Local Service Category:	**Oral Health Care**
Amount Available:	**To be determined**
Unit Cost**:**	
Budget Requirements or Restrictions **(TRG Only)**:	Maximum of 10% of budget for Administrative Costs
Local Service Category Definition:	Restorative dental services, oral surgery, root canal therapy, fixed and removable prosthodontics; periodontal services includes subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Oral medication (including pain control) for people living with HIV (PLWH) 15 years of age or older must be based on a comprehensive individual treatment plan. Prosthodontics services to people living with HIV including but not limited to examinations and diagnosis of need for dentures, crowns, bridgework and implants, diagnostic measurements, laboratory services, tooth extraction, relines and denture repairs. Emergency procedures will be treated on a walk-in basis as availability and funding allows. Funded Oral Health Care providers are permitted to provide necessary emergency care regardless of a PLWH's annual benefit balance. If a provider cannot provide adequate services for emergency care, the PLWH should be referred to a hospital emergency room.
Target Population (age, gender, geographic, race, ethnicity, etc.):	People living with HIV residing in the Houston HIV Service Delivery Area (HSDA).

Services to be Provided:	Services must include, but are not limited to: individual comprehensive treatment plan; diagnosis and treatment of HIV-related oral pathology, including oral Kaposi's Sarcoma, CMV ulceration, hairy leukoplakia, xerostomia, lichen planus, aphthous ulcers and herpetic lesions; diffuse infiltrative lymphocytosis; standard oral health education and preventive procedures, including oral hygiene instruction, smoking/tobacco cessation (as indicated), diet counseling and home care program; oral prophylaxis; restorative care; oral surgery including dental implants; root canal therapy; fixed and removable prosthodontics including crowns and bridges; periodontal services, including subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Proposer must have mechanism in place to provide oral pain medication as prescribed for PLWH by the dentist.
	
	Limitations:
	• Cosmetic dentistry for cosmetic purposes only is prohibited.
	• Maximum amount that may be funded by Ryan White/State Services per PLWH is $3,000/year.
	  • In cases of emergency, the maximum amount may exceed the above cap
	  • In cases where there is extensive care needed once the procedure has begun, the maximum amount may exceed the above cap.
	• Dental providers must document *via approved waiver* the reason for exceeding the yearly maximum amount.

Service Unit Definition(s) **(TRG Only)**:	General Dentistry: A unit of service is defined as one (1) dental visit which includes restorative dental services, oral surgery, root canal therapy, fixed and removable prosthodontics; periodontal services includes subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Oral medication (including

	pain control) for PLWH 15 years old or older must be based on a comprehensive individual treatment plan. Prosthodontics: A unit of services is defined as one (1) Prosthodontics visit.
Financial Eligibility:	Income at or below 300% Federal Poverty Guidelines. Maximum amount that may be funded by Ryan White/State Services per PLWH is $3,000/year.
Eligibility for Services:	Person living with HIV; Adult resident of Houston HSDA
Agency Requirements **(TRG Only)**:	**To ensure that Ryan White is payer of last resort, Agency and/or dental providers (clinicians) must be Medicaid certified and enrolled in all Dental Plans offered to Texas STAR+PLUS eligible PLWH in the Houston EMA/HSDA**. Agency/providers must ensure Medicaid certification and billing capability for STAR+PLUS eligible PLWH remains current throughout the contract term. Agency must document that the primary PLWH care dentist has 2 years prior experience treating HIV disease and/or on-going HIV educational programs that are documented in personnel files and updated regularly. Dental facility and appropriate dental staff must maintain Texas licensure/certification and follow all applicable OSHA requirements for PLWH management and laboratory protocol.
Staff Requirements:	State of Texas dental license; licensed dental hygienist and state radiology certification for dental assistants.
Special Requirements **(TRG Only)**:	Must comply with the Houston EMA/HSDA Standards of Care. The agency must comply with **the DSHS Oral Health Care Standards of Care**. The agency must have policies and procedures in place that comply with the standards ***prior*** to delivery of the service. Oral Health Care services can be delivered via ~~telehealth~~ teledentistry and must follow applicable federal and State of Texas privacy laws. Providers may establish the practitioner-patient relationship with teledentistry in accordance with rules adopted under OCC §111.006.

FY 2026 RWPC "How to Best Meet the Need" Decision Process

Step in Process: **Council**		Date: **06/12/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **Steering Committee**		Date: **06/05/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **Quality Improvement Committee**		Date: **05/13/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
2.		
3.		

Step in Process: **HTBMTN Workgroup #2**	Date: **04/15/2025**
Recommendations:	Financial Eligibility:
1.	
2.	
3.	

FY 2025 Houston EMA/HSDA Ryan White Part A/MAI Service Definition **Oral Health/Rural** (Last Review/Approval Date: November 2021)	
HRSA Service Category Title: **RWGA Only**	**Oral Health**
Local Service Category Title:	**Oral Health – <u>Rural (North)</u>**
Budget Type: **RWGA Only**	**Unit Cost**
Budget Requirements or Restrictions: **RWGA Only**	Not Applicable
HRSA Service Category Definition (**do <u>not</u> change or alter**): **RWGA Only**	**Oral health care** includes diagnostic, preventive, and therapeutic services provided by general dental practitioners, dental specialists, dental hygienists and auxiliaries, and other trained primary care providers.
Local Service Category Definition:	Restorative dental services, oral surgery, root canal therapy, fixed and removable prosthodontics; periodontal services includes subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Oral medication (including pain control) for HIV patients 15 years old or older must be based on a comprehensive individual treatment plan. Prosthodontics services to eligible clients including, but not limited to examinations and diagnosis of need for dentures, diagnostic measurements, laboratory services, tooth extractions, relines and denture repairs.
Target Population (age, gender, geographic, race, ethnicity, etc.):	Persons living with HIV residing in Houston Eligible Metropolitan Area (EMA) or Health Service Delivery Area (HSDA) counties other than Harris County. Comprehensive Oral Health services targeted to individuals residing in the northern counties of the EMA/HSDA, including Waller, Walker, Montgomery, Austin, Chambers and Liberty Counties.
Services to be Provided:	Services must include, but are not limited to: individual comprehensive treatment plan; diagnosis and treatment of HIV-related oral pathology, including oral Kaposi's Sarcoma, CMV ulceration, hairy leukoplakia, xerostomia, lichen planus, aphthous ulcers and herpetic lesions; diffuse infiltrative lymphocytosis; standard preventive procedures, including oral hygiene instruction, diet counseling and home care program; oral prophylaxis; restorative care; oral surgery including dental implants; root canal therapy; fixed and removable prosthodontics including crowns, bridges and implants; periodontal services, including subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Proposer must have mechanism in place to provide oral pain medication as prescribed for

	clients by the dentist.
Service Unit Definition(s): **RWGA Only**	General Dentistry: A unit of service is defined as one (1) dental visit which includes restorative dental services, oral surgery, root canal therapy, fixed and removable prosthodontics; periodontal services includes subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Oral medication (including pain control) for HIV patients 15 years old or older must be based on a comprehensive individual treatment plan. Prosthodontics: A unit of services is defined as one (1) Prosthodontics visit.
Financial Eligibility:	Refer to the RWPC's approved *Financial Eligibility for Houston EMA/HSDA Services*.
Client Eligibility:	Adult persons with HIV residing in the rural area of Houston EMA/HSDA meeting financial eligibility criteria.
Agency Requirements:	Agency must document that the primary patient care dentist has 2 years prior experience treating HIV disease and/or on-going HIV educational programs that are documented in personnel files and updated regularly. Service delivery site must be located in one of the northern counties of the EMA/HSDA area: Waller, Walker, Montgomery, Austin, Chambers or Liberty Counties
Staff Requirements:	State of Texas dental license; licensed dental hygienist and state radiology certification for dental assistants.
Special Requirements: **RWGA Only**	Agency and/or dental providers (clinicians) must be Medicaid certified and enrolled in all Dental Plans offered to Texas STAR+PLUS eligible clients in the Houston EMA/HSDA. Agency/providers must ensure Medicaid certification and billing capability for STAR+PLUS eligible patients remains current throughout the contract term. Must comply with the joint Part A/B standards of care where applicable.

