causes of periodontal disease, prevention of periodontal disease, plus a risk assessment quiz. Each module is further subdivided into relevant sections, which comprise information and images to provide more in-depth information to the patient. At the end of each module, the patient is able to complete a short multiple-choice quiz to actively participate in and assess their learning. Finally, a risk assessment section is presented at the end of the tool in order for patients to assess their risk for gum disease and highlights modifications they can make to lower their risk. In the future, the module will be assessed for effectiveness within the general at-risk population.

Key Words

Periodontal disease, Oral health, Computer Based Patient Education

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Chapter 1

Introduction

Periodontal disease, or gum disease, affects a large portion of the global population. Worldwide, it is estimated that 50-90% of adults suffer from gingivitis, the mild form of periodontal disease (Armitage, 2000). It is estimated from recent data from 2009 and 2010 from the National Health and Nutrition Examination Survey that 47% of the adult U.S population is affected by periodontitis (Eke, Dye et al., 2012). Recently, it has been hypothesized that periodontal disease not only has an effect on oral health but also on one's general health (Watt & Petersen, 2012). Brathall et al., (2006) have described periodontal disease as one of the most important oral diseases that contributes to the global burden of chronic diseases. Several systemic conditions, in addition to poor oral hygiene and traditional risk factors, have been found to be important contributors to the development of severe periodontal disease (Genco et al., 1999). Periodontal diseases have the ability to be inherited but are more likely to be acquired and develop throughout one's life. Unfortunately, many individuals are not aware of the presence of the disease until the later stages when treatment becomes more challenging (Canadian Dental Association, 2014). However, gum disease is preventable and can be treated and reversed during initial development (Canadian Dental Association, 2014). Therefore, educating individuals on the disease and the risk factors involved can largely decrease the prevalence of periodontal disease and its devastating consequences.

One's general health can be affected by their oral health, the US Surgeon General's report suggests that oral health is an essential component of general health and should be included in health care (US Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research, 2000). However, within Canada, which does have universal health insurance, oral care is not included. This poses a large public health concern since those in the lower socioeconomic statuses have the highest levels of problems regarding oral health and also have the most difficult time receiving dental care (Ravaghi, 2013). Since the poorest segment of the population tend to avoid seeing a dental professional, they tend to receive fewer preventive treatments and postpone curative treatments, which can arguably lead to the development of more serious problems such as periodontitis.

In a study designed to measure and compare the differences in income-related inequalities and general health outcomes in Canada, it was found that income-related inequalities for oral health outcomes showing disease states were higher amongst the poor (Ravaghi et al., 2013). The disease states were measures based on the number of decaying or missing teeth, while general health was measured as obesity and high blood pressure. The socioeconomic status was measured using household income. The study was completed using data from the 2007/09 Canadian Health Measures Survey (CHMS) with 3,413 Canadians ages 18-79. The conclusions of the research found that socioeconomic inequalities were more pronounced when examining oral health as opposed to general health. This is likely to be attributed to the discrepancy in

funding for physician-based services compared to dental services. Thus it is evident that those in a lower socio-economic status tend to be at a significant disadvantage when it comes to oral health and potentially developing chronic oral diseases. Further education and treatment is something that could potentially help these patients from developing chronic conditions.

Periodontal disease affects the periodontium, which is comprised of all the structures that anchor the teeth to the mandible (AAP, 2001). The tissues of the periodontium are illustrated in Figure 1. The periodontium has two types of connective tissue; soft and hard, whereby each plays an important role in the structural and functional aspects of the tooth attachment and function. There are four components to the periodontium, the gingiva (also referred to as the gums), the periodontal ligament, the alveolar bone and the cementum (Bartold, Walsh et al., 2000).

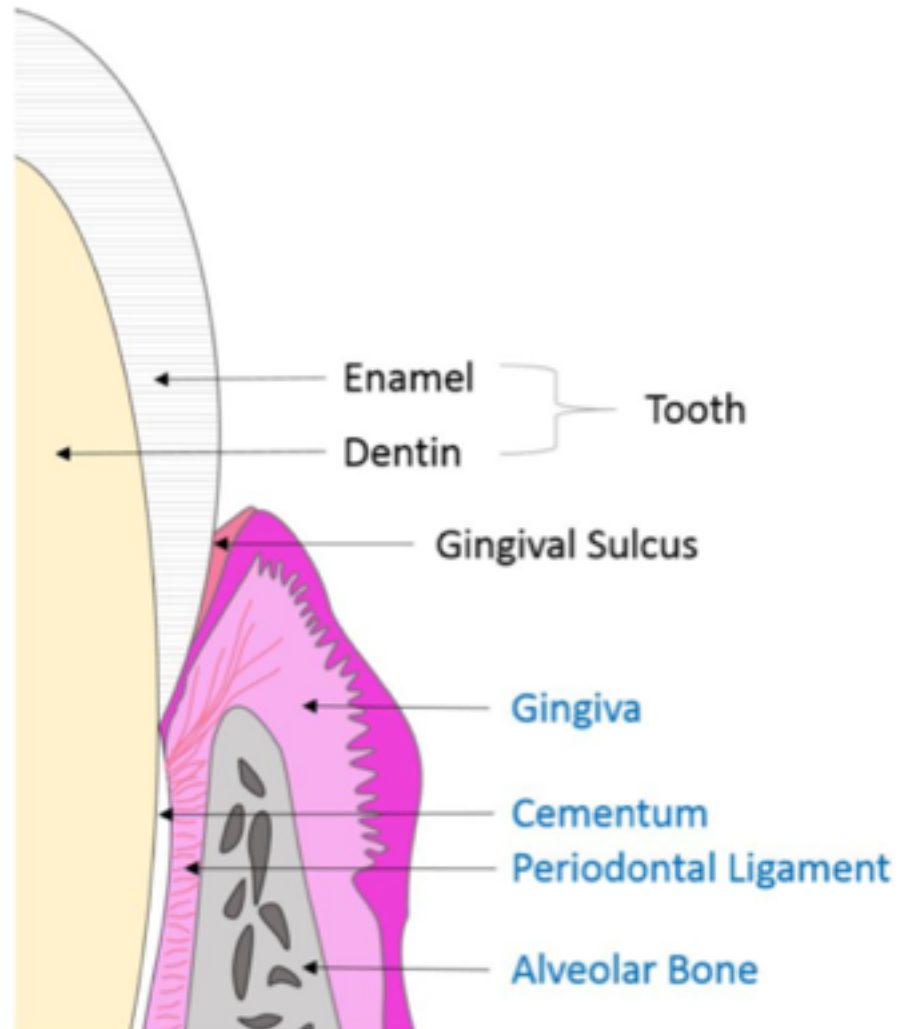


Figure 1: Anatomy of the Periodontium. The figure provides an illustration of the four tissues of the periodontium and is labeled in blue (Michelsons, 2014)

The bone is the main structural support for the tooth; each tooth is anchored through the periodontal ligament into an individual socket composed of mineralized alveolar bone. The periodontal ligament is composed of dense connective tissue and provides the connection from the tooth to the alveolar bone. Cementum is the mineralized tissue that is covering the tooth root where it connects to the periodontal ligament (Foster, 2012). The cementum allows the periodontal ligament to anchor to the root of the tooth (Bosshardt & Selvi, 1997). The final element of the periodontium is the gingiva, which forms a soft cover over the other elements of the periodontium; the periodontal ligament, alveolar bone, cementum and tooth roots. The gingiva prevents the invasion of bacteria into the periodontium, which lies deep to it. Although there is a tight barrier between the periodontium and the connective tissue, it is possible that with prolonged poor oral hygiene, the tissue be invaded by microbes leading to periodontal diseases (Schroeder & Listgarten, 1997).

Periodontal diseases are conditions which affect elements of the periodontium and can range from a simple inflammatory condition of the gums, gingivitis, to a more severe form, periodontitis, which can damage the teeth and surrounding bone, leading to tooth loss (Pihlstrom, Michalowicz et al. 2005IH, 2012). Gingivitis is a moderate form of periodontal disease in which only the gums are affected and can easily be reversed with twice daily brushing and maintaining a proper oral hygiene routine (Pihlstrom, Michalowicz et al. 2005). In data examining the rates of gingivitis in the United States, (Albandar and Rams, 2002) found that 82% of adolescents and 50% of adults were affected

with the condition. With improper care of gingivitis is it possible that it will develop into a more severe condition known as periodontitis (Albandar & Rams, 2002).

Periodontitis is the more advanced form of periodontal disease whereby not only is the gingiva affected but also affects the alveolar bone, periodontal ligament and cementum (AAP 2001, Pihlstrom, Michalowicz et al., 2005). Specifically in the case of periodontitis, the gingival tissue and the periodontal ligament are destroyed, and the alveolar bone may resorb, which can eventually lead to loosening of the teeth and tooth loss. The destruction of the tissues occurs due to a weakening in the junction between the gingiva and the tooth due to invasion of bacteria causing a persistent inflammatory response (Page, Offenbacher et al., 1997). With the weakening of the junction between the tooth and the gingiva, a periodontal pocket has the ability to form whereby the bacteria progresses into the pocket next to the tooth. This creates a space for the bacteria to further accumulate and cause destruction of nearby tissues (Page, Offenbacher et al., 1997). A major concern with the development of periodontitis is the inability of the periodontium to regenerate after the removal of the causal bacterial agents (Pihlstrom, Michalowicz et al., 2005, Hughes, Ghuman et al., 2010). Thus, taking measures to prevent disease development are crucial.

The mouth contains high numbers of microflora, which live in symbiosis within a healthy host. Studies have reported that over 500 different microbial species are found within in the dental plaque, which lives on the tooth (Moore & Moore, 2000). When bacteria accumulate along the gingival margin they may

cause inflammation and a plaque-induced gingivitis can result (Mariotti, 1999). Plaque-induced gingivitis begins along the gingival margin and subsequently has the ability to spread throughout the remaining gingiva (Mariotti, 1999). Along the dentition of individuals it is possible that the intensity of the clinical signs and symptoms vary, with certain areas of the mouth being affected by periodontal disease more severely than others (Mariotti, 1999). There are several symptoms common to plaque-induced gingivitis: erythema, edema, bleeding, sensitivity, tenderness and swelling (Loe, Theilade & Jensen, 1965).

Regular tooth brushing and flossing must supplement the removal of plaque by a dental professional as plaque begins to form within two hours after removal (Halvari & Halvari, 2006). With regular tooth brushing an optimal biofilm mass can be maintained and be compatible with gingival health (Lang, Cumming & Loe, 1973). Studies have shown that when plaque accumulates on healthy teeth for two to three weeks it can cause gingivitis (Halvari & Halvaryi, 2006). Therefore, the best approach for good oral care is combining regular professional teeth cleaning and daily dental care at home (Halvari & Halvari, 2006).

In addition to poor oral hygiene, several other risk factors have been associated with periodontal disease, such as smoking (Gelskey, 1999), alcoholism (Pitiphat et al., 2003), and diabetes (Mealey & Oates, 2006). Gelskey (1999) found that smokers have a higher risk of periodontal disease, which has been documented as a dose-response relationship (Detels et al., 2004). The prevalence of periodontal disease, as well as severity, has been linked to the

number of cigarettes consumed and the number of years smoking. Consumption of oral smokeless tobacco can also lead to gingivitis and loss of tooth support as well (Modeer, Lavstedt & Ahlund, 1980). The risk of one developing periodontal disease after long-term smoking is equal to that of developing lung cancer (Bergstrom, 2004).

An increased severity of periodontal disease has been reported in those consuming excessive alcohol (Pitiphat et al., 2003). In addition to decreased oral health, the loss of teeth can also negatively affect dietary habits thereby further decreasing nutrition status, particularly in the elderly (Petersen, Ueda, 2006).

Research examining the link between oral health status and chronic systemic diseases has discovered a connection between poor oral health status and diabetes, arthritis, respiratory disease and premature birth (Galil, 2004). It has been shown that the relationship between periodontal disease and diabetes is reciprocal. Those with diabetes are more likely to have periodontal disease, and those with periodontal disease are more likely to be affected by diabetes. Furthermore, improvement to one of the conditions, such as regulating blood sugar levels, can improve one's oral health and decrease the severity of periodontal disease (Galil, 2004). In a longitudinal study, periodontal disease has been linked to poor glycemic control in Pima Indians which suggests periodontal disease may complicate diabetes status (Taylor et al., 1996). It is hypothesized that persistent Gram-negative infections, such as periodontal disease, can lead to insulin resistance which can contribute to hyperglycemia and further complicate diabetes mellitus control (Grossi & Genco, 1998).

In a review by Kaur et al. (2013), it was found that patients with rheumatoid arthritis had a higher incidence of periodontal disease, which was measured by attachment levels and the number of missing teeth. Furthermore, there is epidemiological evidence indicating an increased severity of periodontal disease is linked to an increased risk of chronic obstructive pulmonary disease, although the mechanism remains unclear (Garcia et al., 2001). In a review looking at the association between periodontal disease, atherosclerosis, cardiovascular disease, and stroke, a modest association was found (Scannapieco, Bush & Paju, 2003). Therapy of periodontal disease may reduce atherosclerotic changes and may improve function of the endothelium (Han et al., 2014). Recently, clinical, epidemiological and animal studies have found a strong connection between chronic inflammation related to periodontal disease and cancer of several organs (Kipanyula et al., 2013). The risk of one developing head and neck squamous cell carcinomas is increased with the presence of chronic periodontitis (Tezal et al., 2007).

Given the preventable nature of periodontal disease, public education could largely decrease the prevalence of the disease by providing strategies for prevention, as well as descriptions of the warning signs and possible risk factors. Chair-side, preventative approaches and clinical treatment have thus far proven ineffective (Watt & Petersen, 2012). A grass roots approach to community-oriented health promotion that includes outreach and motivation to underprivileged or disadvantaged populations may be more effective. Within a dentistry setting, patient education has typically been clinician-centered and

largely descriptive (Williams, 2011). Patients either accept the information passively or may resist the educational information provided by clinicians. Clinicians have not yet placed importance on factors affecting patient change, such as autonomy, intrinsic motivation, and competence, at the forefront of their efforts.

It is well documented that socioeconomic inequality does exist in health care and that those with worse health status tend to be from lower socioeconomic statuses (Marmot et al., 1991). With the overwhelming presence of evidence indicating inequalities, researchers have recommended directing research to help policy makers overcome these inequalities (Marmot et al., 2008). With further research examining the magnitude of inequalities it is possible to identify those in areas of highest need for intervention (Ravaghi et al., 2013) thus enabling resources to reach those individuals in the most need. For example, a study by (Brothwell & Ghiabi, 2009) examined the distribution of periodontal disease in adults living in Sandy Bay First Nations in Manitoba. The researchers discovered that dental care was only present once a week in the community and that the prevalence of moderate to severe periodontal disease was higher than reported in the general population. In a study analyzing data from 4951 participants it was found that those living in higher socioeconomic statuses had fewer decayed or missing teeth and were less likely to report oral pain. For those living in poverty in industrialized countries, oral diseases do present a tremendous burden (Loignon et al., 2010). Further, evidence shows that those individuals will rarely seek consultation from a dentist regardless of

their need and the widespread availability in Canada of public dental insurance programs (RAMQ, 2005). The main reason for this is that the patients often feel they have a poor relationship with the oral health professional. It has been shown that individuals relying on government assistance feel they are not understood and even rejected by their dentist (Bedos et al., 2003, 2005). Thus, evidence indicates that those living in underserved and underprivileged populations have not only a higher likelihood of developing periodontal disease, but developing more advanced forms. As suggested by Marmot et al., (2008) it is important that information is provided to the populations in the direst need in order to decrease their risk or prevent the advancement of disease. If the individuals living in those communities had specific information pertaining to their lifestyle and risk factors, it is possible that the rates of periodontal disease and other diseases could decrease in those regions.

Patient education is a highly repetitious and important role in the delivery of health care services. Up to one quarter of a physicians time is spent in patient education (Orleans et al., 1985). According to Begley (1994), “people retain 10% of what they see, 20% of what they hear, half of what they see and hear, and 80% of what they see, hear and do”. Using that information to create a tool for periodontal disease education whereby patients see, hear and participate in the learning could be extremely effective. It is believe that computer based patient education (CBPE) could enhance the delivery of health care effectively by combining the three modalities of learning (Sechrest & Henry, 1995) as described below. Computer based patient has certain advantages in

that it can be highly patient focused, fast and also inexpensive with low recurring cost between patients (Keulers et al., 2007).

In a study by Keulers et al. (2007), the researchers examined whether the education regarding an upcoming carpal tunnel surgery, provided by either a doctor or a computer-based patient education program, differed in knowledge levels and satisfaction scores amongst the patients. The researchers found that patients who used a computer-based patient education module had significantly higher knowledge levels than counterparts who were educated by the physicians themselves. With regards to the satisfaction scores regarding the modality of learning, no significant difference was observed. Thus the results support that computer-based patient education may provide higher levels of knowledge to patients than those traditionally receiving the information from a physician.

Recently, the evidence shows that not only are patients more knowledgeable, but there is also increased satisfaction with computer based patient education (Beranova & Sykes, 2007). A randomized trial investigated the recall of knowledge of periodontal disease by patients with periodontitis using 3D animations (Cleeren et al., 2014). A total of 68 patients participating in the trial were randomized into a control group and a 3D animation group. The patients received a pre-test, a 3D or control patient education video, and finally a post-test immediately after viewing the video and a follow up test 2 weeks after. The test comprising 10 multiple-choice questions established no difference in base line knowledge between groups however those patients viewing the 3D animations had significantly higher scores on the post test and follow up test.

