



Dr. Gregory Todd Smith:

Gregory Todd Smith, Gregory Smith, called by lots of different combinations, but everybody calls me Todd. I graduated from the University Of Washington School Of Dentistry in 1979 and I have served in IHS ever since. I received my Certificate in Perio in 1993 and I am Board-certified in Periodontics.

I currently manage a program and provide clinical care for the dental treatment of people with diabetes, of which over 3900 have been enrolled and treated at Phoenix Indian Medical Center alone since about 1998. Please excuse my voice I am kind of recovering from a cold, probably like about half of you are out there.

One of the objectives of this presentation is to recognize that this is not a strawberry with custard from a filled doughnut around these upper front teeth, so we'll go into a little bit more detail on that.

All right, so caries is a common problem that we see, but it's not clear whether our patients with diabetes have a higher caries rate or not, some do and some don't. The evidence is very strong and this connection that we are talking about between diabetes and oral health is the one on gingivitis and periodontitis: the gum diseases.

If we look here you can see under the gingivitis. What's happening is that the gums are a little bit redder, they bleed, but what happens is that there hasn't been any bone loss at this point. So gingivitis is completely reversible.

In periodontitis we now have bone loss, and that bone loss is irreversible; once it's gone, it's gone. So, when we treat periodontitis, we want to try and preserve the bone that is present at that point in time. Some of the signs of periodontitis, it's not only that the gums bleed but they are puffy and red. People can have bad breath or discuss a bad taste in the mouth. Also the gums start to pull-away from the teeth, what we call Recede or Recession.

In the advanced stages you can lose as much as 50% or more of the bone around the teeth and yet still be able to maintain those teeth in the oral cavity.

This is a beautiful slide of what healthy gums look like. I don't get to see this very frequently, but you can see that the gums are almost consistently the same color everywhere you look, and the gums are firm and tight and attached tightly to the teeth.

Once gingivitis starts to set in, you can see the redness, the ring around the teeth, and there still hasn't been any bone loss at this point in time, but you would notice that if you were to brush this area to floss it and then spit out that there would be some blood mixed in with the spit.

Now we are starting to see how periodontal disease can be very site-specific. So, on the upper teeth it's more of a mild to early moderate disease with minimal bone loss, maybe about 30%. These teeth are able to be maintained.

The lower teeth you can see though, you can see the swelling in the gums, some of the plaque that is formed around the teeth, that's difficult in some of areas to brush off and there is bone loss in this area. This is still completely treatable with Periodontal Therapy.

And then, this is my poster. I took this photograph back in 1988 and it shows you how the disease is a silent disease, how bad things can get and yet pain not be involved with it. And when it gets this severe, we are left with no other alternative than to get out these teeth to get this periodontal infection and inflammation under control and then to make full dentures.

The prevalence of good news is that only about 13% of adults across the country get the severe form. The bad news is that in the Indian Health Service it's about twice that getting the severe form. So we have a much higher prevalence across all of our adults.

So what causes gum disease? Well, it's still caused by that bacterial plaque, the plaque that forms on the teeth. There are specific bacteria in that plaque that once they take hold and grow into large enough numbers and that's particularly the gram-negative anaerobes, then the body has to do whatever it can to wall-off this infection from the rest of the body, and there is an inflammatory and immune reaction causing local destruction at the connected tissue and bone to try and prevent that infection from spreading throughout the body.

This is a great picture from Scientific American, and if you look on the left that's the surface of the tooth, that is a picture of what calculus or tartar could look like, and then the bacterial plaque with the gram-negative anaerobes and spirochetes that get up underneath the gum.

When the infection becomes chronic, and the calculus remains and the bacteria is not removed well with brushing, flossing whatever, then you start getting ulcerations on the inner lining of the gum, not the outer lining of the gum surface, so you can't see it.

And once that inner lining gets eroded and ulcerated then the bacteria and their toxins are able to get into the connective tissue and the bloodstream and spread throughout the body.