FY 2026 RWPC "How to Best Meet the Need" Decision Process

Step in Process: **Council**		Date: **06/12/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
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3.		

Step in Process: **Steering Committee**		Date: **06/05/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
1.		
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Step in Process: **Quality Improvement Committee**		Date: **05/13/2025**
Recommendations:	Approved: Y:_____ No: _____ Approved With Changes:_____	If approved with changes list changes below:
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3.		

Step in Process: **HTBMTN Workgroup #2**	Date: **04/15/2025**
Recommendations:	Financial Eligibility:
1.	
2.	
3.	

Modified Monitoring Process

Effective March 13, 2020 TRG enacted emergency response procedures due to COVID-19 pandemic. All monitoring was deferred/suspended in 2020 per DSHS and HRSA guidance.

In 2020, DSHS launched a burden reduction plan to reduce administrative burden by 50% for AA's and Subrecipients.

- This model requires subrecipient monitoring every other year (even years only).
- Per DSHS guidance, TRG is not required to complete monitoring in odd years
- In 2020, subrecipients that didn't have the ability to complete a remote review, were exempted from the 2020 Standards of Care chart review monitoring due to the COVID-19 State of Emergency.

2022 Monitoring

This year all subrecipients will be monitored, remotely if possible and in-person if necessary.

The monitoring period will cover calendar year 2021

Special chart review process is being evaluated for the RW Planning Council process during the "odd" years DSHS is not requiring monitoring (requires DSHS approval)

Oral Healthcare (OHC)

OHC WAS REVIEWED IN 2020. PLEASE NOTE NOT ALL PROVIDERS WERE ASSESSED.

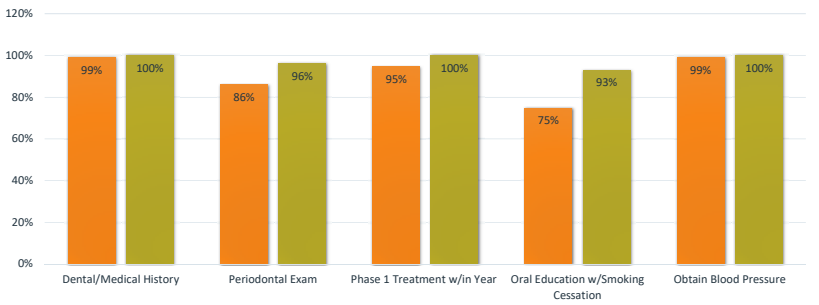
Description of Service

Restorative dental services, oral surgery, root canal therapy, fixed and removable prosthodontics; periodontal services includes subgingival scaling, gingival curettage, osseous surgery, gingivectomy, provisional splinting, laser procedures and maintenance. Oral medication (including pain control) for HIV patients 15 years old or older must be based on a comprehensive individual treatment plan.

Prosthodontics services to HIV infected individuals including but not limited to examinations and diagnosis of need for dentures, crowns, bridgework and implants, diagnostic measurements, laboratory services, tooth extraction, relines and denture repairs.

Emergency procedures will be treated on a walk-in basis as availability and funding allows. Funded Oral Health Care providers are permitted to provide necessary emergency care regardless of a client's annual benefit balance.

Chart Review Highlights- 2019-2020



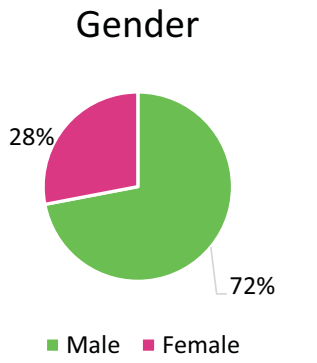
Harris County
Public Health
Building a Healthy Community

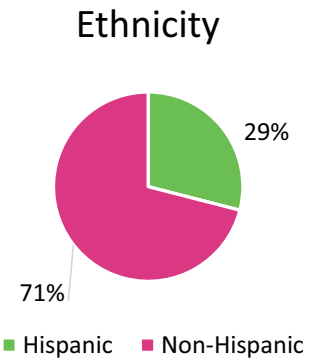
Ryan White Part A, Houston EMA FY20-21 Clinical Care Chart Review Summary of Findings

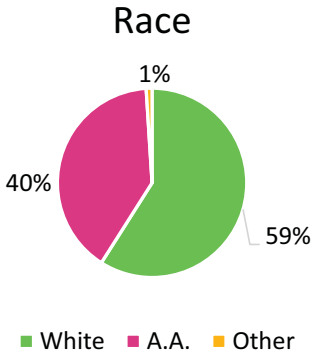
Review period was March 1, 2020 - February 28, 2021

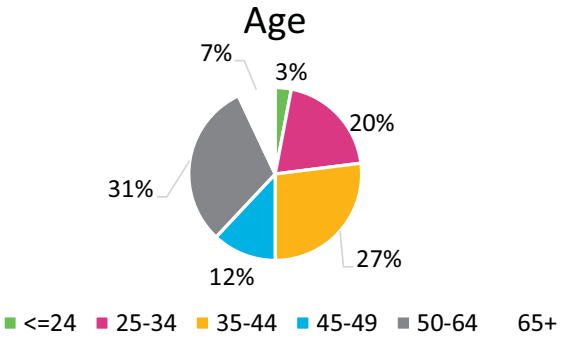
Oral Health-Rural Chart Review

- 75 charts reviewed
- Each sample was determined to be comparable to the racial, ethnic, gender and age demographics of each site's overall vision care population









Oral Health-Rural Chart Review

Performance Measure	2020
Primary Care Provider	100%
Medical/Dental Health History*	76%
Medical History 6 month update	93%
Vital Signs	100%
Current Medications	100%
CBC Documented	96%
Antibiotic Prophylaxis Given	N/A

Performance Measure	2020
Oral Health Education*	99%
Hard Tissue Exam	99%
Soft Tissue Exam	99%
Periodontal Screening*	99%
X-Rays Present	99%
Treatment Plan*	100%
Phase I Treatment Plan Completed	44%

*HIV/AIDS Bureau (HAB) Performance Measures

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Building a Healthy Community

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FY 2020 PERFORMANCE MEASURES HIGHLIGHTS

RYAN WHITE GRANT ADMINISTRATION

HARRIS COUNTY PUBLIC HEALTH (HCPH)

Ryan White Part A
HIV Performance Measures
FY 2020 Report

Oral Health Care
All Providers

Clinical Chart Review Measures*	**FY 2018**	**FY 2019**
100% of oral health clients will have a dental and medical health history (initial or updated) at least once in the measurement year	100%	99%
90% of oral health clients will have a dental treatment plan developed and/or updated at least once in the measurement year	99%	100%
85% of oral health clients will receive oral health education at least once in the measurement year	99%	99%
90% of oral health clients will have a periodontal screen or examination at least once in the measurement year	97%	94%
50% oral health clients will have a Phase 1 treatment plan that is completed within 12 months	34%	55%

TheBody

How People With HIV Can Get the Best Out of Their Dental Care

Part of Keeping Up With Your HIV Care

Jan 14, 2025
By: Tim Murphy

GettyImages/Morsa Images

Going to the dentist can be difficult for people of all backgrounds, but it can be especially fraught for people living with HIV—to the point of total avoidance! A major reason why is that some people with HIV have experienced discrimination or stigma at the hands of their dentist. And before effective treatment for HIV became widely available, national surveys indicated that a significant percentage of polled dentists would not be willing to provide services to the community. While times have changed, the perception that they have not remains a barrier to care.

Though there is little research on how often people living with HIV have accessed dental care in recent years, studies conducted since antiretroviral therapy became widely available tell us a lot. For instance, a study from 2012 found that more than half of people with HIV had not seen a dentist in the past two years, while a study published in 2005 found that up to 58% of people living with HIV don't get the dental care they need.

Whatever the reason for low dental engagement, it is incredibly important for people with HIV to see a dentist regularly because research continues to show that oral health is intimately connected to

other health issues like cardiovascular disease, diabetes, and cancer. Moreover, people with HIV who are worried about experiencing discrimination can turn to the Americans with Disability Act for support; it protects against discrimination of people with HIV by dentists and any other health care provider.