Thus the researchers established that 3D animation was more effective for periodontal patient education than standard drawings.

Research has also shown end-of-module multiple-choice quizzes with feedback have the ability to significantly improve learning benefits. In a study by McDaniel et al. (2011), a quiz was created to assess student's knowledge acquisition in an 8th grade science class. There were three quizzes that were created and administered to the students over the duration of the unit. The study demonstrated that quizzing produced significant learning benefits. The students demonstrated a 13%-25% increase in performance with the quizzing. The authors noticed benefits from the quizzing when administering the end of year exams, as well.

It has been suggested that the use of computer-based tools could help overcome barriers such as low literacy rates, language differences, or education of children (Palin-Palokas et al., 1997). During computer-based patient education there is the possibility of a voice-recorded component to be added, which can be turned on or off based on the patients wishes. There is also the possibility of offering the module in several different languages, which could highly benefit a multicultural center. Further, the inclusion of simplified images or a child's version of the module could allow them to also receive benefits from the computer-based patient education.

Research has also shown that often time's patients do not understand what a physician is saying to them during a medical encounter due to differences in education level and culture (Beranova & Sykes, 2007). This may discourage

the patient and decrease their motivation towards maintaining proper oral hygiene. In periodontal disease, patient motivation and adherence to proper oral hygiene is crucial to prevention or treatment thus proper oral hygiene education delivery is crucial to decrease rates of the disease.

Currently, if a dental professional wanted to provide information to patients regarding periodontal disease and oral hygiene, commercial companies have produced several pamphlets. There are also videos that have been produced which are displayed in dental offices however many of them are not interactive. After a review of randomized clinical trials, which evaluated the usefulness and acceptability of computerized patient education interventions, all but one reported positive results (n=22) (Krishna et al., 1997). Seven of the studies targeted populations with diabetes and they all reported decreased blood glucose levels among patients exposed to the intervention. Thus, it is believed that educational interventions delivered through computer-based methods can lead to an improved health status. However, they are not able to substitute face-to-face time with physicians and should merely be a supplement.

Since periodontal disease in a lower socioeconomic population can be extremely detrimental to one's oral and general health, it is important to also be able to provide them with the information needed to maintain health. To tackle this public health concern, an educational learning tool that will provide information on periodontal disease and preventative measures, such as proper oral hygiene, will be developed. Upon reviewing the strong data suggesting increased satisfaction and knowledge from computer-based patient education

tools, that modality will be used to create the module. Since there is strong evidence showing that the most socially and economically vulnerable individuals in society have the highest rate of oral health problems the module will focus on targeting that specific population. The learning tool will be distributed to underprivileged and isolated populations through public and private dental clinics. Locally, this computer-based patient education module will be available to the Dental Outreach Community Service program at Schulich School of Medicine & Dentistry, and will be used as a teaching tool at Western University School of Dentistry at Schulich School of Dentistry and Medicine.

PURPOSE OF THE STUDY

To create a computer-based patient education module that can be used to educate patients regarding periodontal disease and potential effects on one's oral and systemic health. The module will seek to provide patients with a novel way of learning about their oral health and periodontal disease in the hopes of decreasing the disease prevalence. By increasing awareness of the damaging consequences of the disease patient motivation will hopefully increase. With the recent evidence indicating preference for computer-based learning, the module may be more successful than traditional periodontal disease patient education tools.

OBJECTIVES

- Create an educational tool about periodontal disease that is accessible to underprivileged
- Design the educational tool to educate learners about proper oral hygiene and its relationship to overall systemic health

Chapter 2

Development of the Online Module

The online learning tool was created using software called Articulate Storyline with help from the Instructional Technology Resource Centre (ITRC) at Western University. Initially the module was created in a PowerPoint file and later converted and modified into a more interactive file using Articulate Storyline. Articulate Storyline is e-learning software that allows the creation of highly interactive online and mobile courses that are customizable to the developer's choosing. It allows the addition of images, quizzes, drag features and also audio recordings to be added to enrich the interactivity of the learning module. It also has the ability to be used on any interface whether it is a PC, Apple, etc.

Each module can be read in its entirety or certain sections relevant to the patient can be chosen. There is the feature of a next and previous buttons the subjects can click in order to proceed accordingly. Also a module can be selected without reading the previous module, thus allowing the reader to be in control of the information sought. Further, when a module is selected the subject will see all the subjects covered in that particular module to allow selection is desired or simply to be aware of the information to follow. Each module can be selected from the home screen or from the side bar allowing them the option to change sections are any time. They also have the ability to return to the home page at any time during the progression through the module.

Each module is completed with a quiz section that allows the subjects to review the information they have previously read and received immediate feedback to the correctness of their answer selection. The subject again has the option of not completing the quiz and progressing to the next section they wish to complete.

Another feature present in the modules is the use of a “self-check” section. This feature is present in 3 different sections related to the healthy or disease state being discussed. The first self-check section features a healthy oral cavity and has arrows and text describing the parts of the mouth of focus. For example there is a brief mention regarding the ideal color and texture of the gums seen in the healthy state. Subsequently there is a gingivitis state whereby a picture of a clinical case is shown with arrows and text describing the features present when one has developed gingivitis. Lastly, periodontitis is illustrated in a similar fashion whereby disease features are briefly mentioned. The hope with this section is that patient will look at the picture, read the text and then reflect on their own oral cavity to try to decipher which state describes them best. This may in turn help the patient learn some lifestyle modifications or oral hygiene techniques to improve their condition or return to a healthy state. The use of real images in this section will allow the patients to truly visualize the disease state as opposed to an illustration, which doesn't as clearly depict the features mentioned.

Within the module there is also the use of 3D animations. The success of 3D animations with regards to learning was previously discussed and thus

employed during the project. With the help of ITRC the creation of a cartoon set of teeth was created showing the progressive accumulation of plaque along the gingival margin. This illustrates to the patients how the accumulation is progressive over time and precisely where it develops in their mouth.

During the development of the module there was a large emphasis on elimination of the technical jargon to decrease the level of reading. One of the main aims of the project was to create an online learning tool that the entire population could comprehend. The development focused on creating a tool acceptable to all levels of knowledge and education.

Chapter 3

Results

The online learning tool is organized into four learning different modules: “What is Periodontal Disease,” “Types of Periodontal Disease,” “Causes of Periodontal Disease,” and lastly, “Prevention of Periodontal Disease.” There is also an additional section entitled, “Risk Assessment Quiz,” which patients can choose to complete. Each module includes text and pictures to help with the understanding of the material presented. Also, each module concludes with a few take-home points and a short quiz that patients can complete before moving on to another section. The take home points address the main learning points of the module previously read and the quiz just allows reinforcement of these details. A screenshot of the main menu is shown in Figure 2.

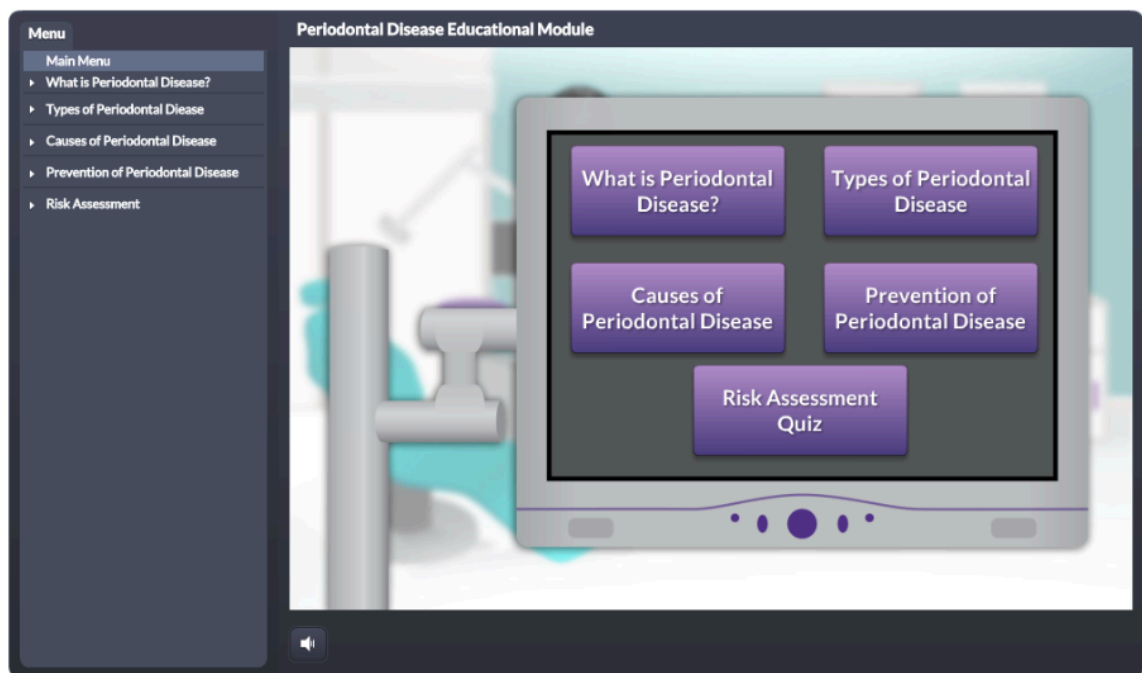


Figure 2: Module home screen

3.1 Module 1- What is Periodontal Disease?

The first module is entitled “What is Periodontal Disease?” which is a general overview of periodontal disease. The patients are made aware that periodontal disease is a disease that affects the gums, but may also affect the bone in later stages.



Figure 3: Module 1- What is Periodontal Disease?

Included in the module are pictures indicating the parts of the periodontium or the gums: the cementum, the periodontal ligament, the alveolar bone and the gums. This allows the main features of the periodontium to be clearly illustrated for the patients to be aware of the elements discussed. Following this, there is a 3D animation demonstrating to the patient how the plaque builds up on the tooth along the gum line and later forms tartar. Once the 3D animation is completed a photo of a real world example of a patient with tartar accumulating along the tooth is shown. That allows the patient to truly

visualize and perhaps compare if their teeth have the same appearance. A screenshot of the animation demonstrating the accumulation of plaque is shown in Figure 4 and the image of the real world patient is shown in Figure 5.

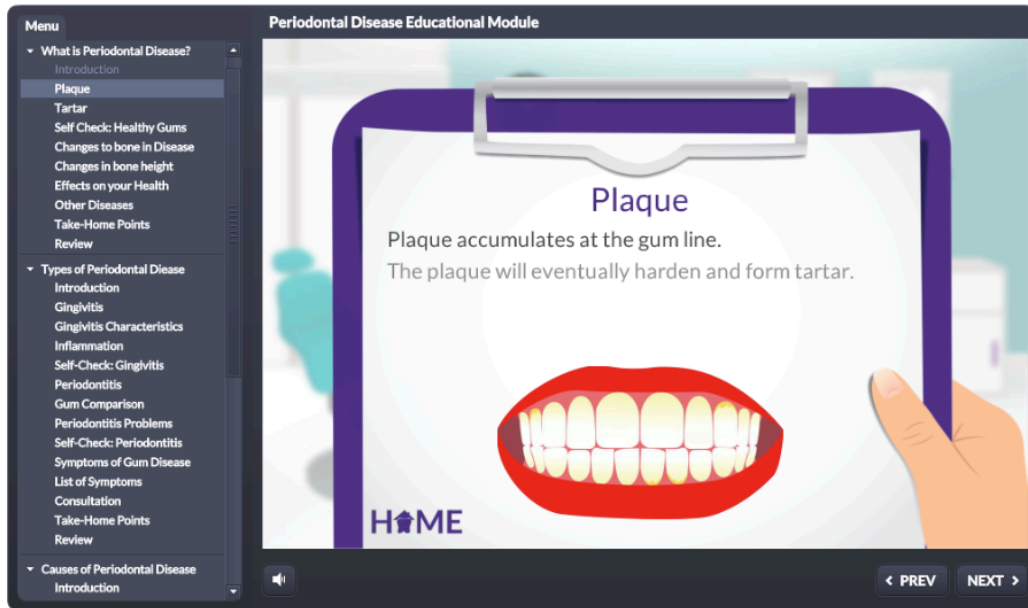


Figure 4- Cartoon image of tartar accumulating along the gum line

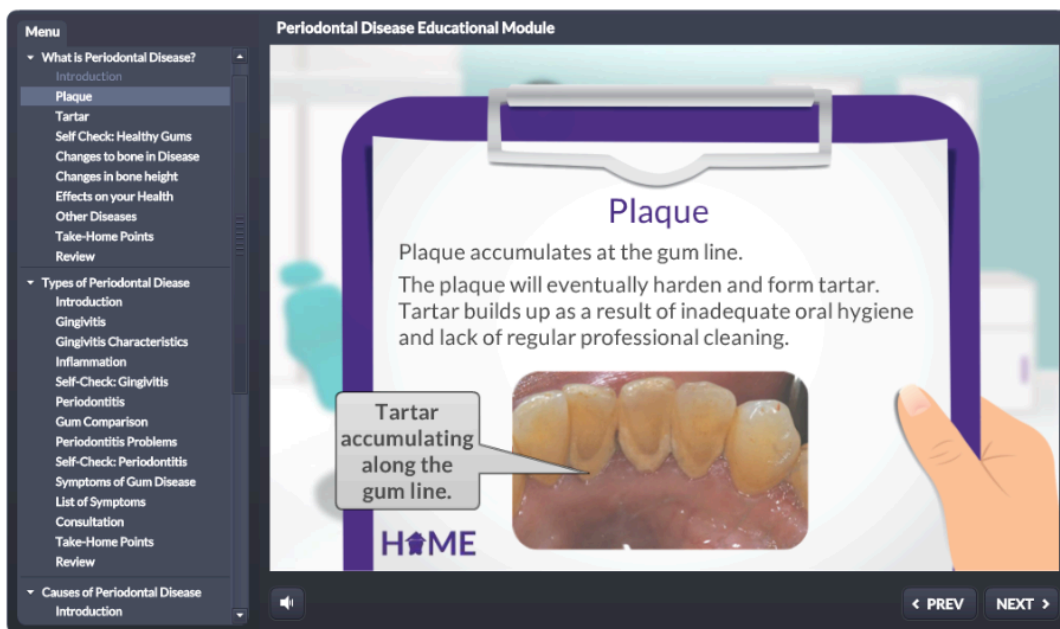


Figure 5: Patient image of tartar accumulating along the gum line

Within the module, there are three self-check sections (Figure 6) in which patients can observe an image of healthy, gingivitis and periodontitis infected gums and their features. The first of the three self-check sections includes the healthy gums and their features. The features of healthy gums are indicated on a patient image, seen in Figure 6, which may allow the patient to observe the example and perhaps relate to features they present when observing their own respective gingiva.

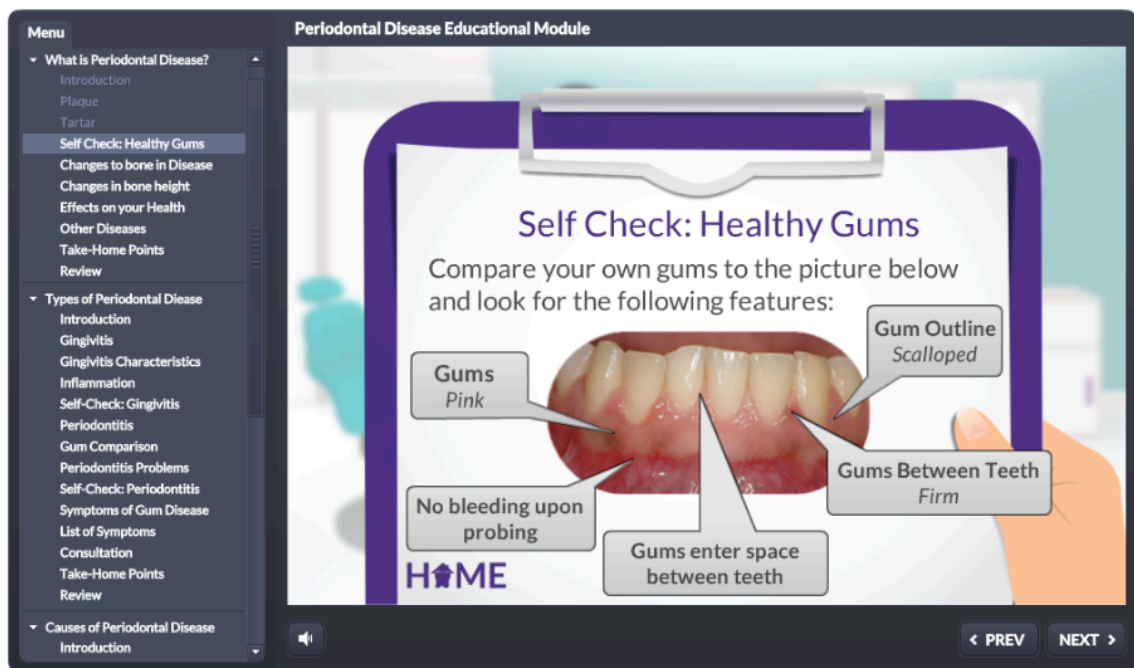


Figure 6: Patient Self Check: Healthy Gums

The overview of periodontal disease continues in the first module with a description of changes that occur in the advanced stages of the disease. In the advanced stages of the disease, (Figure 7) the bone may become infected due to the infiltration of the bacteria, and degradation of the bone may appear. Clinically this will make the tooth appear longer, as gum tissue and bone have receded. In the late stages of periodontitis the tooth may become loose, and the lack of connective tissue may eventually cause them to fall out. The changes to bone health slide are illustrated in Figure 7.