This is a patient that we saw with 28 teeth and Philippe Hujoel, at the University of Washington estimated that if you looked at the surface area of these erosions then it would have been up to 10-20 square centimeters of ulcerated surface. That is 3-5 times the size of this diabetic foot ulcer. And what you wouldn't say to a diabetic with a foot ulcer like this, all it needs is a little bit of soap and water and it will heal, it's the same way with the gum disease. It's going to take a little bit more than just brushing those teeth to get the infection under control.

And that's not a typo. Dr. Miller in 1880 was the first one to discuss oral bacteria having an effect throughout the body. That led rise to the focal infection theories, and in the 20s and 30s many of your grandparents and maybe great-grandparents had all of their teeth removed to try and cure unexplained illnesses like rheumatism and depression.

Well, they found out that that didn't help, but then evidence came out in late 80s, in the 90s that showed that there was a definite connection, and then the Surgeon General's report on oral health, Surgeon General Faucher and along with Surgeon General Carmona's call to action in 2003 found that the oral cavity is a portal of an entry for these microbial infection and inflammation that's spread throughout the body and have a major effect on health status.

And I like Offenbacher's expression and comment that periodontitis needs to be considered an anaerobic infection flooding the bloodstream 24-hours a day with endotoxin and inflammatory mediators.

So it's not, whenever the patient goes to the dentist, hygienist, assistant get their teeth cleaned, this milking of this chronic inflammation and infection into the bloodstream going from local to a systemic inflammation is occurring everyday as we chew, as we swallow, etcetera.

There was a workshop on inflammation with some of the leading experts in the medical as well as dental field, and they said that Periodontitis is a bacterial-induced chronic inflammatory disease, and the kicker is that they felt that periodontitis, diabetes, cardiovascular disease, Alzheimer's disease, Parkinson's and rheumatoid arthritis are all interrelated through inflammation.

So here is some periodontal terminology that many of you have heard about, maybe don't really have a good feeling of what we are talking about. Gingivitis, where there hasn't been any bone

loss, we want to prevent the extension to periodontitis. So we provide a prophylaxis or prophylaxis, this is the standard cleaning.

Once you have periodontitis and you have this tartar formation and the bacteria up underneath the gums in these pockets around the teeth, then you need a deep scale or scaling and root planing, and that often needs to be provided with topical or local anesthesia to numb up the tissue so we can do the work without attorney.

Flap Curettage is more in my field of expertise where I will actually lay a flap, lean the gums to the side to expose the roots and the teeth, and then I can actually visualize the calculus up underneath there to remove it. And then also at the same time we will have a flap open, we have the capability of using replacement bone grafts and membranes to try and rebuild some of the bone and ligament around the teeth.

So this shows the lower anterior teeth, you can see the swelling, the inflammation, the puffy gums. You're going with just a standard ultrasonic scaler and get the calculus off. This patient also had an antibiotic placed: prescribed doxycycline. And so now you have the healing, this is about three months after and you can see that there is no more of that inflammation present. The ulcerations on that inner lining of the gum has healed, and so now we've brought that local and systemic inflammation under control.

I show this slide, this is another patient I saw, 30-year-old male, and you can see the extensive recession and disease, but you can see that it's a history of disease. This patient is on recall. He is actually able to function just fine even with all of these teeth having more than 50% of the bone loss. So even though there is tremendous amount of bone loss, if it doesn't go to the tip of the root and set up a chronic infection that can't be brought under control, these teeth can be maintained.

There was a series of classic studies that were initiated by the National Institute of Diabetes and Digestive and Kidney Diseases; NIDDK here, along with periodontist Dr. Marc Shlossman and Dr. George Taylor looking at the Gila River Indian Community just south of town here in Phoenix. And they found out that across-the-board the diabetics had three times greater attachment loss and bone loss. And on diabetics, this destruction occurred earlier in life, it progressed much faster at 15 times more likely to lose all of their teeth.

A review by Taylor in 2004 and 2008 showed that patients with diabetes consistently had greater prevalence of disease, incidence, greater severity, greater extent throughout the mouth, and it progressed faster.

So what I want everybody to realize is that, even when there is disease present that if the patient can bring their blood sugar under control that the individual is not really at greater risk at that point in time of breaking down. So the dental staff wants the patient with diabetes to be well-controlled just as much as you do.