With that in mind, here's a guide on how to find HIV-knowledgeable dentists and work with them to maximize outcomes—including how to do your share at home between visits to attain the best oral health possible.

Find a Quality Dentist

First of all, if you don't already have a dentist who's comfortable with HIV—and with whom *you're* comfortable—find one! Your teeth do not want you to wait another month to get seen. "This advice goes for anyone looking for a dentist, living with HIV or not," says Jesse Barrett, D.D.S., director of dentistry at NYC's LGBTQ- and HIV/AIDS serving Callen-Lorde clinic. "Word of mouth is probably best." Ask others in your area living with HIV what dentists they see and if they like them. Or call your local HIV/AIDS services organization or care center and ask if they can make a referral.

In fact, your local care center may offer free or nearly-free dental services via HIV-specializing Ryan White CARE Act funding, so you should contact a Ryan White-funded health clinic near you and see if you qualify. An added perk of going through Ryan White-funded clinics is that they are staffed by people with ample experience treating people with HIV.

You can also call your nearest community health center or dental school, which often offer reduced rates if you're willing to be part of aspiring dentists' education process. (I go to NYU College of Dentistry in NYC and *love* it.) If you are without dental insurance or have a plan that doesn't cover much, you can usually find starkly reduced rates—especially for basic work like cleaning, X-rays, and diagnostics—at a dental school.

Find Out if the Dentist Office Has Experience Treating People With HIV

A Ryan White-funded clinic—or a clinic embedded in an LGBTQ-specializing health center—very likely has experience treating people living with HIV. But if you're not sure, Barrett says, call them and ask if they treat people with HIV. "That's going to be the best indicator," he says.

A simple, quick "yes" or "we have lots of patients with HIV" is a green light. "But if you detect any hint of hesitation, like 'Uh....we'll have to get back to you,' it might not be the place for you."

Know Your Legal Rights

Everyone should be able to see a dentist who clearly and proudly states that they serve people with HIV. However, this is not always the case. Fortunately, the Americans with Disabilities Act clearly states that if a clinic says they don't take people with HIV, that is clear discrimination. And those clinics certainly should know better, according to Jose Abrigo, the HIV Project Director at the LGBTQ litigation nonprofit Lambda Legal.

At that point, it's your choice: Move on to another dentist, or report the discrimination to the U.S. Department of Health and Human Services' Office for Civil Rights, your state's department of civil rights, the American Dental Association, your state health department, or Lambda Legal's Help Desk. It may help to present evidence, such as an audio recording of the call (most states only require one-party consent, meaning that only one party on a two-party call—namely, you!—needs to know that it's being recorded).

Are You Required To Tell a Prospective Dentist That You Have HIV?

In all but one state (Arkansas), Abrigo says, you do not have to tell your dentist you are living with HIV. However, initial intake forms at most dental offices ask you to list all pre-existing health conditions, as well as medications you are taking. And it's wise to be honest about your HIV and HIV medications (as well as any other conditions or medications) because they help health providers determine how treatments they might give you will interact with your pre-existing conditions and

treatment. Hopefully by the point you're filling out those forms, you'll already know that your dentist has no hang-ups about HIV.

The bottom line: Even though your dentist may *appear* to be discriminating against you by asking questions about your HIV ("Are you undetectable? What are your T cells?") or taking special precautions like wearing a plastic face screen, it's generally not really discrimination unless they dismiss you from the get-go for saying you're living with HIV—or that they have a blanket policy against treating people with HIV.

How To Optimize Your Relationship With Your Dentist

According to Barrett, once you have a dentist, the single greatest thing you can do to improve your relationship is make regular dental appointments and show up on time. "If you do that, everything will get done eventually," he says. The other thing you can do is to disclose your full health and medication history (usually via initial paperwork). And, especially if your CD4 count is below 200 and/or if your HIV is detectable, give your dentist written permission to consult with your primary health care provider about what's best and safe for you.

Oh, and of course, do your dentist and their staff the service of brushing and flossing your teeth before getting in the chair. Examining and treating a mouth full of food particles won't stop your dentist from doing their job, Barrett says, "but it's a nice thing to do and makes my job a little more pleasant."

On average, it's recommended that people have a dental visit every six months, but, Barrett says, your dentist might make that more or less frequent once they assess the state of your oral health and come up with your treatment plan.

How To Deal With Dental Pain

Generally, dentists know what procedures require anesthetics. For example: It's used for things like cavity fillings and root canal surgery, but not for routine cleanings. "No dentist should ever deny your experience of pain," Barrett notes. "If at any time you feel intolerable pain, you should stop and let your dentist know. And if they say you don't need anesthesia, then leave."

Is It OK To Get a Second Opinion?

"Absolutely," Barrett says. "A compassionate dentist should have no trouble explaining why you need a certain procedure, presenting alternatives to it, or letting you get a second opinion."

Recently, I was told by a private dentist that I needed major work on two teeth—and that, because I had low-coverage dental insurance, the work would cost me about $900 out of pocket for each of four visits. I sought a second opinion at NYU College of Dentistry, where a team of professors and students told me that no such work was needed!

What if My Coverage Options Don't Cover My Dental Needs?

Some Ryan White-funded dental clinics will cover expensive procedures and some won't. The only way to know for sure is to ask! If they won't, Barrett says that a dental school might be your best bet. They usually offer lower sticker prices than private practices *and* might let you set up a long-term payment plan.

Of course, you may live in a place where second options are hard to come by. If that is the case and a procedure is not covered by your dental insurance, Ryan White, or other payers, be completely honest with your dentist and tell them you cannot afford it and ask what can be done instead, even if it's less than ideal.

What Can I Do Between Visits To Maximize My Oral Health?

As most dentists will tell you, the majority of your oral health is based on what you do at home. So here are Barrett's rules for at-home care:

- Brush your teeth twice daily. Hold the brush at a 45-degree angle and make soft, light circular or back-and-forth motions exactly where your teeth and gums meet for two minutes total, as shown in this American Dental Association video. If you use an electric toothbrush, notes Barrett, *do not* bear down on the brush because it can cause gum recession. And he notes that electric toothbrushes have no need of rotating, because the toothbrush is already doing that work for you.
- Wait 15 minutes after meals to brush your teeth, which is how much time a protective layer builds back over them after you consume food or drink, which can expose your teeth to acid.
- You can floss with flossing string, floss pics (floss extended between ends of a D-shaped plastic piece), or interdental brushes (I vastly prefer these, because I *hate* traditional flossing!) "Anything that's getting in between your teeth consistently works," Barrett says, "which does *not* include toothpicks!" Ideally, floss after every meal to remove food particles from between your teeth ASAP.
- Practice good oral health habits and eschew bad ones. Barrett says that good habits include drinking lots of water throughout the day and chewing sugar-free gum or candy with xylitol, which is good for preventing cavities. Bad ones include smoking—which can increase gum

disease and recession—and anything that dries out your mouth or makes you clench or grind your teeth, leading to an array of bad oral health results. No matter what you do or don't do, drinking lots of water can improve your oral health!

- Remember: Oral health is overall health! "There's a lot of research coming out that the mouth and the body are really connected," Barrett says. "And that treating problems in the mouth can lead to better outcomes in chronic disease markers like heart disease, the immune system, and diabetes. So treating any oral infection can lead to improvement with other chronic health problems—so it's important to treat them!"

In other words, don't let anything—fear of being discriminated against or treated weirdly, fear of pain or discomfort, or plain old lack of motivation—stop you from finding an HIV-friendly dentist you're going to have a long, productive relationship with. 'Cause you really need it!

[Editor's note: The original version of this article included a paragraph discussing whether dentists were legally permitted to deny care based on a person's CD4 count. That paragraph has been removed pending further review.]

Tim Murphy, Contributing Editor: Tim Murphy, a freelance writer and journalist based in Brooklyn, has been writing about HIV/AIDS for nearly three decades, including for publications and organizations such as TheBody, TheBodyPro, POZ, New York Magazine, The Nation, Housing Works, and Lambda Legal.