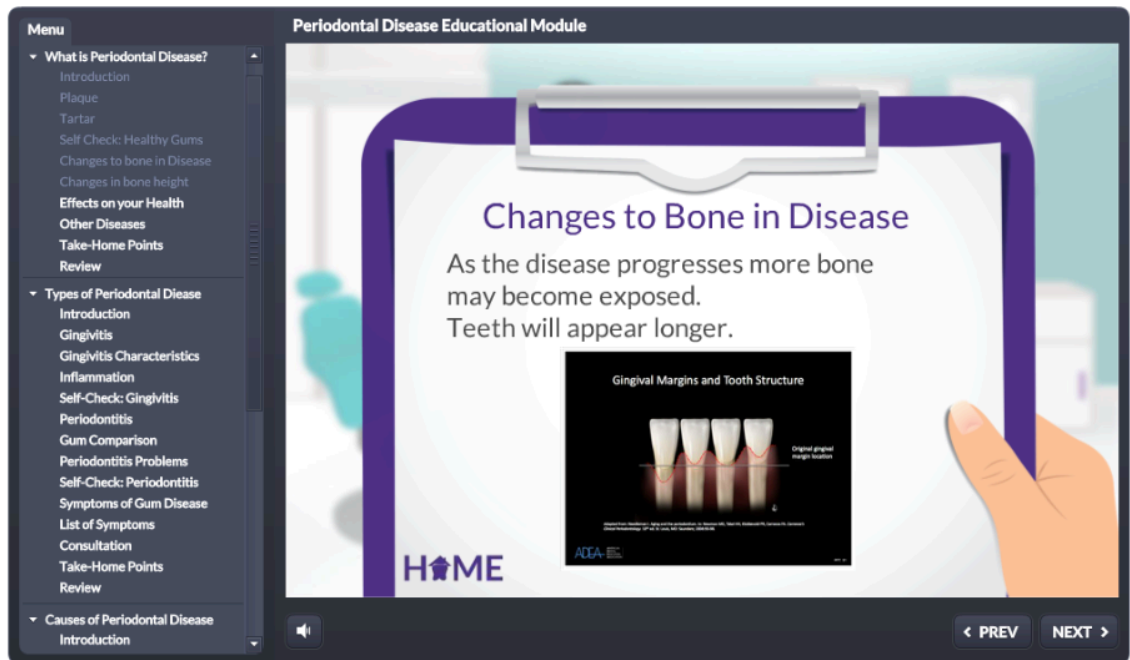


Figure 7: Changes to Bone in Disease state

At the end of the first module, there is information about how periodontal disease not only affects oral health but may also have systemic consequences. As previously stated, periodontal disease may be associated with several conditions such as some cancers, rheumatoid arthritis and preterm pregnancy for example. Although there is some evidence indicating relationships with those diseases, the research is not yet conclusive. Thus, presenting information on two major public health concerns, diabetes and heart disease, will allow the patients to know that they should think about their oral health habits affecting their overall health picture. The patient is able to select (Figure 8) to read about heart disease and/or diabetes and their respective relationships to periodontal disease.

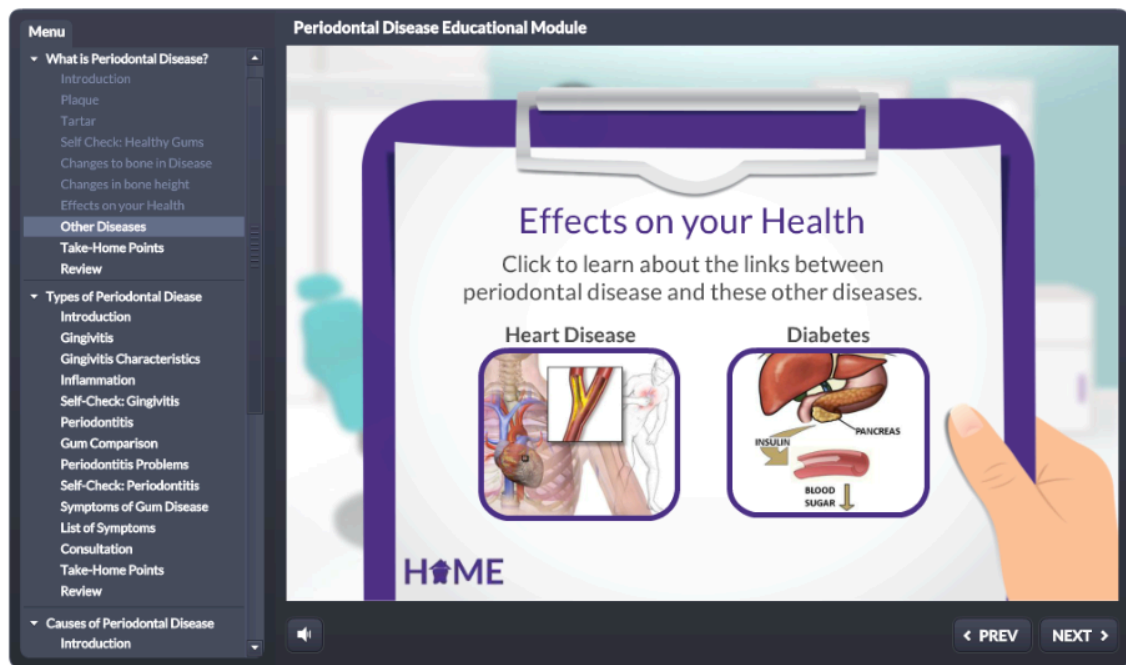


Figure 8: Relationship of periodontal disease to systemic conditions

In order to reinforce the information from the module, a take home message was added to the end of the module (Figure 9). It is important for the patients to read all the information but if they only take away a few key points of information we have selected the most important ones to include in one place.

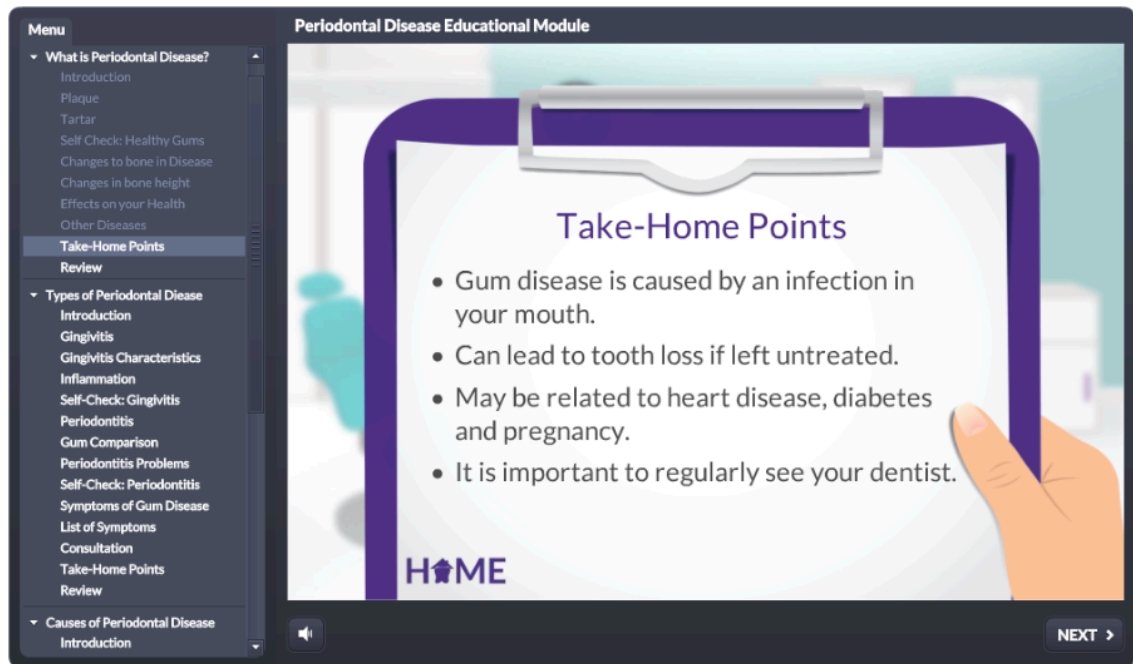


Figure 9: Take Home Points for Module 1

The module is completed with a short 2-question quiz at the end for the patients to complete if they choose to do so. The quiz asks them if periodontal disease is a disease of the: gums, ears, stomach or heart. The second question is asking them to select the true or false statement about if periodontal disease causing tooth loss.

3.2. Module 2: Types of Periodontal Disease

The second module in the periodontal disease tool is entitled “Types of Periodontal Disease”. This module covers the two forms of periodontal disease, gingivitis and periodontitis, in more detail than the first module. It also presents more general information relating to periodontal disease. The home screen of the module is seen in Figure 10.

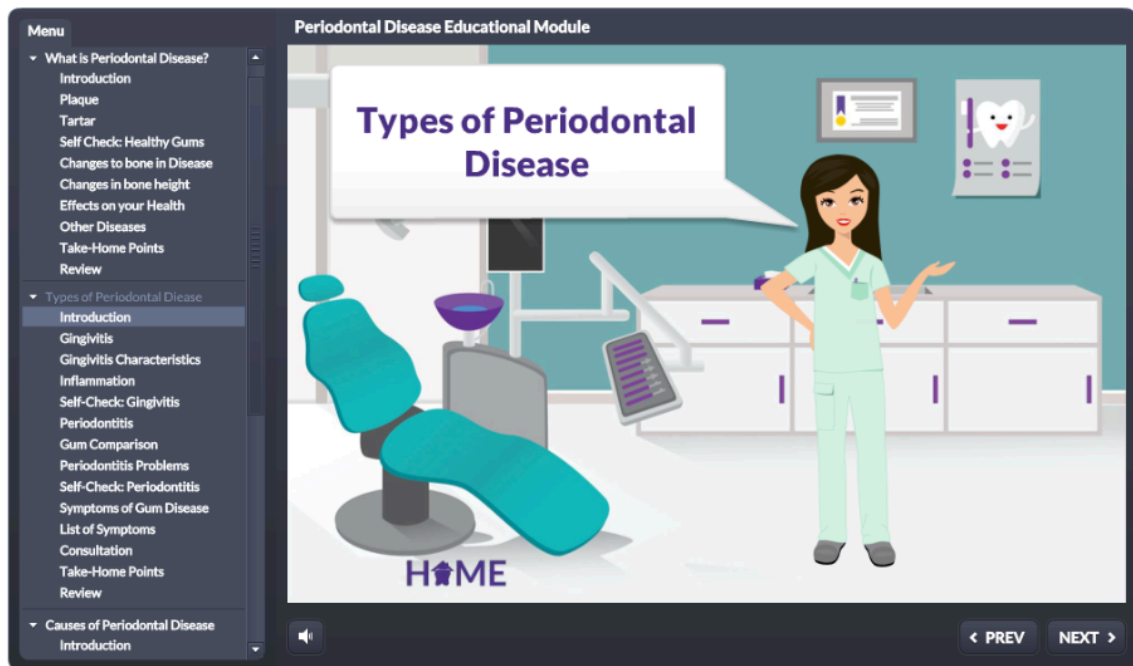


Figure 10: Module 2- Types of Periodontal Disease home screen

The first disease covered is gingivitis. It is the milder form of periodontal disease, thus it has been presented first. Gingivitis presents as swollen and red gums; the disease has not invaded the alveolar bone yet and remains in the gingiva. An illustration of that is included in this section in order for patients to visualize red and swollen gums as can be seen in Figure 11. Other important information for the patients regarding gingivitis is the ability to reverse the condition and to return to a healthy gum state with proper oral hygiene habits and dental care.

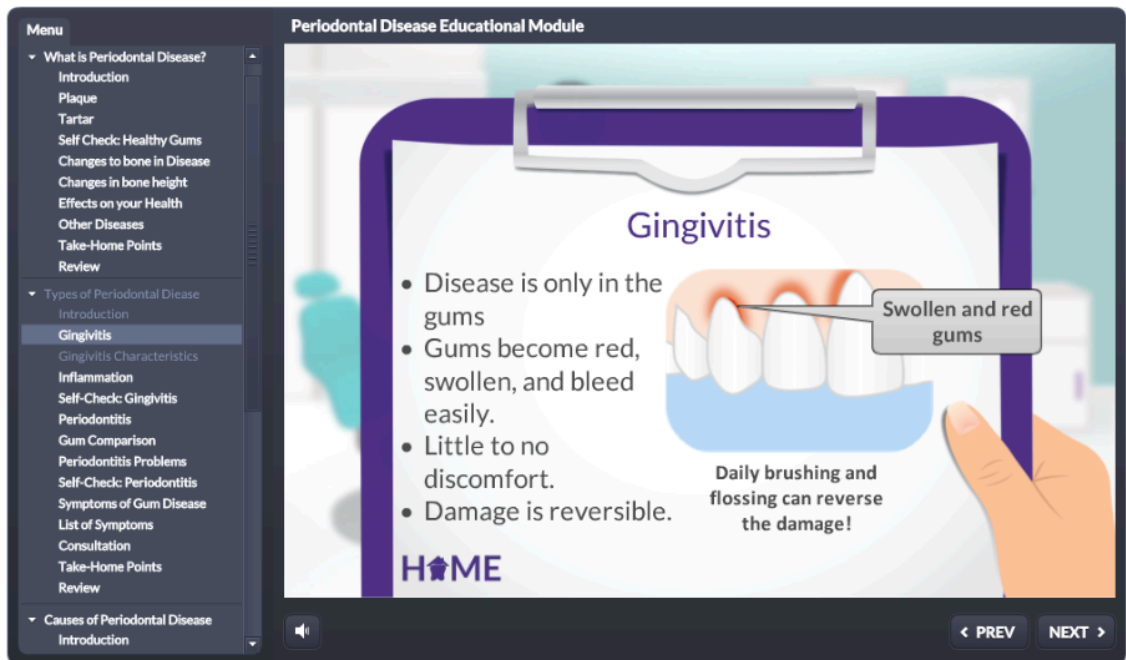


Figure 11: Illustration of swollen and red gums in gingivitis

As was seen in Module 1, there is also a self-check for gingivitis as shown in Figure 12. This self-check includes two pictures, which are labeled to include clinical features of gingivitis such as bleeding and swollen gums. If the patient is able to observe what gingivitis looks like in a real patient they may be better able to relate to and compare to their own oral health. In turn if the patient believes they have a similar condition to the self-check patient, they may be more likely to discuss the issue with their dentist and hopefully learn the steps of proper oral hygiene to return to a healthy state.

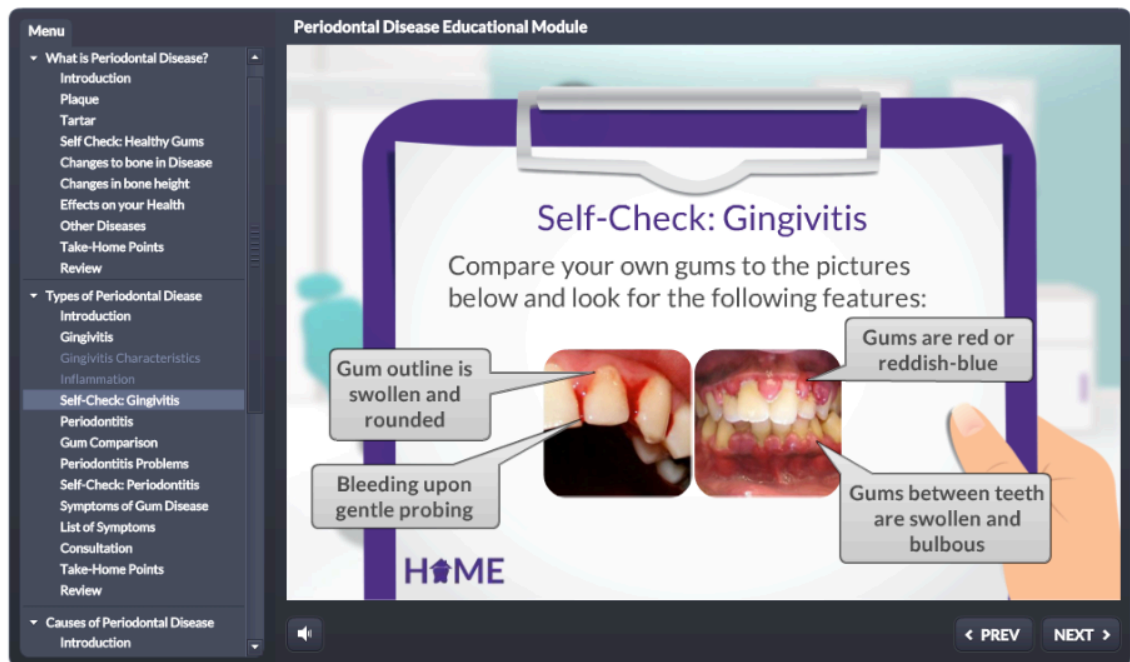


Figure 12: Self-Check Gingivitis

Once the self-check stage is completed in the second module, the patient would advance to read about the later and more severe form of periodontal disease, periodontitis. Periodontitis is unfortunately irreversible and occurs when the infection has spread from the gingiva into the alveolar bone. Some consequences of the disease include the teeth appearing longer, loss of gum tissue and perhaps the teeth falling out in the most advanced stages. Figure 13 is a screenshot of the general overview of periodontitis shown in the module for the patients.