So what's going on? Why is there greater periodontal destruction? Well, with the high glucose and abnormal lipids, it kind of knocks out the white blood cells, so they don't go to the side of infection and gobble up the bacteria as well. Sorbitol, which could be a toxic to the tissues is produced. But the main thing as you know is that you have the glycation where sugar is attached to proteins and lipids, and essentially change the environment to one of inflamed environments where monocytes, macrophages crank out more interleukins of inflammation, there is more tumor necrosis factor-alpha, there is increased production of collagenase and decreased collagen production, along with increased oxidative stress. All of these conditions set up the situation that in the presence of these periodontal bacteria, you're going to get periodontal breakdown.

This is a classic shot of the patients that I look at. You see that rubbery looking tissue on the insides of these lower incisors. Those are described as gingival polyps all the way back in the

20s and 30s. Now it's more considered a granulomatous-type tissue that can heal upon cleaning and upon bringing this blood sugar under control.

Another very common finding is we find abscesses, particularly multiple periodontal abscesses. And around this lower canine or eye tooth, if I was to use my finger and press on the tissue here, you would get pus or suppuration that come up on the edge of the gum.

Another thing that we see frequently are fungal infections in the mouth and we'll also see dry mouth. Dry mouth is a significant problem for us in the dental field because it's very highly likely to be associated with an increase in both gum disease and a higher caries rate.

One of the things I want to point out is that since many of our diabetics have hypertension, they're placed on antihypertensives and some of those calcium channel blockers like Nifedipine and Amlodipine and Felodipine can cause gingival overgrowth and that makes it much more difficult for the patient to maintain these teeth.

So you may find out what I do is I go ahead and consult with the physician of my patient at this point in time and see if they can maybe switch to something like lisinopril one of the ACE inhibitors or something like that to try and help with this gingival overgrowth.

The disease can progress very rapidly, that's why we want to put these patients on a recall program where we can keep maintaining the teeth, but if you look at the upper premolar in the bitewing what happens is it's got fairly good molar levels there and then within about two years, it's loss bone almost down to the tip of the root, now we are talking about how to extract that tooth.

So the two-way relationship, it's absolutely clear that diabetes increases the risk for periodontitis, but does it also increase risk for poor glycemic control? Does it increase cardiovascular disease and kidney disease? And does it increase risk for mortality? And the answer is yes.

Some of the early studies, again George Taylor looking again on the Gila River Indian Community found that if you had periodontitis at baseline and then you took a look two to three years down the line, you were much more likely to have a worsening of your glycated hemoglobin. That was confirmed in another study in non-native Americans and then a fascinating one was done in Scandinavia where they found out the Type 1 diabetics, if they have periodontitis, moderate to severe periodontitis at baseline, they were much more likely not only just to have a worsening of their diabetes but they also ended up getting greater cardiovascular complications, a greater rate of strokes, heart attacks and angina.

And then so that kind of set up for a relatively newer classic study by Saremi and NIDDK again, and they found out that if you had periodontitis at baseline were followed for a median of 11 years that you were much more likely to die of diabetic nephropathy or of cardio mortality, and the powerful aspect of this is the worst the periodontitis, the more likely you were to die.

Looking again at the same population, they found out that if you had periodontitis at baseline, that up to and this study went out as much as 22 years that you are much more likely to develop macroalbuminuria, and end-stage renal disease and so the conclusion was periodontitis predicts the development of over-nephropathy and end-state renal disease in a dose-dependent manner.

So this is my little vicious cycle, and so you have diabetes that tends to lead to poor white blood cell function, you have an inflammatory state and breakdown, and so in the presence of periodontal pathogens you have this increased periodontal destruction.

If that stays a chronic disease, now this chronic infection has local and systemic ramifications and with the huge flooding of the bloodstream with tumor necrosis factor alpha, and prostate

glands and interleukins and CRP being released from the liver, etcetera. You get an increase in insulin resistance and an increase in serum lipids and blood glucose and the diabetes gets worse.

But what if we were to go in and treat the periodontitis; does that improve insulin-sensitivity? This is a slide of Carolyn, my periodontal assistant and myself and people do always say that I look better with my mask on.