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BMC Oral Health

RESEARCH

Open Access

Postmenopausal women with HIV have increased tooth loss

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Abstract

Background With effective antiretroviral therapy, people with HIV (PWH) are living longer and aging; the majority of PWH in the United States are now over the age of 50 and in women have gone through the menopause transition. Menopause potentiates skeletal bone loss at the spine, hip, and radius in PWH. The alveolar bone which surronds the teeth is different than long bones because it is derived from the neural crest. However, few studies have assessed the oral health and alveolar bone in middle aged and older women with HIV. Therefore, the objective of this study was to evaluate periodontal disease and alveolar bone microarchitecture in postmenopausal women with HIV.

Methods 135 self-reported postmenopausal women were recruited (59 HIV-, 76 HIV + on combination antiretroviral therapy with virological suppression) from a single academic center. The following parameters were measured: cytokine levels (IFN-γ, TNF-α, IL-1β, IL-2, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, IL-17 A, OPG, and RANKL) in gingival crevicular fluid, bleeding on probing, probing depth, clinical attachment loss, number of teeth present, alveolar crestal height, and alveolar bone microarchitecture.

Results The mean age of participants was 57.04+/-6.25 years and a greater proportion of women with HIV were black/African American (HIV + 68.42%, HIV- 23.73%; $p < 0.001$). There was no significant difference in bleeding on probing ($p = 0.17$) and attachment loss ($p = 0.39$) between women who were HIV infected vs. HIV uninfected. Women with HIV had significantly higher RANKL expression in Gingival Crevicular Fluid (HIV + 3.80+/-3.19 pg/ul, HIV- 1.29+/-2.14 pg/ul ; $p < 0.001$), fewer teeth present (HIV + 17.75+/-7.62, HIV- 22.79+/-5.70; $p < 0.001$),), lower trabecular number (HIV + 0.08+/-0.01, HIV- 0.09+/-0.02; $p = 0.004$) and greater trabecular separation (HIV + 9.23+/-3.11, HIV- 7.99+/-3.23; $p = 0.04$) compared to women without HIV that remained significant in multivariate logistic regression analysis in a sub-cohort after adjusting for age, race/ethnicity, smoking status, and diabetes.

Conclusion Postmenopausal women with HIV have deterioration of the alveolar trabecular bone microarchitecture that may contribute to greater tooth loss.

Keywords Periodontal disease, Bone biology, Computed tomography, Women's health, Alveolar bone

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Introduction

Prior to the advent of effective antiretroviral therapy (ART) used to treat HIV (human immunodeficiency virus), people with HIV (PWH) were at risk for greater periodontal disease severity compared to the general population. [1, 2] Proinflammatory cytokines, such as IL-1β, IL-6, and TNF-α, are associated with oral inflammation, periodontitis, and bone resorption, and have previously been found in higher abundance in PWH. [3] However, a review of the current literature indicates widespread use of ART has improved periodontal parameters in PWH, which now better match outcomes people without HIV. [4]

ART has allowed PWH to experience longer life expectancies. [5] With extended life come aging-related risk factors and comorbidities, such as bone loss. [6] According to data from the National Health and Nutrition Examination Survey 2017–2018, older women have a greater prevalence of bone loss and fractures in long bones compared to younger women and men. [7] This can be attributed to menopause and a decrease in estrogen. [8] It is unlclear what the role of estrogen loss during menopause plays on the jaw bone. For example, the risk of mandibular fracture does not increase with age in women [9] and the effect of menopause on the jaw bones appears to be site specific. In one study it was shown that the thickness of the cortical crestal bone was thinner in the posterior maxilla but not in the anterior mxailla, anterior mandible and posterior mandible in women over the age of 50 compared to women under the age of 50. [10]

Older PWH who experience menopause have been shown to have greater bone loss than the general population. [11] We previously found that postmenopausal women with HIV have lower bone mineral density than postmenopausal women without HIV, and greater longitudinal bone loss [12, 13] In a separate study, we confirmed that menopause and HIV infection are independently associated with lower bone mineral density and have an additive effect on the lumbar spine and total hip bone mineral density. [14] However the role of HIV infection and menopause on the Jaw bone microarchitecture is unknown.

A recent meta-analyis concluded that postmenopausal osteoporosis patients are more likely to suffer from markers of periodontal disease including increased clinicial attachment loss, increased pocket depth and increased bleeding on probing. [15] Since postemenopausal women with HIV have accelerated skeletal long bone loss, it may be possible that they also experience greater alveolar bone loss leading to increased severity of periodontal disease. Therfore, this study aims to evaluate alveolar bone microarchitecture and periodontal disease in the postmenopausal women with and without HIV.

Materials and methods

Study population

This study was approved by the Columbia University Irving Medical Center Institutional Review Board (IRB-AAA5233). Written informed consent was obtained from all study subjects. As part of an ongoing study examining the mandibular bone microarchitecture in PLWH. Our primary outcome was changes in Alveolar crestal height levels. Based upon our preliminary data [16], with a sample size of 120, we will have >90% power to detect the observed effect size of a difference of 0.4 mm between HIV+and HIV- postmenopausal women in ACH. 135 patients were recruited from the dental clinic and Comprehensive Health Program clinic at Columbia University Irving Medical Center from September 2017 to December 2022; 76 were women with HIV and 59 without HIV. Inclusion criteria for the PWH cohort were: (a) self-reported menopause status, defined as the absence of menstrual bleeding for greater than 12 months; (b) 35–70 years old; (c) HIV-infected as defined by documentation of a positive antibody test or detectable HIV-1 RNA level any time prior to enrollment. In addition, women with HIV had to be on combination ART for at least one year with virological suppression, have a CD4 count>100 cells/μL at time of enrollment, and no opportunistic infections within the last six months prior to enrollment.

Inclusion criteria for women without HIV were: (a) self-reported menopause status; (b) 35–70 years old; (c) a negative HIV antibody test. Exclusion criteria for both groups included: (a) current chemo- or immunotherapy; (b) antibiotic use in the preceding three months other than prophylaxis for opportunistic infections; (c) history of bisphosphonate or other osteoporosis therapy; (d) current oral contraceptive, hormone therapy (HT), or testosterone supplementation.

Blood samples were collected using serum separator tubes, separated into serum aliquots, stored at −80 °C, then thawed and batch-analyzed at the Irving Columbia University Irving Medical Center Biomarker Laboratory. Circulating estrogen levels were measured by Estradiol ELISA (Siemens Cat# LKE21).

Periodontal examination

A full-mouth periodontal examination was performed on all study participants by calibrated dental examiners using a UNC 15 probe. Probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP) were recorded on all teeth excluding third molars at six sites per tooth: mesio-buccal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual, and disto-lingual. Periodontal status was classified according to the Centers for Disease Control and Prevention/American Academy of Periodontology (CDC/AAP) definitions [17]: (1) no/mild periodontitis: neither “moderate” nor “severe” periodontitis;

(2) moderate periodontitis: ≥ 2 interproximal sites with CAL ≥ 4 mm (not on same tooth) or ≥ 2 interproximal sites with PD ≥ 5 mm (not on same tooth); (3) severe periodontitis: ≥ 2 interproximal sites with CAL ≥ 6 mm (not on same tooth) and ≥ 1 interproximal site with PD ≥ 5 mm. BOP was recorded as present or absent. All missing teeth, excluding third molars, were recorded.

Gingival crevicular fluid (GCF) collection

Gingival crevicular fluid (GCF) samples were collected from the distal site of six index teeth: two molars, two premolars, and two incisors. The selected teeth included the maxillary right first molar (#3), the maxillary left central incisor (#9), the maxillary left first premolar (#12), the mandibular left first molar (#19), the mandibular right central incisor (#25), and the mandibular right first premolar (#28). If any of these teeth were missing, the next most anterior tooth in the same quadrant was selected and recorded. Supragingival plaque was removed, and the gingiva was dried with cotton and an air syringe. Precut periopaper strips (Oraflow, Smithtown, NY, USA) were introduced into the periodontal pocket until mild resistance was felt, angled to meet the midpoint of the distal surface, and held in place for 30 s. The strips were then placed in a single microcentrifuge tube containing 500 µL of sterile phosphate buffered saline (0.02 M phosphate, 0.15 M NaCl, pH 7.5, containing 0.05% Tween 20 [PBST; Fisher Scientific Co., Fair Lawn, NJ, USA]) and the GCF was eluted by centrifugation.