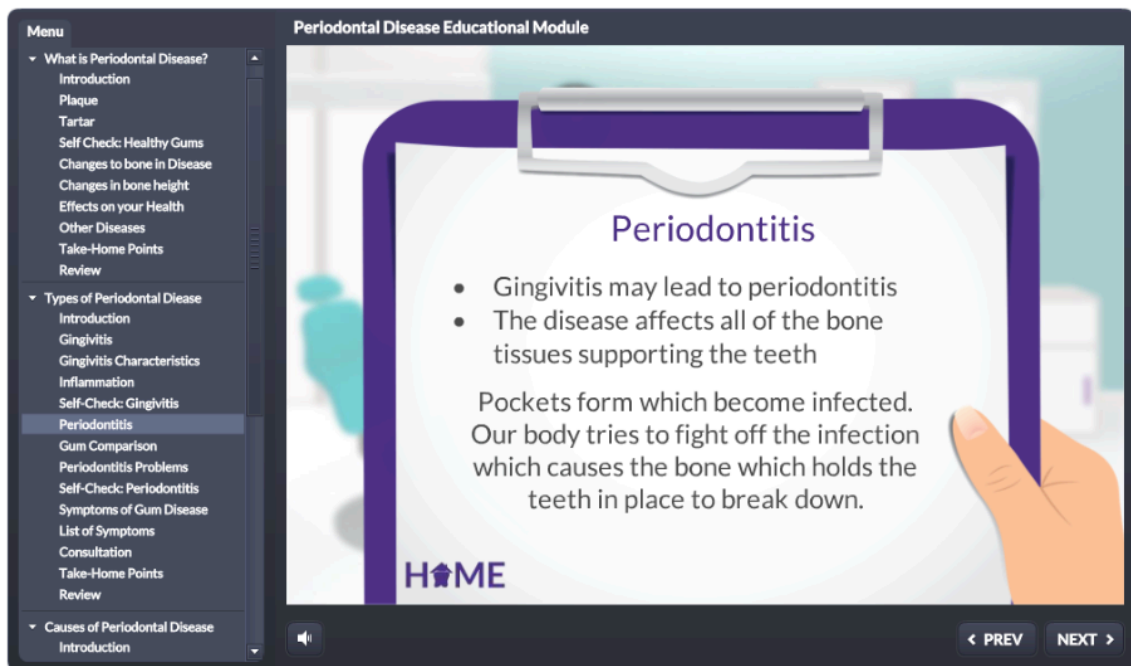


Figure 13: Overview of Periodontitis

As with the healthy and gingivitis state a self-check for periodontitis is included for the patients to see a real example of the disease. The picture in Figure 14 indicates that the teeth may appear longer, the gums may not fill the space between the teeth, the tooth may become loose and even fall out and there may be bleeding or pus discharge from the gums.

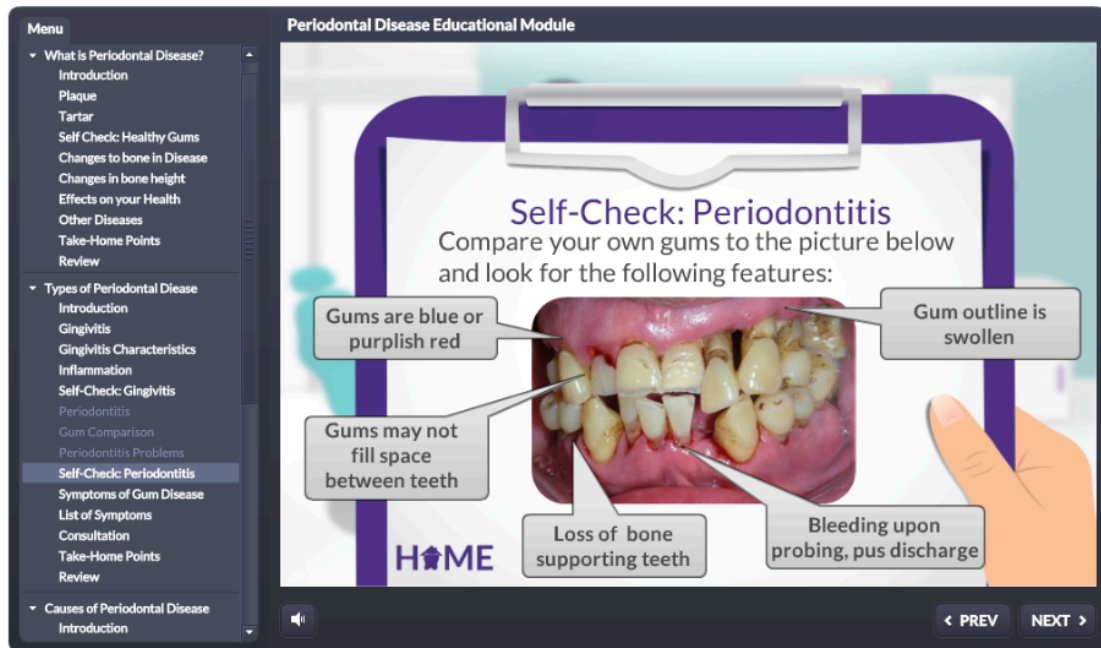


Figure 14: Self-Check for Periodontitis

After both conditions are presented, the list of common symptoms for periodontal disease is presented. A patient may present with only one symptom, or may present with many if they are in the more advanced stages. It is important for patients to be aware of the symptoms that may indicate they may be developing gum disease. Presenting the symptoms, as in Figure 15, allows the patient to be familiar with those symptoms to look for when they are brushing their teeth or flossing. If a patient presents with any of the symptoms it would be important for them to have a discussion that with their dentist to see if there are any changes they could make to prevent or reverse the disease.

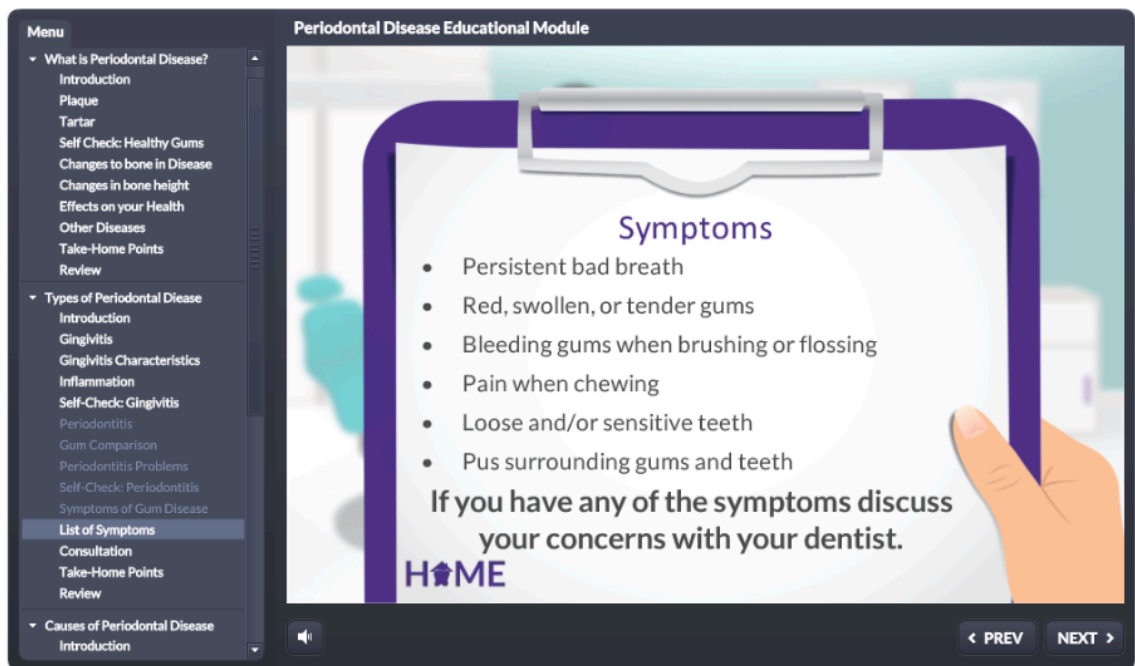


Figure 15: Periodontal disease symptoms list

Lastly, in order to reiterate the important points of the second module a take home section is added at the end (Figure 16). There is substantial information in the second module but if the patient retains certain key points, then it was successful. It is important for them to know there are two types of periodontal disease, a mild form which can be reversed and a more serious form which can only be treated but not reversed. Also, if the patient suspects they present with any of the symptoms it is essential for them to discuss that with their dentist.

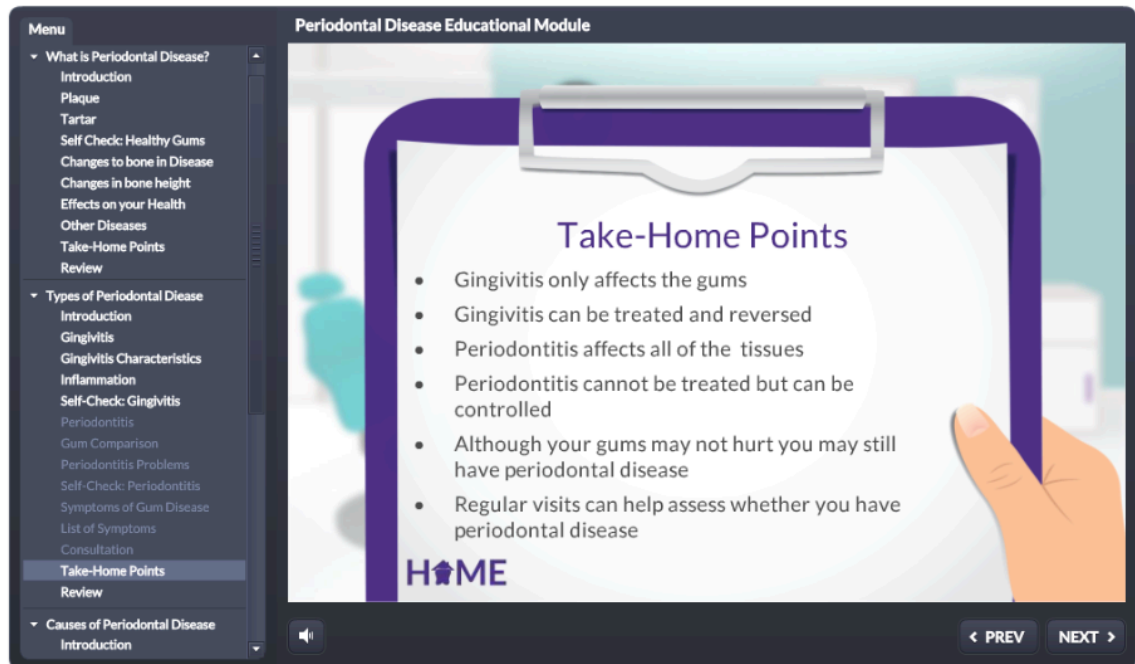


Figure 16: Types of Periodontal Disease take home points

Lastly, there is a quiz section asking them to identify whether gingivitis or periodontitis is the more severe form of the disease. There is then a true or false question asking whether periodontitis can be reversed. A third question, as seen in Figure 17, is asking them to select the boxes to identify which are symptoms of gum disease. Finally, the last question refers to the ability of gum disease asks to remain undetected for a long period of time. There are subsequent questions asking about types of periodontal disease and another question asking in which condition results in does permanent damage occurs.

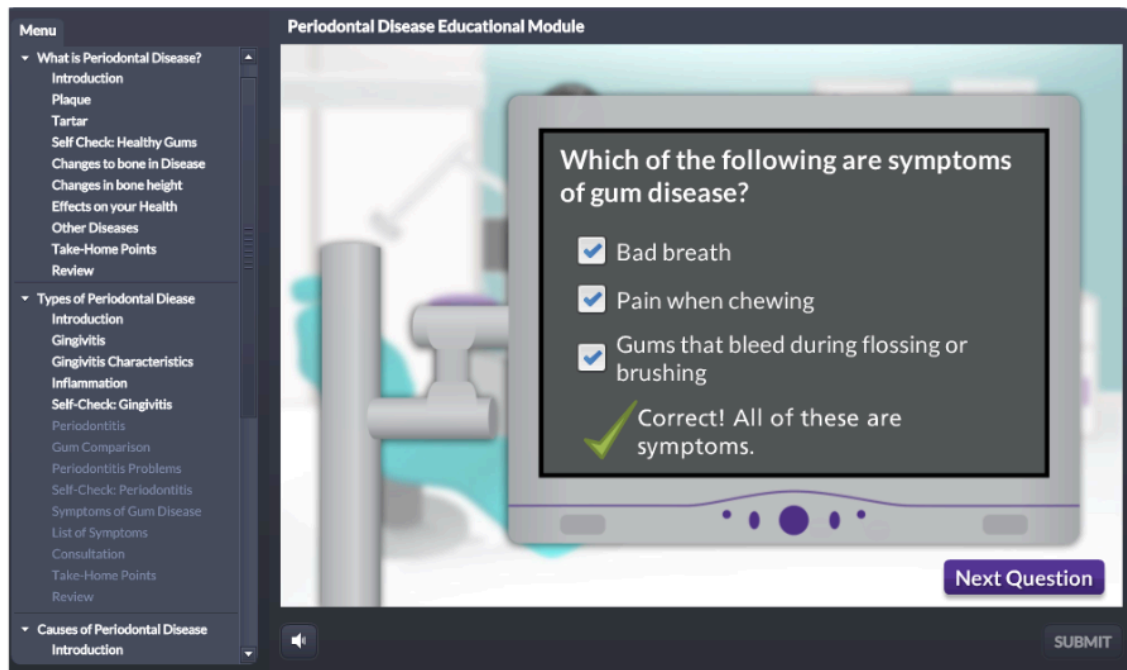


Figure 17: Example of review question for module 2

3.3 Module 3-Causes of Periodontal Disease

The third module (Figure 18) describes the causes of periodontal disease. It is important for the patients to know what the reasons for the development of the disease and how behavioral and lifestyle modifications could decrease their risk.

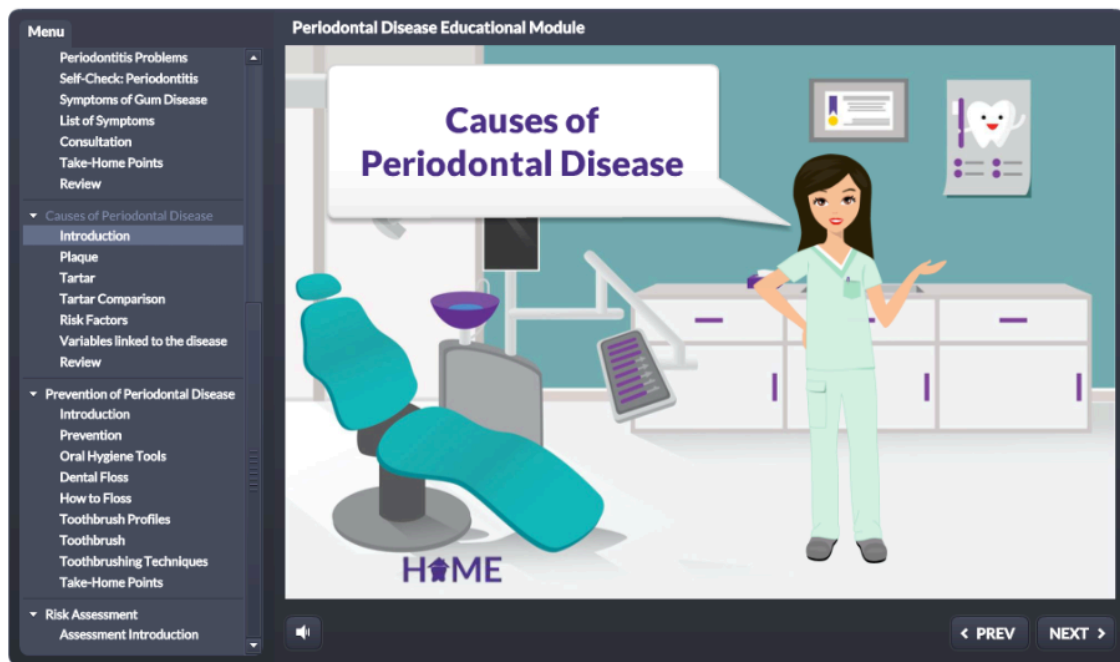


Figure 18: Module 3- Causes of Periodontal Disease

The causes of periodontal disease are related to the plaque that builds up on our teeth within a mere two hours of brushing. Plaque is the result of bacteria and debris depositing itself along the gingival margin. With twice daily brushing and flossing it is possible to remove most of the plaque on our teeth. However, with improper oral hygiene the plaque turns into tartar. It is important for patients to be aware that with proper oral hygiene they can remove the harmful debris each day and prevent more serious complications from arising. Figure 19

illustrates how tartar build up would appear clinically if the plaque is not removed.