So, there has been dozens of studies and the majority of them show that yes, you treat the periodontal infection and you get a statistically and clinically significant improvement in A1c. The one meta-analysis that didn't show that was Janka, but yet they showed an A1C decrease at 0.7% and many would consider that a clinically significant decrease.

The other meta-analysis is systematic reviews, Darre. Tccuwand in the Cochrane Library all felt the treating perio can lower blood sugar levels in Type 2's.

This is my group right now. Carolyn is next to me, that's Angie, my hygienist, and Sophie. Since 1998 we've enrolled 3900 patients in our program and after creating the disease, usually with just cleanings and improving oral hygiene, motivating the patients to that, then they are placed on anywhere from three to a nine-month recall.

The demographics of our population is two-thirds of them just had gingivitis to mild chronic perio, so they just needed simple cleanings. About 30% though had moderate to severe disease, including almost 6% that it was so bad that we had to take out the teeth and put in full dentures.

This is what many of you will have heard of, the dental staff call this us our diabetic protocol and what makes it a little bit different than standard periodontal therapy is that we do it in half mouth sections, we provide local anesthesia to do a relatively aggressive cleaning. We extract teeth that we know for absolute certain that they are not going to improve and then we kind of empirically put them on a relatively heavy dose of Doxycycline for two weeks or three weeks; three weeks, if the tissues look very bad, if the patient is quite poorly controlled, and if we see a lot of suppurating sites. We put them on mouth rinse, analgesic, and then put them on recall.

By doing this methodology we found that over 90% of the patients improve after this therapy or were stable at their first recall visit and that's pretty impressive in a population where only about 34% of them here at PMIC are able to reach the target A1c of 7% or less.

I had a chance to work with doctors Charlton Wilson, Bill Moeller and Jeff Curtis and we looked at that population of around 6% of the patients where they actually had their dental infection eliminated by removing the teeth. So at this point in time none of these gram-negative anaerobes can get into the bloodstream, so this truly cheers the periodontal disease by removing these sources of infection, and sure enough we should see an improvement in A1c by doing that and we're only able to get the analysis in 30 patients, but the findings whereas that we had clinically and statistically significant decrease of over one percentage point and this was also where we were controlling for weight medications. So this was with no change in weight and no change or addition in medications.

The American Dental Association and the American Diabetes Association had a symposium together and with all of the data that's come out over the years they concluded that periodontal disease is associated with insulin resistance and poor glycemic control, and systemic inflammation appears to be the critical link.

And then the International Diabetes Federation says that medical providers now for all their patients with diabetes should be inquiring about regular oral health checkups; inquire at least annually about symptoms of gum disease, and to be able to make a referral if they notice that to a dental provider. Remind them that adequate daily oral homecare is a normal part of

diabetes' self-management. That's my favorite, so that says that your patients as well as monitoring home glucose levels or monitoring glucose levels at home that they are also practicing a good diet, they're taking their medications at the appropriate time, and they are brushing and flossing.

Early in my career I was stationed out on the Northern Plains in Rosebud, South Dakota and it was four wonderful years, but I show this slide of buffalos out on the open prairie because this is actually in Arizona. It's a herd that runs on about 10,000 acres in an area out near Winslow, Arizona.

So these are some of the links that we have with the systemic inflammation. We've known a standard of care for many years whenever we clean teeth that if a patient had a prosthetic heart valve or had a prosthetic joint that they need to be covered with an antibiotic prior to cleaning their teeth. There's links with cardiovascular disease, pulmonary disease, rheumatoid arthritis, etcetera. But of all of these the strongest evidence is that link between periodontitis and diabetes.

So let's look at some treatment slides. Here we have a, looking at the lower teeth, you can see kind of the swelling in the gums and the puffiness, and so all we did here, this patient had a A1c of 11.3. We put him on Doxycycline and did a deep-cleaning, not gum surgery.

You can see now the shrinkage in the tissues. This is what we want, now a patient can get in between those teeth with a little brush, be able to clean that and ten years after this fact the patient still has these teeth.

This is another case. It looks like, oh my God, there is what can we do to treat this? We did a deep-cleaning, put him on an antibiotic.