Inflammatory cytokine assays in GCF

Samples were assayed for GCF cytokines (IFN-γ, TNF-a, IL-1β, IL-2, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, IL-17 A, OPG, and RANKL) in pg/ml and in duplicate at the Salimetrics SalivaLab (Carlsbad, CA) using an electrochemiluminescence method developed and validated for GCF by Salimetrics for all assays except OPG (abcam OPG ELISA Kit (ab100617)). Calibration curves were generated to determine analyte concentration using a mix of standards for assays run in multiplex (IL-1 beta, IL-6, IL-8, TNF-a, IFN-γ, IL-2, IL-7, IL-10, IL-12p70). The average coefficient of variation for all samples tested was <15%. Sample test volume was 25 µL of GCF per determination.

Intraoral radiographs

Study subjects were exposed to a full mouth series of up to 11 standardized intraoral radiographs (seven anterior periapical radiographs and four posterior bitewing radiographs), taken on the Progeny Preva Unfors-XI (Midmark Corporation, Lincolnshire, Illinois, USA) at 60 kV, 7.0 mA and time range 0.10–0.16 s at a 20 cm source-to-skin distance. Alveolar crestal height (ACH) is defined as the distance in millimeters between the cementoenamel junction (CEJ) and the most coronal part of the alveolar crest directly adjacent to the root surface along the long axis of the tooth, and measured according to published methods. [18] ACH was measured by blinded investigators in up to 24 teeth at two sites per tooth (mesial and distal), excluding third molars and canines. Whole-mouth mean ACH was calculated by averaging the ACH levels in all teeth measured as previously described. [19]

Cone beam computed tomography (CBCT) acquisition

High resolution cone beam computed tomography (CBCT) images of the alveolar bone were obtained by a Planmeca ProMax 3D Classic CBCT scanner (Planmeca Inc., Hoffman Estates, Illinois, USA) at 84 kVp, 8 mA, and 15 s scan time. The manufacturer's standard high-resolution scanning protocol was used to acquire an 80×42×68 mm region at a nominal isotropic resolution of 100 µm. Participants were positioned in the scanner and secured using a temporal bone support and chin rest to reduce motion artifacts, and instructed to occlude on the posterior dentition in the position that provided the best fit. The aim was to obtain maximum occlusion.

To analyze the alveolar bone, 60 consecutive sections without intersection gaps were stacked after skipping the first 40 consecutive sections posterior to the opening of the mental foramen (Fig. 1). The region of interest included the trabecular and cortical bone, taken as the negative ROI from isolated trabecular bone. Skyscan Ctan Software (Bruker Corporation, Billerica, MA, USA) was used to isolate the ROI, convert to binary image form via local thresholding, and perform 3D microstructure evaluation. Parameters of interest included trabecular bone volume fraction (BV/TV), trabecular thickness, trabecular number, trabecular separation, cortical BV/TV, cortical thickness, and cortical porosity as previously described. [20]

Statistical methods

Statistical analyses were conducted in R (4.2.2). Participant demographics and clinical characteristics were summarized for the study cohort and by HIV status. Variation in participant characteristics across HIV status were tested with F-statistics from type III ANOVA models or Chi Squared tests, as appropriate.

Univariable and multivariable linear regression models were used to investigate differences in odds of periodontitis across HIV status. All regression models were adjusted for participant age, race/ethnicity (black/Hispanic), smoking status, and history of type 2 diabetes. Adjusted analyses were only conducted in a subset of the cohort, excluding those with missing co variates and of white race, due to no HIV cases among participants who were white. We have complied with the STROBE guidelines for human observational studies.

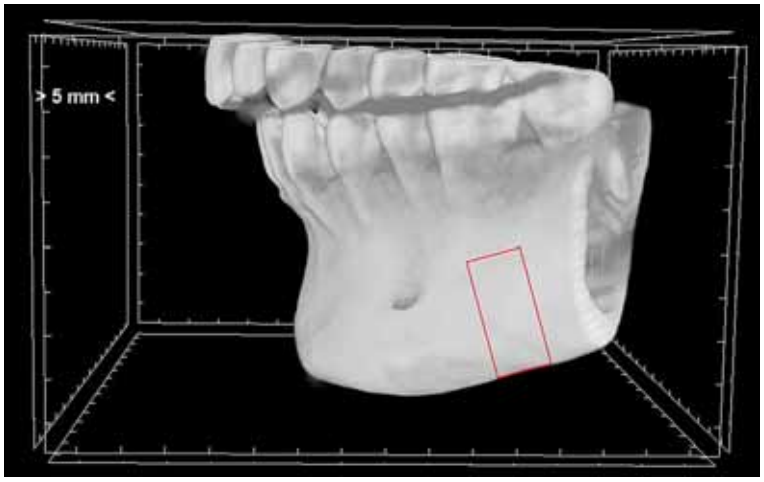

Fig. 1 3-Dimensional cone beam reconstruction of lateral view of the mandible depicting the region of interest boundaries

Results

The rationale of this cross sectional study was to examine periodontal disease activity and alveolar bone microarchitecture in postmenopausal women with and without HIV. A total of 135 postmenopausal women were recruited for the study (76 HIV+, 59 HIV-) with an average age of 57.04+/-6.25 years old (HIV+56.95+/-5.06 yrs/old, HIV- 57.15+/-7.56 years/old; p=0.85). Postmenopausal women with HIV had been on cART for a average of 17.79 +/- 7.4 years. There were significantly more black women (HIV+68.42%, HIV-23.73%) and no white women (HIV+0%, HIV- 20.34%) in the group with HIV (p<0.001) (Table 1).

PWH have fewer teeth but similar periodontal disease activity

Postmenopausal women with HIV had significantly fewer teeth (HIV+17.75+/-7.62 teeth, HIV- 22.79+/-5.70 teeth; p<0.001) than postmenopausal women without HIV, with a maximum of 28 teeth present, excluding third molars. However, there was no significant differences in mean PD, CAL, or % BOP between HIV groups (Table 1).

PWH have increased GCF markers of bone resorption

GCF levels of IFN-γ, TNF-a, IL-1β, IL-2, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, IL-17 A (pg/ml), and OPG were similar in the two groups. GCF RANKL expression was significantly higher in women with HIV (HIV+3.80+/-3.19 pg/ml, HIV- 1.29+/-2.14 pg/ml; p=0.0002) (Table 1).

PWH have increased alveolar bone loss and microcrhitectural alterations

Two-dimensional intraoral radiographs revealed that mean ACH was greater in women with HIV (HIV+3.26+/-1.28 mm, HIV- 2.72+/-1.01 mm; p=0.01) than women without HIV, where higher values indicate greater alveolar bone loss (Table 1).

Three-dimensional CBCT analysis of the microarchitecture of the alveolar bone surrounding the mental foramen region of the mandible revealed that women with HIV had significantly greater trabecular thickness (HIV+7.25+/-1.25, HIV- 6.24+/-1.78; p<0.001), lower trabecular number (HIV+0.08+/-0.01, HIV- 0.09+/-0.02; p=0.004), greater trabecular separation (HIV+9.23+/-3.11, HIV- 7.99+/-3.23; p=0.04), greater cortical BV/TV (HIV+99.18+/-1.38, HIV- 98.53+/-1.8; p=0.04), and lower cortical porosity (HIV+0.82+/-1.38, HIV- 1.47+/-1.8; p=0.04) compared to women without HIV (Table 1; Fig. 2).

Multivariate logistic regression analysis on sub-cohort

Multivariate logistic regression was performed on a subcohort. The 12 white participants without HIV and nine other participants with missing diabetes and/ or smoking status were not included in this analysis, resulting in a total of 114 sub-cohort participants from 135 total participants. In an unadjusted analysis of the sub-cohort, RANKL (p=0.001), mean PD (p=0.045), number of teeth present (p=0.002), trabecular thickness (p=0.024), trabecular number (p=0.015), cortical BV/TV (p=0.038), and cortical porosity (p=0.038) were significantly all different between women with and without HIV (Fig. 3). After adjusting for age, race/ethnicity (black/Hispanic), smoking status, and diabetes, RANKL (p<0.0001), mean PD (p=0.017), number of teeth present (p=0.012), trabecular number (p=0.009), and trabecular separation (p=0.044) remained significant.