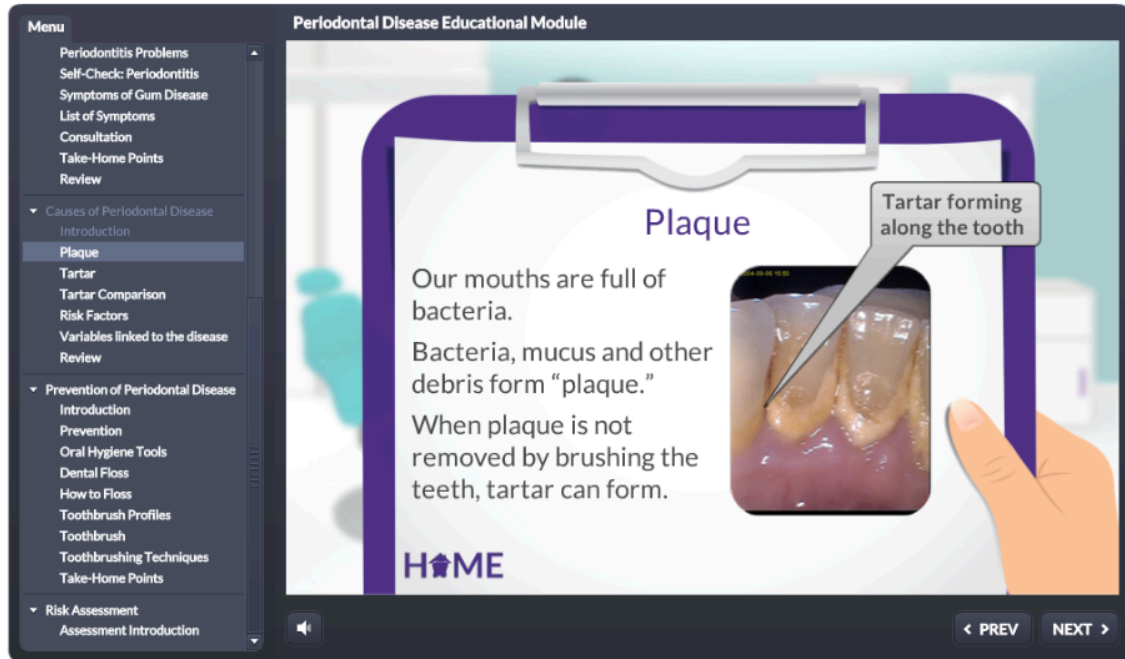


Figure 19: Description of plaque accumulation consequences

When the plaque is not removed, tartar forms and, unfortunately, only a dental professional can remove it. Thus, it is extremely important to be certain that plaque is removed daily in order to prevent long-term consequences. If there is tartar accumulation on the tooth after removal by a dental professional, it is possible for patients to return to a healthy state. Figure 20 illustrates that with proper oral care or tartar removal by a dental professional drastic changes can be seen in gingiva health.

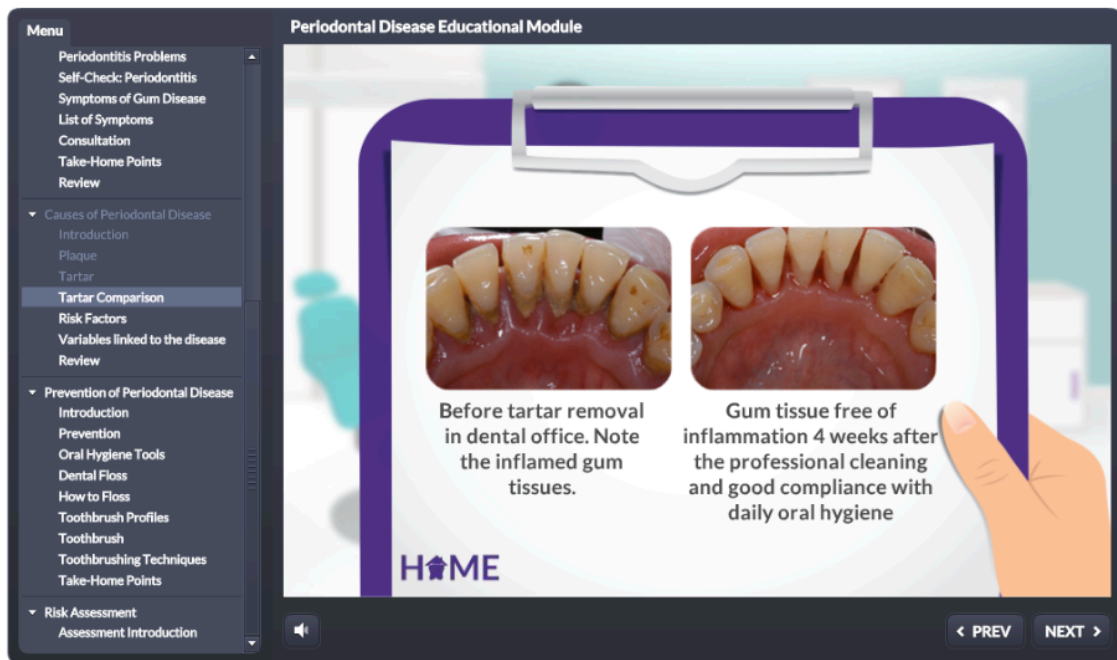


Figure 20: Comparison before and after tartar removal by a dentist

Not only does improper oral hygiene habits contribute to periodontal disease there are also modifiable risk factors which can contribute to the disease. There are several modifiable risk factors that contribute to the development of the disease, but one of the most important risk factors is smoking. As it is risk factors which could be modified with lifestyle changes, it is

important for patients to be aware of the consequences of smoking. Other risk factors such as poor nutrition, improper oral hygiene habits and diabetes could contribute to the disease state. A short piece of information is included about the above-mentioned risk factors in Figure 21. The patient can select which risk factor they would like to learn about individually or they can choose to read them all.

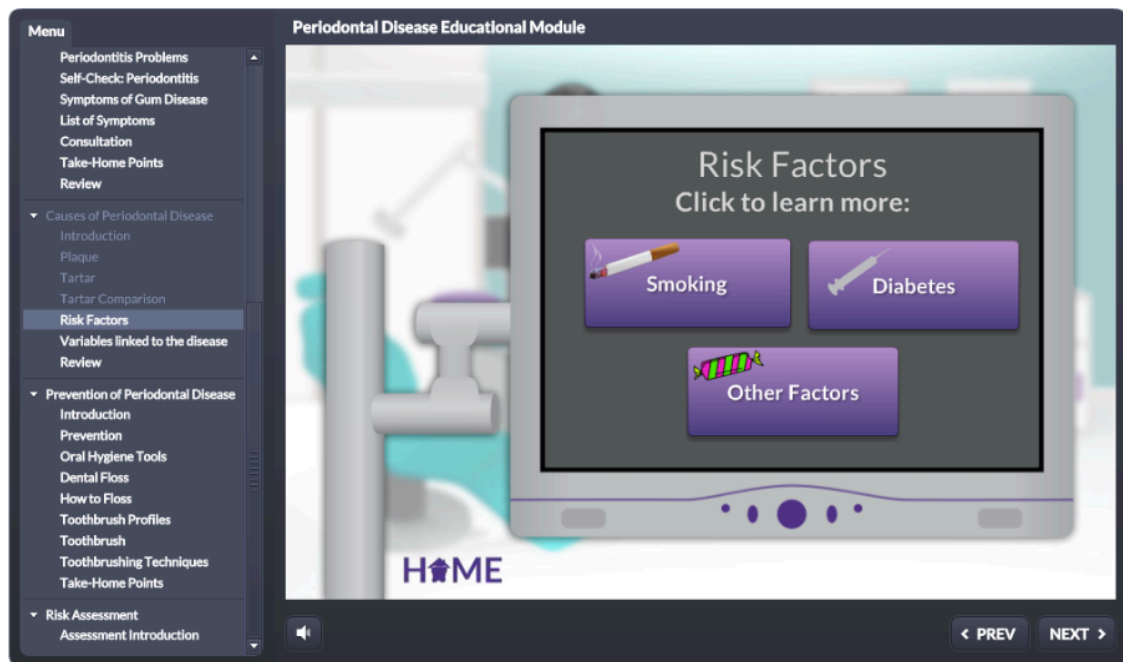


Figure 21: Periodontal Disease Risk factors

Lastly, to complete the module, there is a short quiz at end. It asks the patient whether smoking is a risk factor for periodontal disease.

3.4- Module 4- Prevention of Periodontal Disease

The last module relates to the prevention of periodontal disease (Figure 22). As periodontal disease is a highly preventable disease, it is important for patients to be aware of how to prevent the condition from developing. It is also important for those affected by periodontal disease to be aware how to manage and treat their condition. Even in the advanced form of periodontitis it is possible for the condition to be managed instead of progressing and worsening.

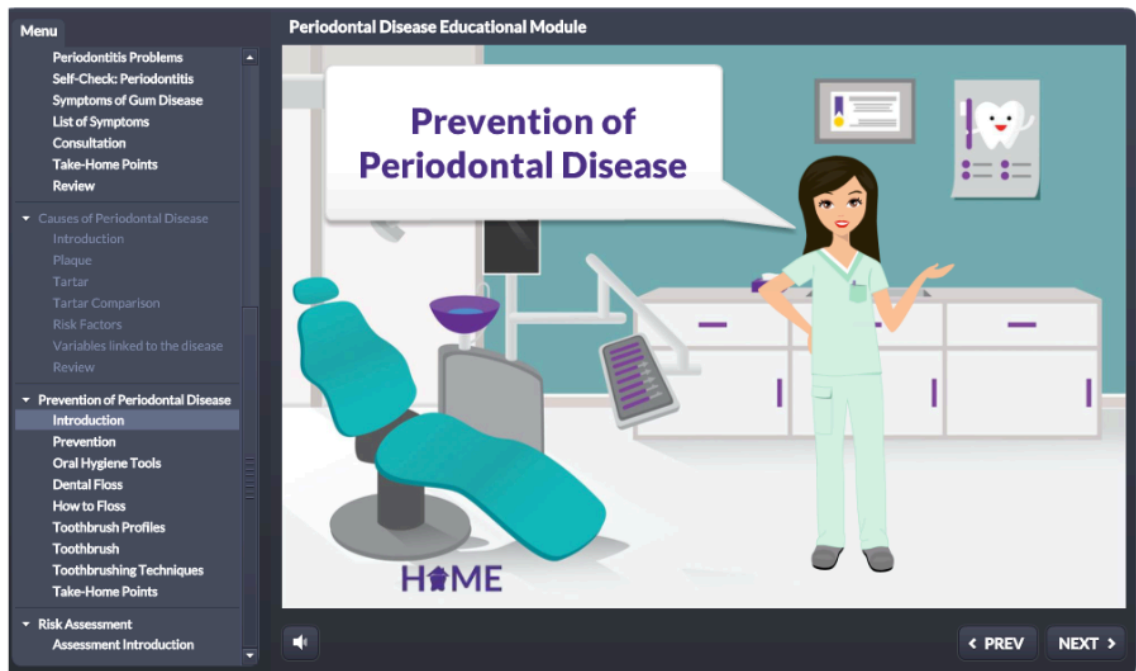


Figure 22: Module 4- Prevention of Periodontal Disease

Periodontal disease can be prevented with daily proper oral hygiene habits, therefore educating patients on how to properly take care of their teeth could decrease the prevalence of the disease (Figure 23). Although there are ample educational sources for tips on proper oral hygiene, there is the potential,

based on evidence, that providing the information in a computer based format will allow the patients to be more satisfied and retain more of the knowledge. Decreasing the prevalence of the disease as mentioned before could help manage other systemic conditions as well. The module begins with illustrations of the essential tools for maintaining daily proper oral hygiene that each patient should have at home.

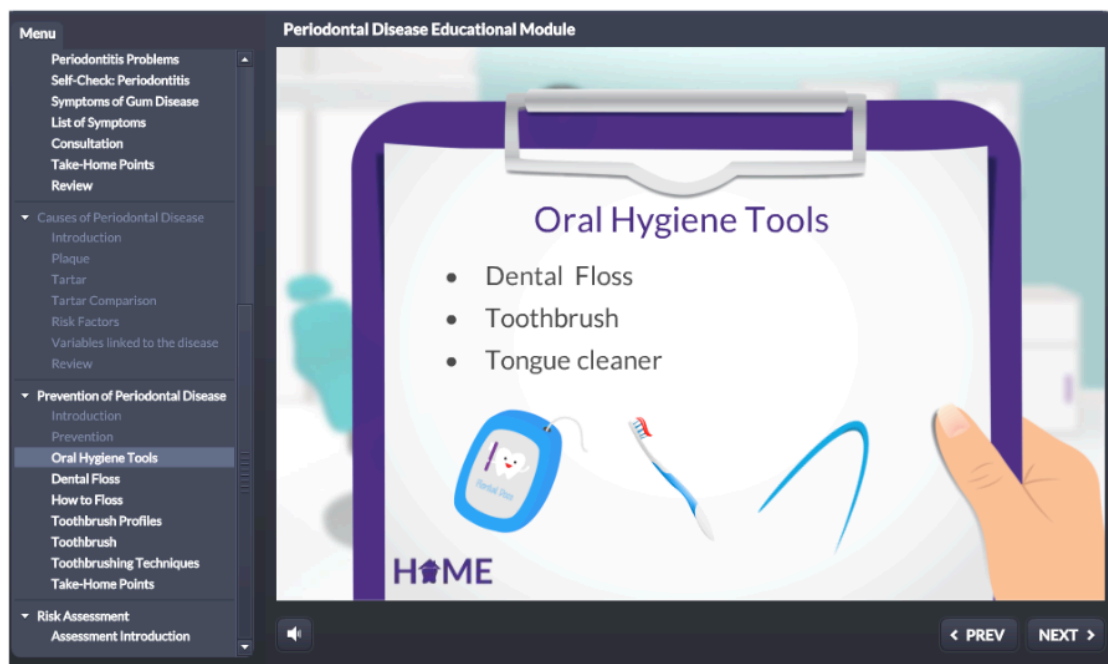


Figure 23: Essential tools for maintaining proper oral hygiene

Following the introduction of the types of oral hygiene tools patients should use, there is a description regarding each one. Most patients are aware of the importance of tooth brushing, however there are also other tools that need to be used in conjunction with tooth brushing for maintaining oral hygiene. Dental floss needs to be used in conjunction with twice daily brushing to remove the debris trapped between the teeth and in places the toothbrush cannot reach.

Patients are made aware there are two types of dental floss, both of which are equally effective and could be used interchangeably.

Another important oral hygiene lesson from this module is proper instructions on how to use dental floss effectively. Proper flossing technique includes placing the floss between two teeth and wrapping it around one of them before bringing it between the tooth and the gums. Figure 24 shows proper flossing techniques to the patients with descriptions of the steps.

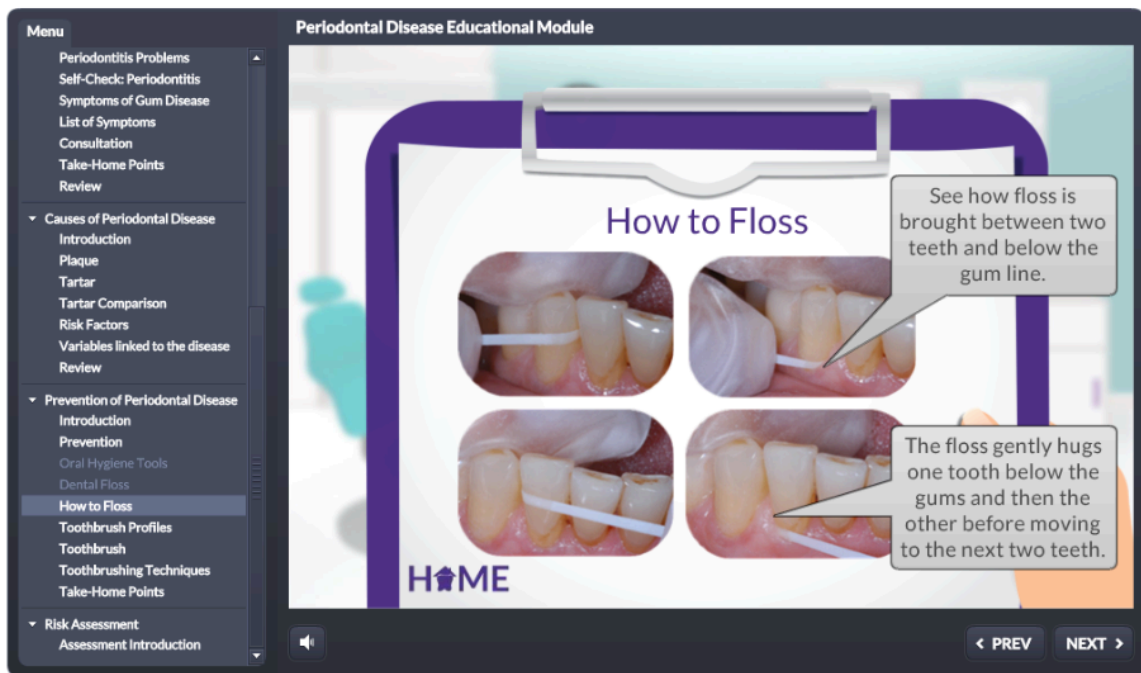


Figure 24: Illustration of proper flossing techniques

Patients are generally aware that proper brushing is essential to oral hygiene, but it is important for patients to be aware of the different types of toothbrushes and also different bristle strengths. It is important for patients to discuss and choose the right toothbrush for them with their dentist. If patients have chosen the wrong toothbrush they may be further damaging their gums. Therefore, proper selection is crucial. Furthermore, it is important to educate patients regarding proper tooth brushing techniques, as was done with flossing. Figure 25 describes the proper tooth brushing techniques to employ for healthy oral habits.