This is three months later. Now, this looks much better, but do you notice that there is still some redness in the tissue? So, we still haven't really brought this infection under control. So, we work more with the patient, talk to him about what they're doing to clean in between the teeth and they weren't doing a very good job of that. We can provide another recall cleaning and then monitor this case a little bit more closely.

This patient unfortunately has been an episodic user, but this is still 13 years later, and he still has all these teeth, and this isn't a patient whose blood sugar has consistently been in the 200s, never been able to get it under control, so there is always individual variation as to how our patients are going to respond.

If you take a look around the upper two front teeth, you can see that there is still some disease that's active in present, and hopefully, we'll be able to get this guy to be a believer and start getting some more regular cleanings and follow-up with us.

This patient wasn't as lucky. This is a 28-year-old female, high blood sugar, and so we did our diabetic protocol. You can see the granulomatous tissue on those palatal surfaces. That's two months afterwards, that's a very good healing. I am very pleased to see that, and I am thinking by golly this is going to work. But the

patient did not come back in, did not come back in for a recall, did not come back in to get some of our carious teeth restored and so this is two years later.

And you can see the infection has come back, those teeth have drifted more, and now unfortunately, the treatment is going to be in a 30-year-old female to extract those four front teeth and put-in a flipper to try and stabilize this area while we're trying to save the other teeth.

And then this is a case that I did. This kind of shows a combination of things as you look at

some of the things that we face. So definitely this guy is only 27, and we need to try and save some teeth because lower-full dentures just don't work as well as we would like them to. They tend to slide around. So we're going to take out some teeth, but we're also going to clean them at the same time.

This shows the extent of bone loss. Bone has been lost all the way the tip of the roots on these short premolars but the canine I2 still has about half of the bone and so does the molar. So let's save those teeth and get out the bad ones.

This show the teeth have already been extracted and now we're doing that open flap curettage where I can visualize the roots. This is one of our ultrasonic scalers. That tip moves about a 20<sup>th</sup> of a millimeter back-and-forth 30,000 times a second and it's that buzzing that our patients just love to feel as we're cranking the stuff off of the teeth.

And then here I am going ahead and using some iris scissors to remove that infected tissue on the inside of the gum. This is that ulcerated stuff that I showed you in the illustration. And then we just do some closure, and this is what it looks like healing.

Now, these are lower teeth, so there was upper teeth, you could see that there are some aesthetic problems, but not down here, the lip covers this. The patient can maintain these teeth, they're easy to clean, and it is much better to have a partial denture in here. It allows the patient to be able to eat healthier foods, such as fruits and vegetables, and nuts rather than eating refined carbohydrates.

And so, periodontal treatment involves scaling the teeth, yes, but I prefer to use the ultrasonics as much as possible because it flushes the bacteria out, and changes that bacterial plaque to more positive, a more friendly bacteria that are in the mouth. We can also use localized antibiotic.

So the one in the middle that's one that is a microsphere of Minocycline that has a slow release over one to two weeks to sterilize active pockets in the mouth. Connect these two syringes together and squirt a gel of Doxycycline which has a slow time release in the mouth and these are done around just specific teeth with disease.

I'm a firm believer in electric toothbrushes. The majority of the studies show the electric toothbrushes remove plaque better than manual toothbrushes and control disease better. That includes even these real cheap ones. They're like \$7-\$8 ones where you put AA battery in the handle, and they're easier to grasp. So we like to recommend that.

There are toothpastes that are approved that also have the fluoride in them to help fight caries, but have active ingredients in them to help control plaque and gingivitis. And then there are certainly mouth rinses. And I almost recommend a mouth rinse to everyone: they have a high caries rate, it's one with fluoride. If they don't have a high caries rate, but they have periodontitis then I want them to use one of these agents that is a true anti-plaque, anti-gingivitis agent, because studies show that those individuals that brush and floss and use a mouth rinse, the tissues get actually healthier than those that just brush and floss.

And the real kicker is getting our patients to clean in-between their teeth. There are all sorts of different things from flosses and brushes and rubber tips and soft picks. Anything we can do, and it's site-specific. Some people's teeth that are very tied together can't use the brushes. So we have to do it as to what the individual presents with, but this is the important aspect. If we can get them to do something to break up that plaque in-between the teeth, then that's not only going to help them to get their disease under control, but it can help them systemically also.