Discussion

The effects of HIV infection on the alveolar bone and periodontal disease in women who have undergone the menopause transition is unknown. Therfore in this

Table 1 Demographics, Gingival crevicular fluid biomarker cytokine levels, Periodontal and X -ray and CBCT Variables for the Full cohort of post-menopausal women with and without HIV. Biomarkers were performed for Interferon Gamma (IFNγ), Tumor Necrosis Factor Alpha (TNFα), Interleukin (IL) 1 alpha, 2, 5, 6, 7, 8, 10, 12p70, 13, and 17 alpha, Osteoprotegrin (OPG) and Receptor Activator of Nuclear Factor Kappa Beta (RANKL). Abbreviations used are Trabecular (Trab.), Bone Volume (BV), Total Volume (TV), Cortical (Cort.) and Alveolar Crestal Height (ACH)

Full Cohort					
Variable	**# Missing**	**All**	**HIV -**	**HIV +**	**p-value**
N		**135**	**59**	**76**	
Age	0	57.04 (6.25)	57.15 (7.56)	56.95 (5.06)	0.8507
Race/Ethn	0				**< 0.0001**
Black		66 (48.89%)	14 (23.73%)	52 (68.42%)	
Hispanic		57 (42.22%)	33 (55.93%)	24 (31.58%)	
White		12 (8.89%)	12 (20.34%)	0 (0%)	
Smoking	7				0.3730
No		90 (70.31%)	42 (72.41%)	48 (63.16%)	
Yes		38 (29.69%)	14 (24.14%)	24 (31.58%)	
Diabetes	5				0.1014
No		104 (80.0%)	49 (83.05%)	55 (72.37%)	
Yes		26 (20.00%)	7 (11.86%)	19 (25%)	
Biomarkers pg/ml	**# Not Detectable**				
Estadiol	20	38.29 (38.05)	43.0 (51.85)	35.16 (24.97)	0.2809
IFN g	23	1.42 (0.93)	1.44 (1.03)	1.4 (0.85)	0.8079
TNF a	20	1.32 (1.24)	1.35 (1.44)	1.3 (1.07)	0.8044
IL1 b	17	60.56 (65.58)	48.57 (56.31)	70 (71.05)	0.0780
IL2	20	0.56 (0.54)	0.5 (0.6)	0.6 (0.5)	0.3075
IL5	114	0.04 (0.03)	0.05 (0.05)	0.03 (0.01)	0.1627
IL6	21	0.71 (1.1)	0.54 (0.57)	0.85 (1.38)	0.1347
IL7	123	0.07 (0.05)	0.09 (0.05)	0.04 (0.02)	0.0749
IL8	17	586.87 (667.96)	514.26 (656.93)	644.07 (675.98)	0.2966
IL10	19	0.28 (0.25)	0.26 (0.24)	0.29 (0.25)	0.5288
IL12p70	75	0.26 (0.22)	0.31 (0.26)	0.23 (0.19)	0.2332
IL13	23	5.28 (3.35)	4.99 (3.58)	5.5 (3.18)	0.4245
IL17 a	56	0.58 (0.7)	0.6 (0.91)	0.57 (0.58)	0.8630
OPG	43	31.21 (28.55)	37.58 (42.88)	27.64 (15.12)	0.1099
RANKL	61	2.65 (3.02)	1.29 (2.14)	3.8 (3.19)	**0.0002**
Periodontal Variables	**# Missing**				
Periodontitis	8				0.9966
Mild		7 (5.51%)	3 (5.08%)	4 (5.26%)	
Moderate		45 (35.43%)	20 (33.90%)	25 (32.89%)	
Severe		75 (59.06%)	33 (55.93%)	42 (55.26%)	
Mean AL (mm)	10	3.49 (1.13)	3.58 (1.17)	3.41 (1.1)	0.3913

Table 1 (continued)

Full Cohort					
Variable	**# Missing**	**All**	**HIV -**	**HIV +**	**p-value**
N		**135**	**59**	**76**	
Mean PD (mm)	10	3.12 (0.92)	3.25 (1.01)	3.02 (0.83)	0.1657
% BOP	9	0.29 (0.26)	0.25 (0.23)	0.32 (0.28)	0.1680
# Teeth present	2	19.91 (7.28)	22.79 (5.7)	17.75 (7.62)	**<0.0001**
X-ray and CBCT Variables	**# Missing**				
Trab BV/TV %	25	54.26 (15.74)	52.22 (16.32)	55.68 (15.29)	0.2596
Thickness (Pixels)	25	6.85 (1.57)	6.24 (1.78)	7.27 (1.25)	**0.0006**
Number (1/Pixels)	25	0.08 (0.02)	0.09 (0.02)	0.08 (0.01)	**0.0042**
Separation (Pixels)	25	8.73 (3.21)	7.99 (3.23)	9.23 (3.11)	**0.0450**
Cort BV/TV %	25	98.91 (1.59)	98.53 (1.8)	99.18 (1.38)	**0.0350**
Cort % Porosity	25	1.09 (1.59)	1.47 (1.8)	0.82 (1.38)	**0.0350**
Mean ACH (mm)	7	3.03 (1.12)	2.72 (1.01)	3.26 (1.28)	**0.0112**

study we examined the alveolar bone microarchitecture by cone beam tomography, assessed gingival crevicular fluid cytokines and perfomed a periodontal examination in postmenopausal women with and without HIV. We found similar to other studies [4] that there was no difference in periodontal disease activity (BOP and CAL) in postmenopasal women with and without HIV. However, we did find that postmenopausal women with HIV in our study have on average four to five fewer teeth present than women without HIV.

In contrast, in an older oral substudy of the Women's Interagency HIV Study (WIHS), they found that women with HIV had increased attachment loss, increased pocket depth and one fewer tooth present compared to women without HIV. [21, 22] The difference in the results between our study and the WIHS-Oral substudy could be attributed to age and menopausal status. The average age of participants in our study was 55 years old, whereas the average age in the WIHS-oral substudy was 37 years old at baseline. [22] Since the average age of menopause is 50 years old [23], it could be suggested that the menopause transition potentiates periodontal disease [24] in PWH. This may cause the teeth with periodontal disease to be extracted during the menopause transition in women with HIV resulting in less teeth present but better average attachment loss in postmenopausal women with HIV.

[14 After an adjusted analysis in our study, we found that postemenopasal women with HIV had a decrease in trabecular number and an increase in trabecular spacing compared to postmenopausal women without HIV. Although the association between alveolar bone microarchitecture and tooth loss, periodontal disease, or dental implant survival is not well-defined [25–27], decreased trabecular number and increased trabecular spacing at the spine and radius have been shown to increase fracture risk. [28] It can be suggested that these parameters produce a similar mechanism in alveolar bone, but future longitudinal studies are needed to determine any such relationships.

This study found that after an adjusted analysis, GCF RANKL levels remained significantly higher among in women with HIV. RANKL is the major cytokine involved in periodontal disease-associated alveolar bone resorption. [29] We have previously found that the oral microbiome in postmenopausal women with HIV with severe periodontal disease was enriched with bacteria harboring lipopolysaccharides (LPS) compared to postmenopausal women with HIV without severe periodontal disease. [30] LPS are believed to play a major role in mediating periodontal disease-associated alveolar bone loss by in part increasing RANKL expression. [31] Therefore, it could be suggested that the increased RANKL levels seen in HIV infection contribute to alveolar bone deterioration seen in PWH.