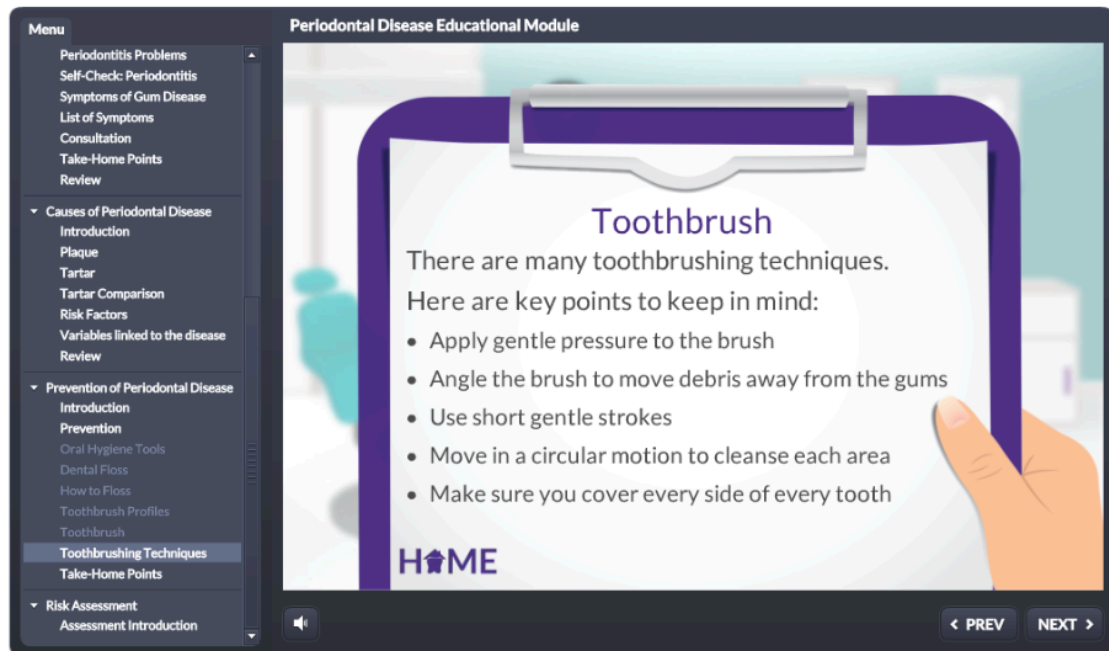


Figure 25: Description of techniques for effective tooth brushing

The fourth module ends with a take home slide to review certain key points from the module. The goal of the module is for patients to be aware of twice-daily tooth brushing, daily flossing, and visiting the dentist regularly are important elements of oral health. The fourth module may be the most important as periodontal disease can be treated and or reversed with daily proper oral hygiene habits. Thus, educating a patient using a preferred learning method, such as computer-based education, may lead to decreased rates of the disease. Figure 26 is an image of the take home section for module four.

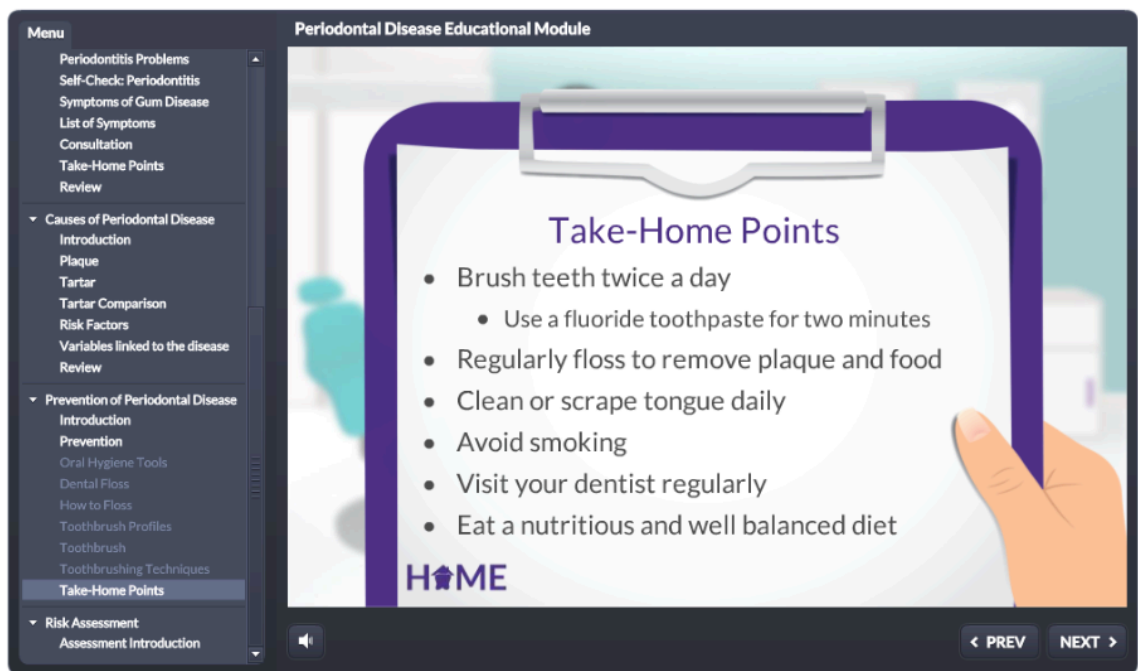


Figure 26: Module 4 take home points for proper oral hygiene habits

3.5-Risk Assessment

The last section of the computer-based tool is a risk assessment section where patients can answer questions about their daily life and assess their own individualized risk for developing periodontal disease (Figure 27). This is again an optional section that the patients could complete without reading the module just to have an idea of how their risk factors may or may not be leading to the disease.

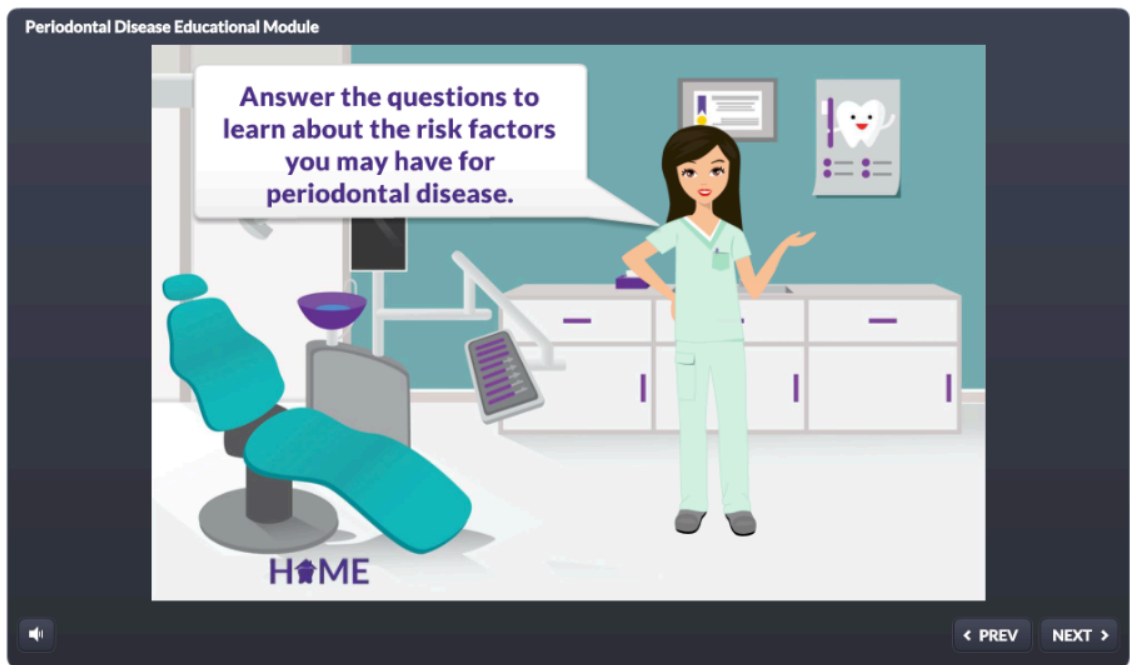


Figure 27: Risk Assessment module home screen

The first question in the risk assessment is asking the patients to indicate their age. It is important for patients to know that as they age the risk of developing periodontal disease increases as years of improper oral hygiene are compounded furthering the risk. Figure 28 illustrates the screen the patient would see.

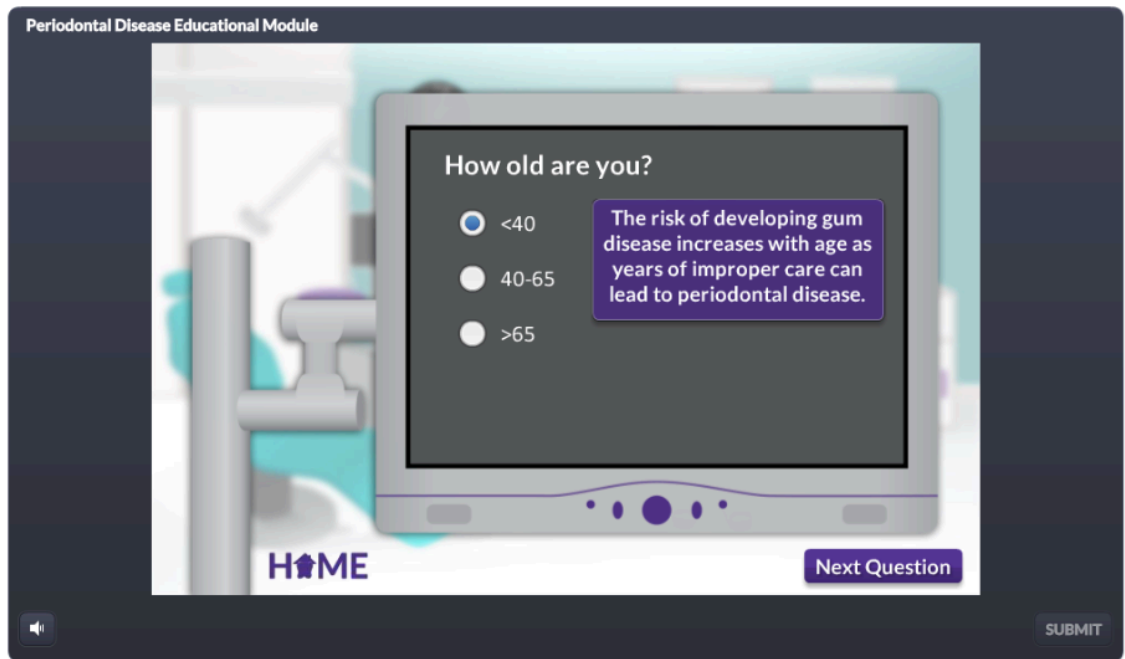


Figure 28: Risk Assessment question for patient age

The second question of the risk assessment asks the patient whether their gums ever bleed. One indicator of periodontal disease is bleeding gums (Figure 29). One of the earliest clinically visible signs of periodontal disease is bleeding gums. The gums may bleed during brushing, flossing or probing by a dental professional. If the patient does observe bleeding gums, during daily oral care, it is important to discuss that with their dentist. Since the disease is reversible in the early stages with advice from their dentist it is possible for the patient to reverse the bleeding gums and hopefully return their gums to a healthy state.

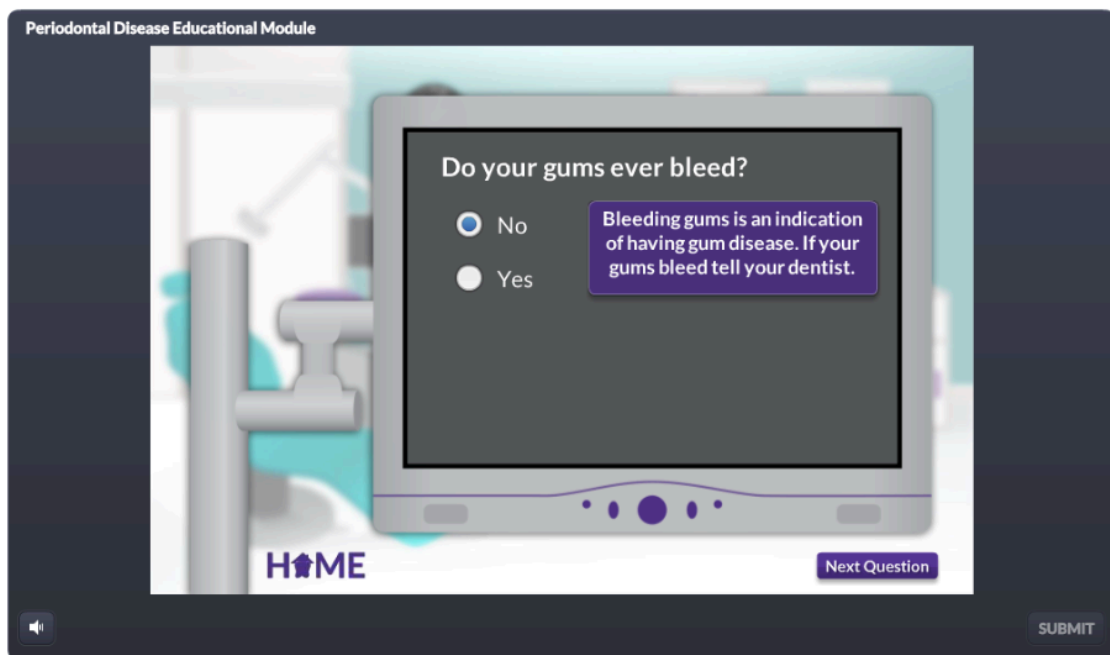


Figure 29: Risk assessment for patients gum health

In the event that the patient ignores the early symptoms of periodontal disease, such as bleeding gums, it is possible, over time, for the condition to progress into the more advanced form of periodontal disease, periodontitis (Figure 30). If the patient does present with loose teeth it is due to the disease progressing to not only affect the gums but also the alveolar bone which supports the teeth. When the alveolar bone is affected the disease is in the advanced stages and only managing the condition is possible.

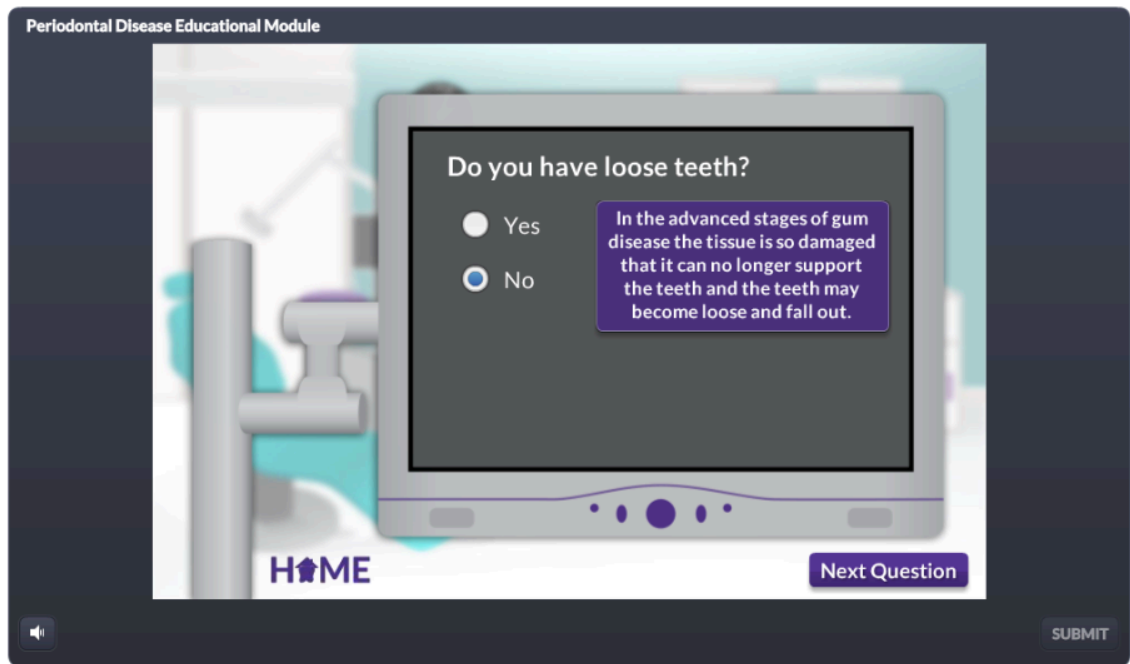


Figure 30: Risk assessment for loose teeth

As previously mentioned in one of the modules, smoking or the use of tobacco products is an important risk factor in the development of periodontal disease and can significantly increase one's risk. As it is a modifiable risk factor, it is important for patients to be aware that smoking cessation could decrease their risk of developing not only gum disease, but perhaps other medical conditions as well. Figure 31 is a screenshot of the question regarding tobacco use and the information presented once the patient has answered the question.