So this came, I photographed this from 'Newsweek' in April last year, and if you take a look this is talking about, not necessarily how to live forever, but how to extend your life. So one of them, it shows the glass, it says "you are an optimist" and if you see the glass as half full, then

that is much better for you and your longevity than being a pessimist. But the one right in the middle is right there, is if you brush and floss daily, that is another way to extend your life, and Michael Roizen in his bestseller *'The RealAge Makeover'* discusses just the addition of flossing can add 6.4 years to your life.

This is up near Sedona, one of my favorite hiking areas. So, treating the periodontal disease in an age of increasing healthcare costs that treatment can actually decrease costs.

Aetna, started out, was the first one that did a study, and when they enrolled people into the study they found out that those individuals who got periodontal care just did a cleaning in their first year actually have lowered total medical costs for their members with diabetes coronary artery disease and stroke.

That was duplicated in other populations, so on the Blue Care Network of Michigan they found out that medical costs for diabetics decreased. Blue Cross/Blue Shield of Maine, the dental care decreased medical costs \$1700 a year for these individuals, almost double that if they had coronary artery disease, and then just last month it was reported in *'The Journal of the American Dental Association,'* that regular dental cleanings reduced hospitalizations and ER visits for diabetes specific medical care compared to those who didn't receive it. It actually came out to be a third less likely to need a visitor or a hospitalization. So that's significant.

So insurance companies are in the business to make money and because with that if they can save money then what they are going to do is change their policies. So now Aetna, Cigna, Blue Cross/Blue Shield, Delta, United, all of them have increased their dental benefits, sometimes not even counting toward the yearly maximum. So if they know that if their patients can get in, get dental treatment done, get cleanings done that their patients will be healthier and then there will be less cost involved.

So what's the dental provider's role? Well, there's many adults that make it into the dental clinic every year that don't make it into medical. So it's our job to identify those; almost everybody, 94% of people with periodontitis met American Diabetes Association guidelines for screening.

In the dental chair we can go ahead and get a blood pressure, we can ask about a family history of diabetes, we can talk about when the last medical visit was, we can ask about whether they're taking their medications or refilled their medications, and we can discuss lifestyle modifications. Another huge risk factor and comorbid condition is smoking in our patients.

So if we can get them to get into a smoking cessation program, that's going to benefit them for their cardio disease, their diabetes, and their periodontitis, and their lung disease. So that's all part of our chronic disease initiative.

We can talk to them about diet and weight loss, talk about getting exercise, and it's our job to establish the oral health; ZT4BG was set up by Chris Kammer. What that stands for is Zero Tolerance for Bleeding Gums, and there is a website that allows you to go to links to look at diabetics, and this oral systematically. It's a pretty cool website. But it's our job to treat these patients and get the gum disease under control.

The medical provider's role is to know what gum disease looks like, you know, to be able to look in the mouth, take tongue blade, take a peek in there, see if you see a lot of disease, ask about when the last dental exam was, encourage patients to practice good oral hygiene, you can help push that for us also, and develop a good working relationship with the patient's dentist.

Many of our clinics, dental clinics across IHS are overwhelmed and we're structured to take care of caries and deal with that, and may be less structured, and don't have as many resources to put towards periodontitis, but that doesn't make that right.

And so, if you can figure out a way, a contact in your dental department or some way to maybe set up a referral system so that your patients that may be in the greatest need, some of the ones that the teeth really are starting to drift where you can see some of this more moderate to severe periodontitis is setting in there. You know, it's going to be in your patient's best interest to get them over to dental.

So, in summary, chronic inflammation is the link between many illnesses including diabetes and periodontitis, and periodontal treatment reduces this cumulative systemic pathogen and inflammatory burden throughout the body.

The consequences of under-treatment could be more than loss of just a few teeth; those consequences being increases in cardiovascular complications, kidney complications, etcetera.

And so this is me, I am a little hard to find on the listserv. As I mentioned there is another Gregory Smith, there is another Dr. Todd Smith in the IHS. So here is my email if I can be of any assistance to you. And I just wanted to thank you for your interest.