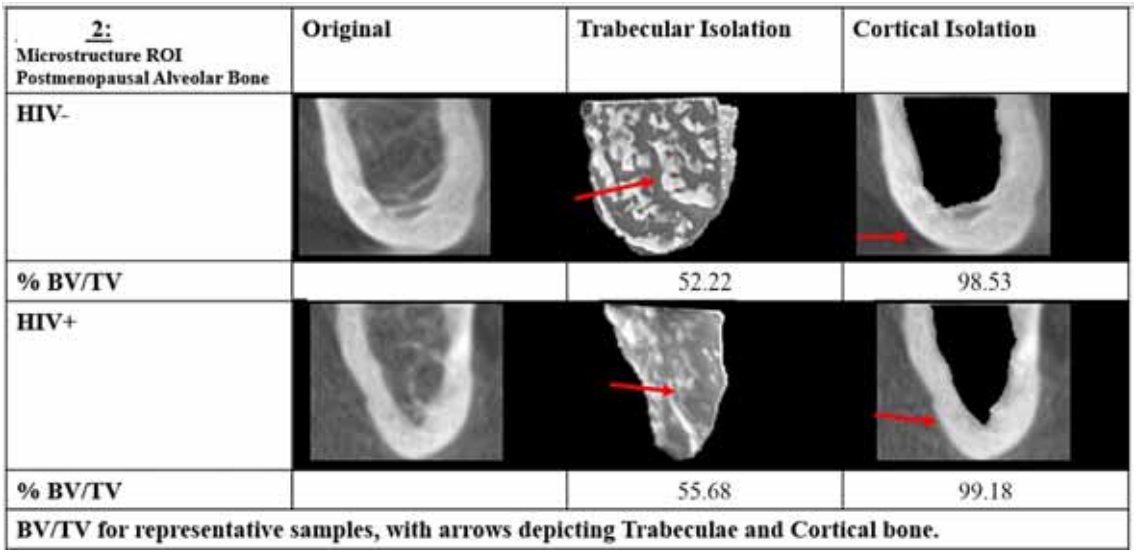

Fig. 2 Representative Cone Beam 3-D images of the original mandibular alveolar bone and the trabecular and cortical compartments from people with HIV (PWH) and HIV-negative controls

Another explanation for fewer teeth among PWH is decreased dental care utilization, 19% of women with HIV in the US reported unmet dental needs [32] as a result of bias and/or barriers felt in seeking oral healthcare. Recent studies have shown that the majority of dentists are still uncomfortable providing dental care PWH, which may delay care and treatment. [33] PWH also continue to report high levels of stigmatizing and discriminatory attitudes and behavior in the dental setting, which were strongly associated with the avoidance of dental care. [34] The results of this study add to the literature a better understanding of the impact of aging and menopause on PWH, and effects on alveolar bone. It brings to light the need for PWH to have greater access to regular dental care in order for this vulnerable population to be better served by the medical community.

The World Health Organization has identified that keeping a functional, esthetic, and natural dentition of 21 or more teeth during one's lifetime should be oral health treatment goal for everyone. [35] In our study we found that middle aged women with HIV living in New York city had on average < 18 teeth present. It is generally accepted that People living with HIV on Antiretroviral therapy have accelerated biological aging. [36, 37] In a recent review, it has been suggested that the characteristics of biological aging-cellular senescence, stem cell exhausation and immunoaging are also involved in maintaining periodontal homeostasis leading to increased tooth loss in subjects whose biological age at baseline is higher than their chronological age. [38] Other studies have shown that as people with HIV get older they are more likely to develop moderate to severe periodontal disease [39] and have increased tooth loss. [40] Therefore in order to maintain a functional dentition (>20 teeth present) in peole with HIV throughout their lifetime, it is important to aggressively treat periodontal disease earlier to prevent future tooth loss as they potentially undergo accelerated biological cellular aging in the periodontal complex.

Conclusion

Postmenopausal women with HIV have higher GCF RANKL levels and deterioration of the alveolar trabecular bone microarchitecture that may contribute to the observed greater tooth loss.

Limitations

The sample size of the study was small which makes it difficult to extrapolate our data to the entire PWH population. Postmenopausal status was self-reported and not confirmed by longitudinal estradial levels, so there is a chance of misclassification, especially in people under the age of 40. The race/ethnicity of recruited participants was biased and more representative of people attending a New York City HIV clinic and dental clinic than the general population.

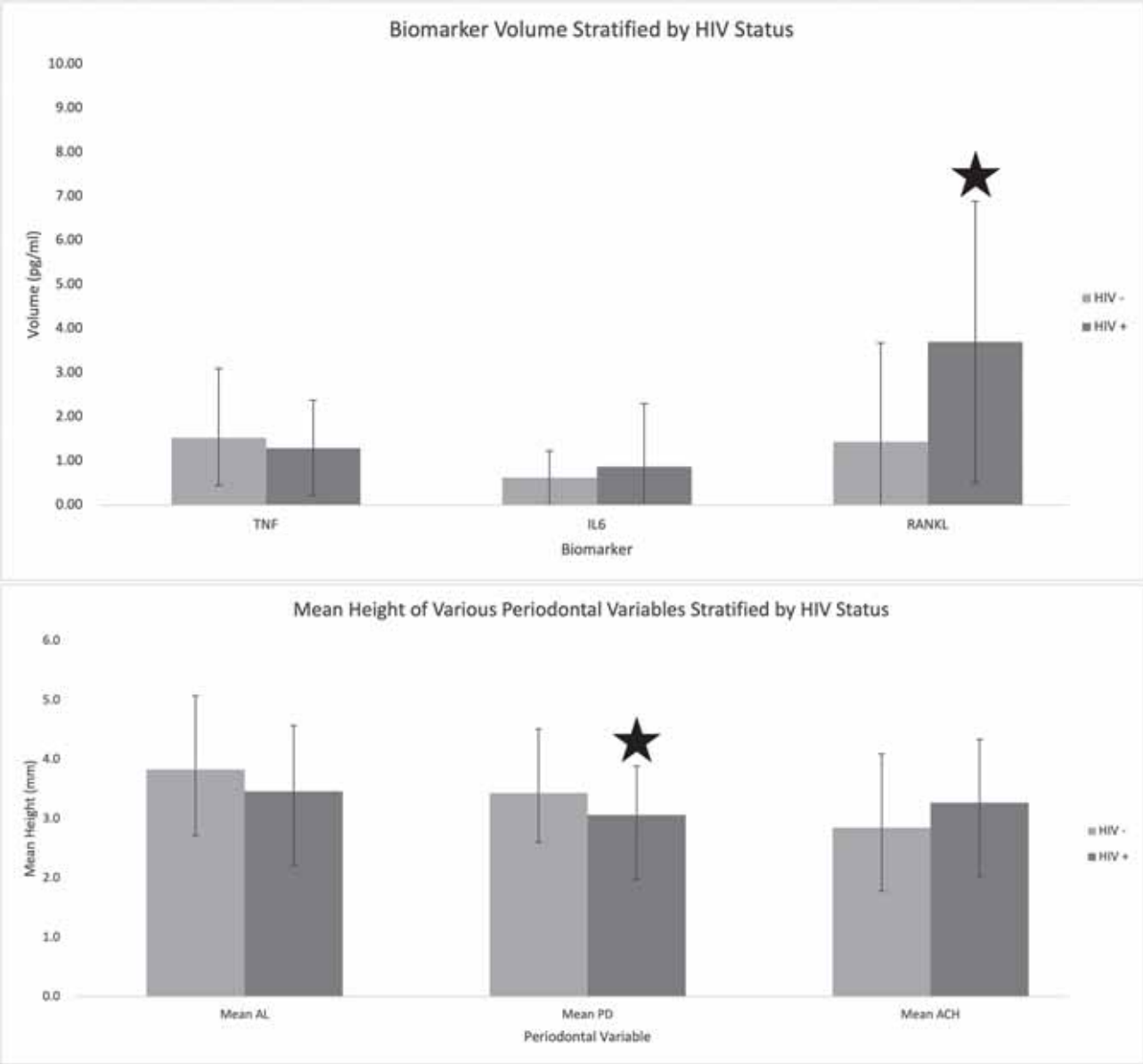

Fig. 3 Gingival crevicular fluid biomarker of bone resorption cytokine levels (TNF a, IL-6, and RANKL), and Periodontal (Atachment Loss (AL), Probing Depth (PD) and Alveolar Crestal Height (ACH)) Variables on the subcohort of post-menopausal women with and without HIV (n = 114) excluding 12 white participants and 9 participants missing smoking and/or diabetes status from the full cohort. * Siginifiant difference $p < 0.05$ between HIV + vs. HIV- negative controls

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Author contributions
SW- Contributed to conception, design, data acquisition analysis and interpretation, drafted and critically revised the manuscript, T.F.- Contributed to data acquisition and interpretation, drafted and critically revised the manuscript, K.K- Contributed to data acquisition and critically revised the manuscript, S.M-Contributed to data acquisition and interpretation and critically revised the manuscript, M.L.- Contributed to data acquisition and interpretation and critically revised the manuscript, A.C.- Contributed to data acquisition and critically revised the manuscript, J.S.-Contributed to data acquisition and critically revised the manuscript, B.B.- Contributed to data analysis and critically revised the manuscript, E.L- Contributed to conception, design, and critically revised the manuscript,J.G. - Contributed to conception, design, and critically revised the manuscript, R.D.-Contributed to data analysis and critically revised the manuscript and M.Y.- Contributed to conception, design, data acquisition analysis and interpretation, and critically revised the manuscript. All authors gave their final approval and agree to be accountable for all aspects of the work.