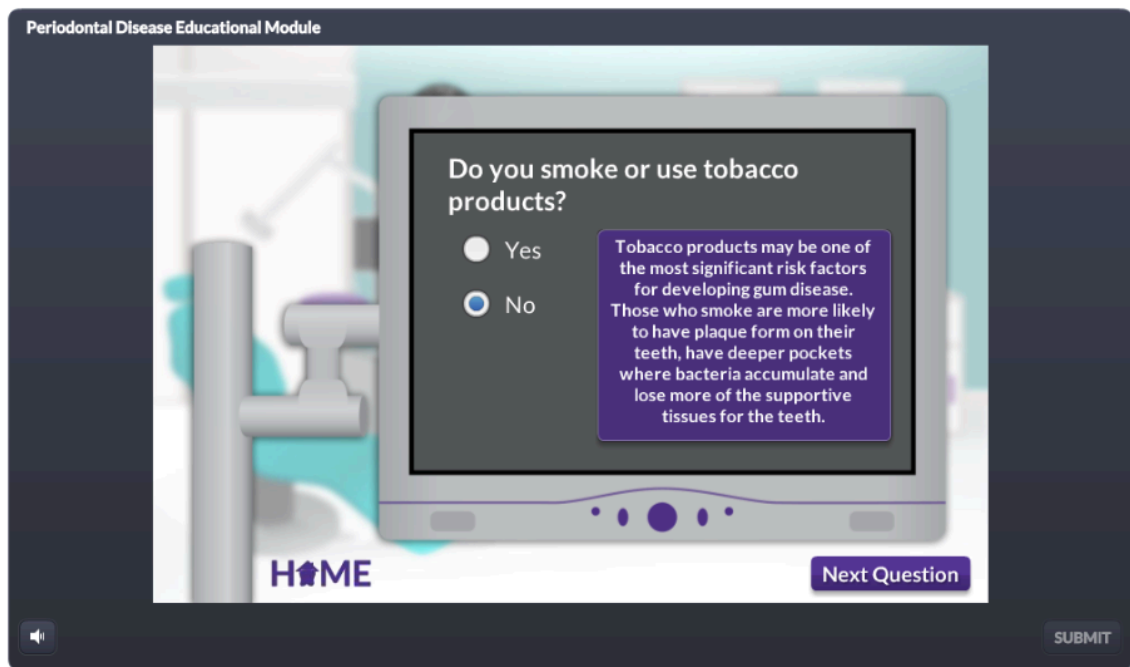


Figure 31: Risk assessment for the use of tobacco products and smoking

Along with good oral hygiene habits, including daily brushing and flossing, it is also important to visit the dentist regularly. It is important so that they can remove any plaque and tartar that is in places that cannot be removed by brushing and flossing and can only be removed by professionals. Such areas include regions below the gingival margin on the teeth, which can only be reached by certain instruments. It is also important for patients to visit the dentist to assess the depth of the periodontal pocket, which may provide insight into whether the individual has gingivitis or periodontitis. A dentist would use a periodontal probe to measure the depth in millimeters to assess their current state and make suggestions on risk management. Figure 32 is the next question in the risk assessment asking patients how frequently in the past two years they have seen a dentist.

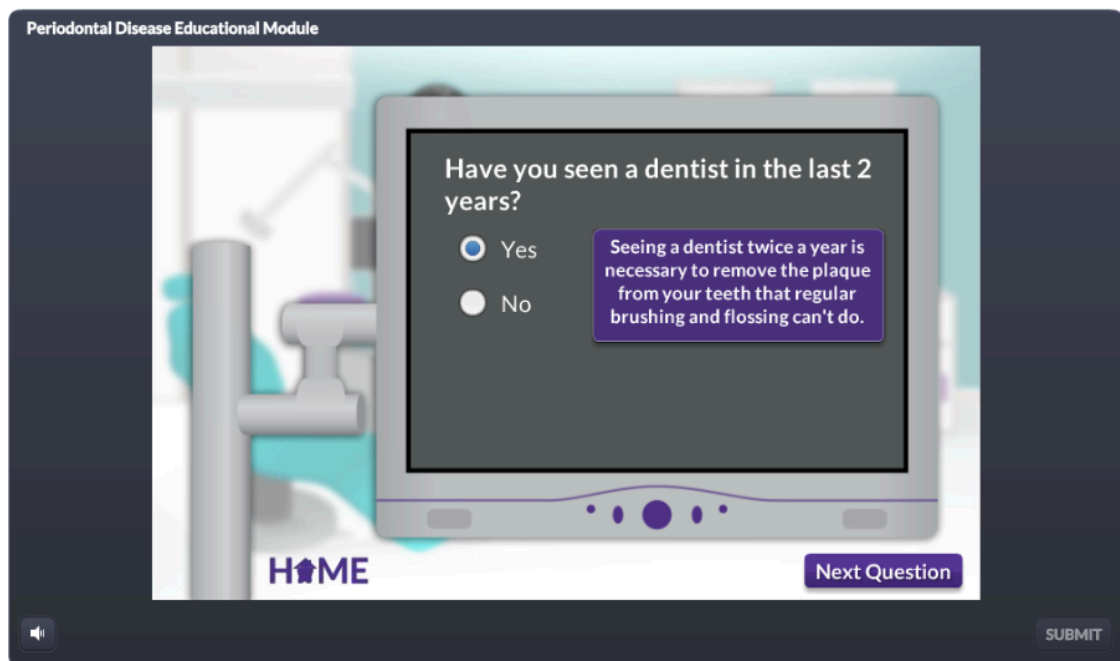


Figure 32: Risk assessment for visit frequency to the dentist

Daily flossing along with twice daily brushing is an essential component to proper oral hygiene and should not be overlooked by patients. Patients should be made aware that as much as tooth brushing is part of a daily habit, flossing needs to be as well. Flossing allows the build up between the teeth to be removed or any other areas in which debris cannot be removed by a toothbrush. Educating patients on proper flossing techniques is essential and has previously been addressed in module four (Figure 33).

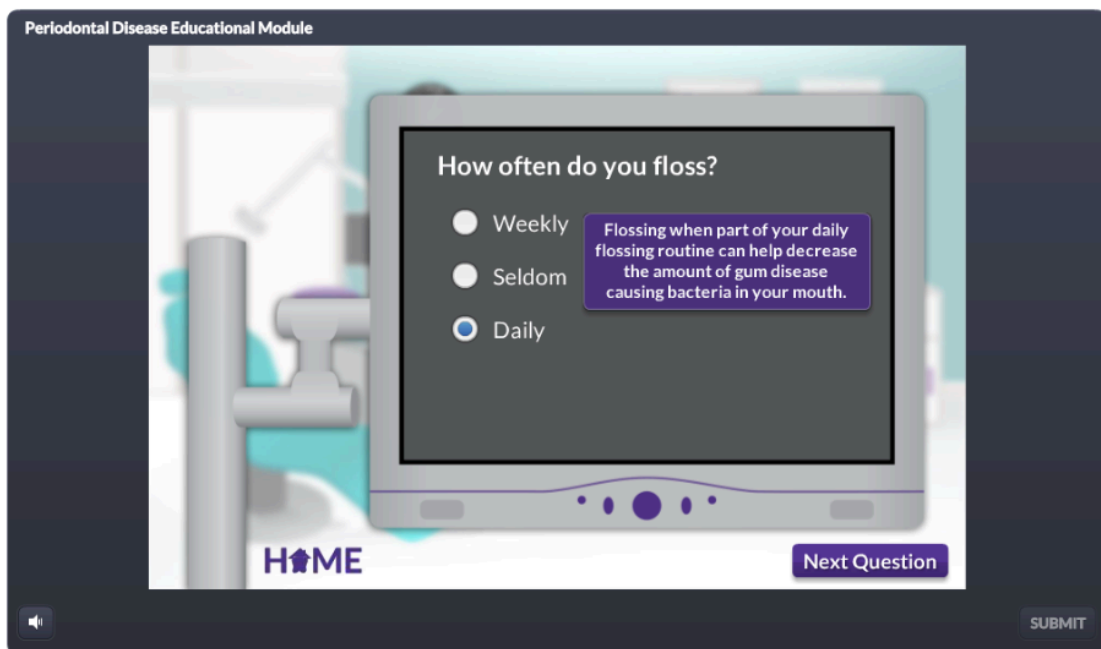


Figure 33: Risk assessment for flossing frequency

Although a dentist may not have used the words periodontal disease, they may have previously told their patients they had poor gum health, for example. It is essential that patients are made aware of how they can manage any early symptoms of periodontal disease. If the dentist measured a periodontal pocket that was enlarged, proper techniques for oral hygiene should be discussed as in the early stages it is possible for the patient to revert back to a healthy state with daily compliance (Figure 34). Once an individual has developed gum disease, they may be at higher risk to develop the disease again in the future if proper habits are not maintained.

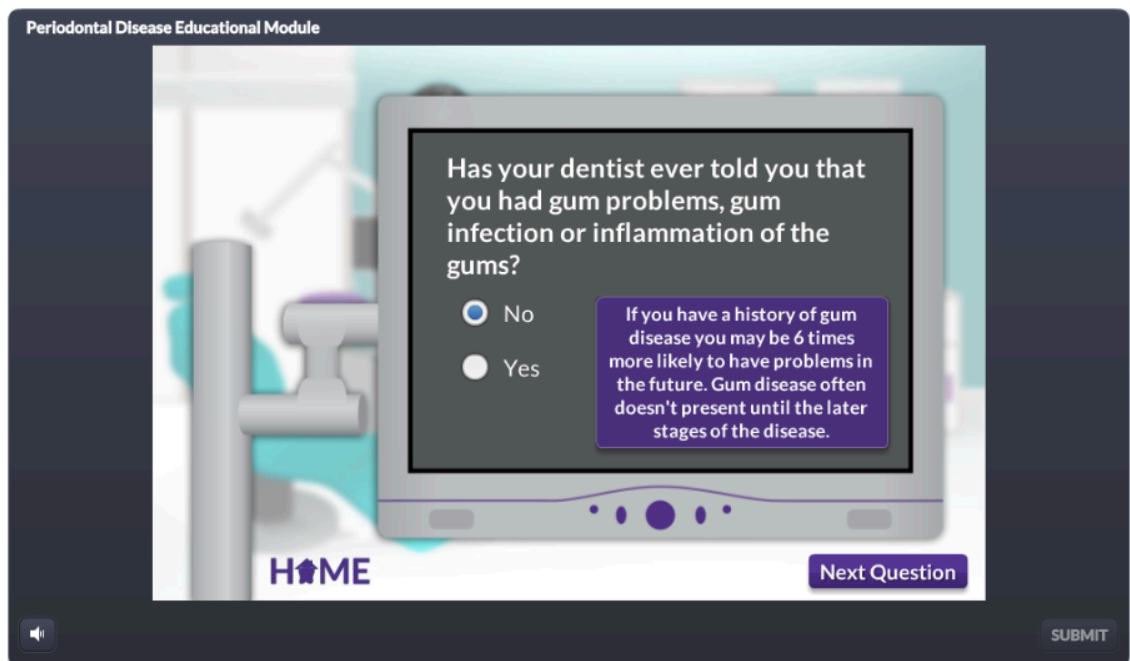


Figure 34: History of gum disease risk assessment

The last question (Figure 35) in the risk assessment for periodontal disease is whether any family members have periodontal disease. It is important for patients to know that there is a link between their risk and the history of periodontal disease within their family. It is also important that they realize the connection, and may educate family members to try to lower their risk of developing the disease as a result. This is particularly important for patients who are parents to educate their children in the early stages of their lives.

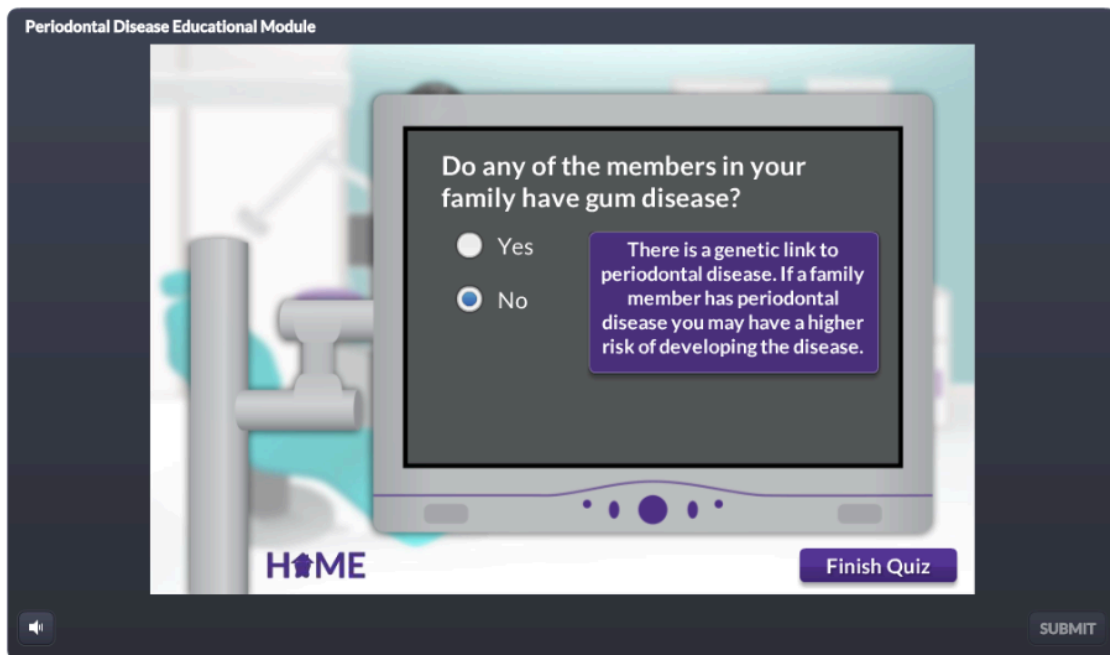


Figure 35: Family history of periodontal disease assessment

The last section of the computer based patient education tool is the overall results from the questions within the risk assessment (Figure 36). This provides the patients with the answers to the questions they answered in one slide. If they answered the question and they are not at risk for developing periodontal disease the response is in green. However, if the answer the question and the response increase their risk for developing the disease the answer appears in red. This is a useful section as the patient could present this to the dentist and discuss the responses with them and the risk factors that may be worsening their oral health are clearly indicated by the red. The dentist may be able to provide guidance as to how to change their habits and decrease their risk.

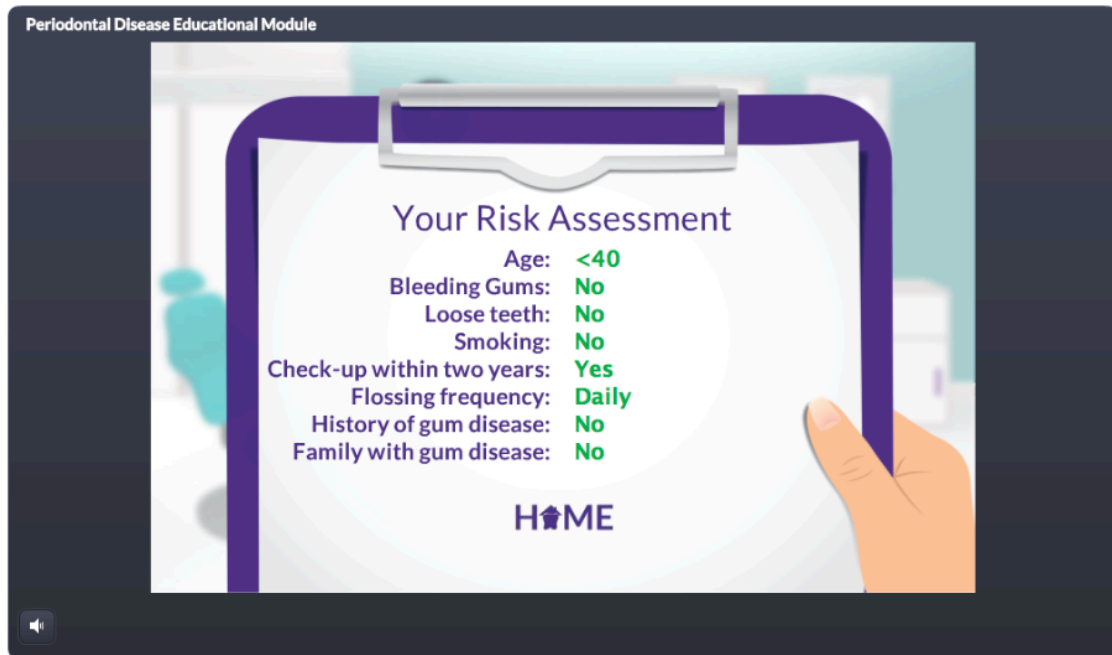


Figure 36: Results from the risk assessment

3.1 Pilot Study

A short pilot study was completed with voluntary participation from five graduate students in Anatomy and Cell Biology at Western University. The pilot study was used to assess the feasibility of using the tool in a larger scale population. The participants were to simply progress through the module at their own pace and following completion were asked to complete a short questionnaire. The questionnaire comprised questions regarding their experience while completing the module and certain features in the module such as the end of module quiz. The questionnaire completed by the patients can be found in the appendix.

Results from the first part of the questionnaire, which comprised demographic questions, indicated that all five subjects had completed post secondary education. Within the last two years two subjects had been to the dentist three or more times, and three students had been twice. When asked if they had previous knowledge of gum disease, only two students had prior knowledge, three students had no knowledge prior to completing the module.