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Data availability
The datasets generated and/or analysed during the current study are not publicly available due to protected health information but de-identified data are available from the corresponding author on reasonable request.

Declarations

Ethical approval
This study was approved by the Columbia University Irving Medical Center Institutional Review Board (IRB-AAA5233) and was carried out in accordance with relevant guidelines. Written informed consent was obtained from all study participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Wearing dentures may slow cognitive decline

Denture use may protect against cognitive decline among older adults with tooth loss, emphasizing the potential importance of prosthodontic rehabilitation in maintaining brain health, reports a study published in *Aging Medicine*.

By — Ava Barros

Jan 14th, 2025

Denture use may protect against cognitive decline among older adults with tooth loss, emphasizing the potential importance of prosthodontic rehabilitation in maintaining brain health. This study was recently published in *Aging Medicine*.

Furthermore, the findings support the connection between oral health and brain aging, the authors wrote.

"We found that denture use was associated with better cognitive function at baseline and a slower rate of cognitive decline over time among dentate participants," wrote the authors, led by Xiang Qi of the New York University Rory Meyers College of Nursing (*Aging Med*, December 23, 2024).

Dementia is influenced by modifiable factors such as tooth loss and impaired mastication that are linked to cognitive impairment and reduced brain activity. This study examined the relationship between denture use and cognitive health among Chinese older adults, they wrote.

The 10-year cohort study analyzed data from 27,708 adults age 65 and older in the Chinese Longitudinal Healthy Longevity Survey from 2008 to 2018, assessing cognitive function using the Mini-Mental State Examination (MMSE). The MMSE evaluated six cognitive domains, including orientation, registration, attention, language, memory, and visuospatial ability.

Using linear mixed-effect models, the relationship between denture use, baseline cognitive function, and cognitive decline, adjusting for sociodemographic, behavioral, and health factors, was examined. Subgroup analyses explored variations in associations among dentate individuals with differing tooth loss levels, they wrote.

Dentate participants with dentures had better baseline cognitive function (β = 1.032; 95% confidence interval [CI], 0.813 to 1.251; $p < 0.001$) and a slower annual cognitive decline (β = 0.127; 95% CI, 0.047 to 0.206; $p < 0.01$) compared to non-denture users.

Among edentulous participants, denture use was linked to higher baseline cognitive function (β = 3.063; 95% CI, 2.703-3.423; $p < 0.001$) but showed no significant association with cognitive decline rate (β = 0.011; 95% CI, -0.082 to 0.105; $p = 0.818$). The findings were consistent across dentate subgroups with varying levels of tooth loss, they wrote.

The study, however, had limitations. Using interview questionnaires to assess dental status, health behaviors, and health status may have introduced recall bias, the authors added.

"The findings of our study indicate that denture use is associated with better baseline cognitive function and a slower rate of cognitive decline among Chinese older adults with partial tooth loss," they concluded.

Oral health: integral component of overall health and important determinant of ageing

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Considerable research has focused on the role of oral health in overall health and the ageing process.[1] Oral health and periodontal disease have been linked with conditions such as Alzheimer's disease, cancer, cardiovascular diseases, diabetes, inflammatory bowel disease, osteoporosis, pneumonia, and rheumatoid arthritis.[2] Additionally, the association between poor oral health, periodontal disease, and increased mortality and frailty is well documented.[3] Furthermore, poor oral health or oral frailty is associated with the development of physical frailty, physical disability, and systemic comorbidities.[4]

Fewer teeth or severe tooth loss are key factors in the oral frailty index.[3,4] Owing to the differences in health-care systems,[5] socioeconomic status, and societal values across regions, the prevalence and distribution of tooth loss or poor oral health conditions can differ across countries and continents.[6] Possible mechanisms linking poor oral health to an increased mortality risk include exacerbated immune responses or infection due to oral microbial dysbiosis, unresolved chronic inflammation, nutritional deficiencies, physical frailty, difficulties in social interactions that might make seeking oral care more challenging,[7] and disruptions to mental wellbeing.[1,2] A new perspective advocating for a systems approach to ageing biology has been suggested—namely, the integrative emergence of hierarchical organisation, network dynamics, and resilience.[8] The relationship between oral health and the development of frailty or functional disability, particularly in ageing populations, requires further study. Four categories of oral frailty indicators have been described and associated with systemic outcomes: oral health status deterioration; decline in oral motor skills; chewing, swallowing, and saliva disorders; and oral pain.[3] However, high-quality research examining these factors in relation to functional disability and mortality within the same study cohort is scarce.[1]

The study by T Abe[1] in *The Lancet Healthy Longevity* addresses this gap with a thorough investigation into the role of four key oral health factors—namely, masticatory function, oral hygiene, number of remaining teeth, and periodontal status—in predicting functional disability and mortality among older Japanese individuals. Their findings indicate that various aspects of oral health, including the number of remaining teeth, objective and subjective masticatory performance, periodontal disease status, functional dysphagia, tongue mobility, articulation disorder, oral hygiene, decayed teeth, and denture inadaptation, greatly influence the onset of functional disability and the overall risk of mortality. Notably, objective masticatory performance emerged as a crucial factor for survival, suggesting that chewing ability plays an important role in maintaining overall health in older adults. A key strength of this study is its use of robust methods, including the use of large sample sizes, survival analyses, and the population-attributable fraction to quantify the effect of various oral health factors on major health outcomes within the same cohort. Importantly, such parallel and systematic comparisons of potential effects and risks of various oral health factors on functional disability and mortality have not been performed before.[1]

Reports based on data from the US National Health and Nutrition Examination Survey support these findings by indicating that participants with fewer remaining teeth had lower femoral head bone mineral density, increased risks of hip fracture, and higher disease-specific and all-cause mortality.[9] Moreover, National Health and Nutrition Examination Survey participants (age range 20–85 years) with unsatisfactory oral health behaviours and conditions (such as infrequent dental visits, infrequent flossing habits, and subjective poor oral health) also faced higher risks of all-cause mortality, independent of their baseline health comorbidities and the number of remaining teeth.[10] Female health-care providers older than 70 years in the Women's Health Study also showed a strong correlation between self-rated poor oral health and heightened risks of systemic conditions, such as cardiovascular diseases, stroke, diabetes, and osteoporosis.[10]

The observational nature of these reports limits the ability to establish causality.[1,3,10] Although noteworthy, the findings might not be generalisable beyond the specific study populations, highlighting the need for further research, particularly in diverse populations and through interventional studies. Nevertheless, the implications for clinical practice are substantial, as these studies suggest that comprehensive oral health assessments should

become a routine part of overall health care. Interventions that improve oral function, maintaining adequate dentition and treating periodontal disease, could be beneficial in preventing or delaying the onset of frailty. By focusing on preventive measures and treatments that enhance masticatory performance and address other key oral health issues in young and middle-aged adults, health-care providers could reduce the risk of disability and mortality in ageing populations.

In summary, oral health should be considered an integral component of the overall health-care system and an important factor in assessing ageing. Using clinical tooth loss data, objective masticatory function, or subjective self-assessments of oral health in large-scale studies might help to understand the connections between oral and systemic health and provide deeper insights into oral frailty. Oral health conditions could be potential risk factors for physical frailty or functional disability. The importance of oral health for overall wellbeing and longevity should be emphasised.

I declare no competing interests.

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