When analyzing the results regarding the module itself the subjects were to answer from 1 to 5 on a Likert scale with 5 being strongly agree and 1 strongly disagree. The results from the seven questions in the survey are reported in Table 1.

Table 1: Participant response after completing the module

Question Title	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
I found it easy to read and follow the module	0	0	0	1 (20%)	4 (80%)
I like the quiz at the end of each module	0	0	0	2 (40%)	3 (60%)
I prefer learning and reading on a computer	0	1 (20%)	1 (20%)	2 (40%)	1 (20%)
Learning about gum disease will help me improve my oral care	0	0	0	3 (60%)	2 (40%)
I would encourage the creation of other similar computer based patient education modules in the future	0	0	0	3 (60%)	2 (40%)
I would recommend the gum disease module to my friends and family	0	0	0	4 (80%)	1 (20%)
I had a good understanding of gum disease after completing the module	0	0	0	3 (60%)	2 (40%)

After the subjects completed the seven questions using, there was a section to complete the survey that allowed them to input any comments they choose regarding the module. The responses in the comments section are reported in Table 2.

Table 2: Examples of participant's opinions

Response 1	"The division of the content in the module made it easy to follow. The quizzes broke up the material to avoid monotony and maintain interest. "
Response 2	"I like the self-check slides which allowed immediate comparison. Two thumbs up"
Response 3	"The module was well organized and easy to follow. The information was clear and simple"
Response 4	"Great modules, clear and really easy to follow. The pictures are terrific for showing the gums and disease clearly."
Response 5	"The module was very aesthetically pleasing. Everything looked really nice. The information was very practical and useful"

Chapter 4

Discussion

The purpose of the project was to create a novel way to teach patients about periodontal disease, its related systemic health consequences, and prevention strategies using a computer-based tool. With the recent advances in technology and the widespread use of computers and mobile devices, modernizing the way of teaching is essential to reflect the changes in society.

The ability to provide patient education using a computer-based model seems promising for several reasons. The use of patient education through a computer-based model would leave more time during consultations with a dentist to allow for questions to be answered, as well as discussing various treatment options. With the patient having already been briefed on the condition, the patient may feel more prepared to discuss questions with his dentist, leading to improved treatment. Oftentimes, patients are unable to understand what is being explained to them by the dentist due to differences in education or simply cultural differences. Thus this would allow the patient to read through and process the information by him or herself. Further, some patient questions may be answered simply in the computer-based education module, allowing more time for the dentist to discuss or explain more pressing items. With the patient having been briefed beforehand, they may be more willing to participate in the conversation with the dentist, which may also lead to a feeling of confidence and could lead to positive treatment outcomes for the disease. This could also have the ability of increasing the patient satisfaction, as a

whole, during the visit, which may lead to increased frequency of visits to the dentist.

There is the possibility, as well, that time and money would be saved, allowing for more efficient patient care. The negligible per-use cost rate for the module could lead to widespread use and distribution within the dental community. If the module was displayed on an a tablet, then between each patient there is no recurring cost, as there would be if the dental office were to hand out brochures or pamphlets. Also, valuable face-to-face time with the dentist would not be spent discussing minute points, which could easily be found in the module. Thus, the time spent with the dentist could allow a more useful acquisition of information relating to their particular oral hygiene.

Since the module is highly interactive, it allows the patient to select which section is of interest to them. It is possible the patient would have time to read one or all 4 of the module while waiting for their visit with the dentist. Not all of the information will be relevant to all patients, thus they can simply read what is of interest in their case. During progression of the module, that patient will uncover information about periodontal disease, but the various pictures may motivate them to change their oral health habits. The patients may see how the disease progresses from a healthy state, to gingivitis, then to periodontitis and reflect on their own habits. It is possible that the patient may, in a sense, fear progression of the disease and adapt better oral hygiene habits from simply progressing through the module.

The development of the tool with Articulate Storyline allowed many adjustments to be made during the process of its creation. Articulate Storyline is operated similarly to Microsoft PowerPoint and allows many modifications to be made, whether it is reordering the information, insertion of pictures, etc. It was imperative during its creation that the level of language was scrutinized to allow even patients with minimal education to understand the information being presented. With the evidence from Ravaghi et al (2013), it is clear that those patients most in need of education and treatment for periodontal diseases are those of a lower socio-economic class. Thus it was of utmost important to ensure the module would be able to target its intended population. It is also important that patients who are young be able to progress through the module as well. It is important that oral hygiene habits be instilled in youth as, that way, it will become habit in the future and not difficult to change, if needed.

The hope is the module will someday be distributed to dental offices within the community where the module could be displayed on a tablet or computer device within the waiting room. It is the hope that the module would be accessible in Northern, remote and underserviced areas, as those are the regions whereby the individuals are in need of the most inequality in health status when compared to the general population. Further, the module has been designed to be highly interactive, simple and easy to follow which will enable those individuals to successfully complete and understand the module. By providing resources to the regions that have been identified as having the most

inequalities and providing them with resources to improve their condition, it is possible some improvement will be seen in the population.

In order to assess the effectiveness of the module a pilot study questionnaire (Appendix B) was created to obtain anecdotal feedback. Results from the questionnaire indicated that subjects found the module easy to follow, and kept subjects on track with frequent multiple choice questions to review the material. Furthermore, the subjects liked the immediate comparison between the diseases, which were shown in their relevant disease states, for example, healthy state, gingivitis or periodontitis. Subjects also found that the module was clear, simple and well organized and could maintain their attention with the quizzes to verify that they remembered the information they were learning. Thus, feedback from the subjects indicates that even those with lesser education than the subjects who participated in the pilot study should be able to comprehend and retain information from the module.

Although a pilot study was conducted, obtaining feedback from a more diverse and large sample could truly bring forth widespread opinions. The current pilot data produced is from a very small sample of subjects who are all highly educated individuals and do not truly reflect the targeted demographic for the module. The subjects used for the pilot study were from a group of Master's students in the Department of Anatomy & Cell Biology from which the module was developed at Western University. The ideal population to be used in a more formal study would be from the general community and focusing on those from a lower socioeconomic status and education level.

During the formal study, the use of a questionnaire similar to that in the appendix, which patients could answer regarding the module, would allow further insight into its strengths and weaknesses as viewed from the general community. It is possible that although the subjects used in the pilot study found it simple and easy to follow, the general response from the community might differ. There is also the possibility of certain features, such as the quiz, negatively affecting the opinions of those in the community. Since Master's students are focused on performance and are used to having periodic evaluation, these opinions may differ than certain individuals who may not have had a testing situation in several years. Thus, the results of the questionnaire could dictate which changes need to be made to provide the general population with an excellent periodontal disease-learning tool. In the future, the hope would be for the module to be used in dental clinics and by dentists to educate their patients.

4.1 Future Directions

Although the pilot study provides data to support that individuals enjoy the online periodontal model, there was no data collected on whether or not retention improved after using a computer-based model compared to a traditional patient education format. Further, a questionnaire could be completed that would investigate the knowledge retention of patients using the mobile site compared to those using a traditional patient education tool such as a pamphlet. It would be worthwhile to test whether patients do, in fact, retain more from a computer-based modality rather than traditional methods, as has

been published in the literature. Testing the computer-based patient education module compared to traditional patient education tools could provide insight into whether retention is higher or lower with this format and increase the validity of the tool in the future. Assessing knowledge retention in the dental community regarding a specific condition, if favorable, could indicate the need for the development of more computer-based patient education tools. The results could point to the development of computer-based patient education tools for in-depth proper oral hygiene habits, for instance, or other disease states.

It is also possible that if favorable data were obtained, the use of computer-based education would become more widespread in dental clinics and the medical community at large. Patients could select what they would like to learn about from an array of choices all in one location, as opposed to searching through magazines or flyers, which aren't as appealing to a younger technologically-focused generation. It could also point to the need of development for computer-based tools in the medical community as well. If the same population is of focus, that of a lower socio-economic states, there are other medical conditions which could be brought to light to potentially decrease prevalence, such as diabetes, hypertension, and dyslipidemia.

4.2 Limitations

This project is not without limitations, some of which will be discussed here. Currently, the online learning tool requires one to complete a fair amount

of reading and there is the possibility that a percentage of patients entering a dental clinic would not be able to complete the module in this format. Thus, providing alternative ways to complete the tool, such as with an audio component, would be worthwhile. Another future direction is for an audio recording to be added to the entirety of the module that could be user controlled to turn off or on as desired. Adding an audio component would allow those people who are unable to read to listen to the module and still receive the knowledge included

A second challenge currently being faced is distributing the module to the general population. Currently the module is only available on a specific Western University portal, OWL, and is only available to people who are invited to the site. It is the hope that the computer based tool is converted to perhaps an application that could be downloaded on portable devices by the general population or a website which could be located online. Converting the online patient education tool could allow its use in not only the community at Western University, but have a more global approach. The conversion into an app could also allow patients to review the tool on their own time or show a family or friend who was not at the appointment with them. Expanding the population that currently has access to the module is of utmost importance in order to accomplish the ultimate goal of the project: to decrease the severity and prevalence of periodontal disease and its systemic consequences.

Chapter 5

Conclusion

The use of computer-based patient education tools has become more common in recent years, however there has not been a module created for periodontal disease, a disease with potential oral-systemic complications. The literature supports the fact that computer-based learning improves patient satisfaction and knowledge retention. The results from a pilot study indicate that use of the computer-based patient education module on periodontal disease could have a positive effect on a patient's oral health by increasing their disease knowledge. The pilot study supported the fact that patients do prefer learning on a computer-based modality and that they did learn information from progressing through the module. Further testing is warranted to obtain responses from the general community regarding the effectiveness of computer-based patient education on periodontal disease.

In conclusion, a computer-based module for oral hygiene has been developed using Articulate Storyline, which educates patients about oral hygiene and emphasizes prevention of periodontal disease. Given the proven efficacy of computer-based learning, the module, with adequate public availability, will improve public knowledge regarding periodontal disease, particularly among the target population of patients from lower socioeconomic classes. By increasing awareness, the module can contribute to decreasing prevalence of periodontal disease.

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Appendices

Appendix A: Patient Questionnaire

Please circle your education level:

8th Grade or less High School Post Secondary

How many times have you visited the dentist's office in the last 2 years?

0 Times Once Twice Three or more times

Have you ever learned about gum disease previous to the program?

Yes No

Please rate how strongly you agree with the following statements

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

I found it easy to read and follow the modules. ____

I like the quiz at the end of each module. ____

I prefer learning and reading on a computer. ____

Learning about gum disease will help me improve my oral care. ____

I would encourage the creation of other similar computer based patient education modules in the future. ____

I would recommend the gum disease module to my friends and family. ____

I had a good understanding of periodontal disease after completing the program. ____

Please share any additional comments you may have:

Appendix B: Curriculum Vitae

Sari Johnston

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EDUCATION

Master of Science in Clinical Anatomy **Anticipated completion: April 2015**
Schulich School of Medicine and Dentistry, Western University, London, Ontario
Supervisor: Dr. Khadry Galil

Bachelor of Science in Kinesiology (Honours) **September 2008-May 2012**
Department of Physical Education and Kinesiology, McGill University, Montreal, Quebec
Honors Thesis: Perspectives of Paralympic coaches on building team cohesion
Supervisor: Dr. Gordon Bloom

TEACHING EXPERIENCE

Teaching Assistant for Human Gross Functional Anatomy September 2013-December 2013

Department of Physical Therapy, Western University, London, Ontario

- Aided students in weekly cadaveric dissections
- Assisted in answering student questions and improving dissecting techniques
- Counseled students experiencing difficulties in the course
- Conducted oral assessments

Teaching Assistant for Head and Neck Anatomy **September 2013-Present**

Schulich School of Medicine and Dentistry, Western University, London, Ontario

- Assisted in teaching laboratory sessions to first year Dentistry students using cadaveric prosections
- Assisted in answering student questions and provided clinical applications
- Attended lectures to provide assistance to students with course material
- Counseled students experiencing difficulties in the course

- Marked laboratory examinations

**Teaching Assistant for Medicine Anatomy
Present**

September 2014-

Schulich School of Medicine and Dentistry, Western University, London, Ontario

- Assisted in teaching laboratory sessions to first and second year medical students using cadaveric prosections
- Assisted in answering student questions and provided clinical applications
- Counseled students experiencing difficulties in the course
- Marked laboratory examinations and assignments

Teaching Assistant for Systemic Anatomy

September 2014-Present

Schulich School of Medicine and Dentistry, Western University, London, Ontario

- Assisted in teaching laboratory sessions to first year Dentistry students using cadaveric prosections
- Assisted in answering student questions and provided clinical applications
- Attended lectures to provide assistance to students with course material
- Counseled students experiencing difficulties in the course
- Marked laboratory examinations

**Tutor
Present**

June 2012-

- Tutored students in French, Biology, Chemistry and Anatomy
- Determined the students' learning styles and adopted a suitable teaching method for each individual student

RESEARCH EXPERIENCE

**The Sport Psychology Laboratory
2012**

September 2011-June

McGill University, Montreal, Quebec

- Compiled research to complete a comprehensive literature review
- Created a demographic survey and interview guideline used to interviewed 7 Paralympic coaches across Ontario and Quebec
- Transcribed and analyzed data collected from interviews
- Completed manuscript for publication

**Fourth Year Research Project
2011**

September 2011-December

McGill University, Montreal, Quebec

- Completed research project to fulfill course requirement for Advanced Biomechanics Theory EDKP 566
- Designed study investigating ankle stability while completing a gymnastics skill, the turn prep
- Compiled and analyzed data using Matlab

**Cochrane Family Health Team Summer Student
2011**

May 2011-August

Cochrane Family Health Team, Cochrane, Ontario

- Conducted osteoporosis research
- Completed a presentation educating elderly women at high risk of developing osteoporosis
- Organized a falls prevention clinic for the elderly
- Compiled information to produce an informative poster for the waiting room

**Research Methods Project
2010**

September 2010- December

McGill University, Montreal, Quebec

- Completed to fulfill requirement for Research Methods EDKP 443
- Designed a research project investigating the effect of the timing of exercise on resting heart rate
- Compiled evidence for literature review
- Submitted to the Review Ethics Board at McGill University
- Compiled and analyzed data from six subjects
- Completed written report

CONFERENCE & WORKSHOP PARTICIPATION

**Perspectives of Paralympic coaches on building team cohesion
2012**

March

Western University, London, ON, Canada

- Presentation at Eastern Canadian Sport & Exercise Psychology Symposium (ECSEPS)

**Eastern Canadian Sport & Exercise Psychology Symposium
2011**

March

Wilfred Laurier University, Waterloo, Ontario

- Gained current knowledge on the topics of exercise and sport psychology by listening to keynote and seminar speakers

Future Professor Workshop Series

Western University, London, Ontario

- Putting together a teaching dossier **October 2013**
- Writing a teaching philosophy statement **October 2013**
- Facilitating Discussions in the Intercultural Classroom **November 2013**
- Education for Global Citizenship **November 2013**

LEADERSHIP SKILLS

Vice President External **May 2011-May 2012**

The Student Association of Physical Education and Kinesiology, McGill University, Montreal, Quebec

- Attended and helped lead committee meetings
- Attended departmental and faculty meetings and relayed information to the students of Department of Physical Education and Kinesiology
- Acted as a liaison between student population and the faculty members
- Assisted in event planning and fundraising efforts
- Assisted in curriculum design and evaluation

Third Year Representative **May 2010-May 2011**

The Student Association of Physical Education and Kinesiology, McGill University, Montreal, Quebec

- Acted as a liaison between third year students and The Student Association of Physical Education and Kinesiology
- Relayed information or ideas between classmates and council members
- Assisted in event planning and fundraising efforts

Greenweek Fundraising Coordinator **May 2010-March 2011**

McGill University, Montreal, Quebec

- Contacted various local companies regarding potential sponsorship
- Executed fundraising events
- Planned or led events during Greenweek
- Completed written exit report summarizing the fundraising success

VOLUNTEER EXPERIENCES

Habitat for Humanity Global Village Volunteer **September 2010- May 2011**

Habitat for Humanity McGill Chapter, Montreal, Quebec

- Participated in fundraising events for 8 months to secure funds for a humanitarian trip to Central America
- During the fundraising initiatives, provided information on the organization Habitat for Humanity and it's outreach in the local and international communities
- Traveled to El Salvador in May 2011 to help build houses in a rural village and provide humanitarian support

Hospital Volunteer **September 2009-May 2010**

Montreal Children's Hospital, Montreal, Quebec

- Played with children and siblings at children's hospital bedside or in play areas
- Provided support to families
- Provided clerical support in reception areas

SCHOLARSHIPS & ACADEMIC HONOURS

Western Graduate Research Scholarship **September 2013- August 2014**

School of Graduate and Postdoctoral Studies, Western University, London, Canada
\$10,000/ year, over 2 years

CERTIFICATION & TRAINING

- **CPR Level C** **November 2011**
McGill University, Montreal, Quebec
- **Comprehensive WHIMIS Certification** **September 2013**
Western University, London, Ontario
- **Safe Campus Community** **September 2013**
Western University, London, Ontario
- **Accessibility in Teaching** **September 2013**
Western University, London, Ontario
- **Health and Safety Orientation** **September 2013**
Western University, London, Ontario

LANGUAGES

- **English**
Native level of competence

- **French**
Fluent with excellent conversational and written