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# Study on the link between gum disease and heart problems using artificial intelligence

**Submission date**
04/09/2025

**Recruitment status**
No longer recruiting

**Registration date**
23/09/2025

**Overall study status**
Completed

**Last Edited**
09/09/2025

**Condition category**
Other

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[ ] Record updated in last year

**Plain English summary of protocol**

Background and study aims
Many people have both gum disease and heart problems, but we don't fully understand how these conditions affect each other. This study uses artificial intelligence (computer technology) to find patterns that doctors might miss, helping us better understand who is at risk. This research looks at how gum disease and heart disease might work together to affect blood vessel health. We measure a substance in the blood called ADMA, which tells us how healthy blood vessels are. High ADMA levels mean blood vessels aren't working properly, which can lead to heart problems.

Who can participate?
Adults aged 18-75 years, divided into four groups:
1. People with healthy gums and heart
2. People with only gum disease
3. People with only heart disease
4. People with both conditions

What does the study involve?
Participants come for ONE visit (2-3 hours) where we:
1. Check your teeth and gums
2. Take dental X-rays
3. Collect a small blood sample (two teaspoons)
4. Collect saliva
5. Check blood pressure
6. Ask about medical history
This is an observational study - we only measure and analyze, we don't provide any treatment.

What are the possible benefits and risks of participating?
The study will:
1. Help identify people at higher risk for heart problems
2. Show if saliva tests could replace blood tests
3. Create a simple scoring system for dentists to spot at-risk patients
4. Improve understanding of how gum disease affects heart health

The procedures are the same as routine dental and medical check-ups. The only discomforts are minor - like having your gums examined or giving a blood sample. No payment is provided, but you receive a free comprehensive dental examination and information about your cardiovascular risk markers. All information is kept confidential. You get a study number instead of using your name. Only the research team can access your data, which is stored securely following privacy laws. Results will be published in medical journals, but no participant will be identifiable.

Where is the study run from?
IRCCS Istituto Tumori "Giovanni Paolo II" (Italy)

When is the study starting and how long is it expected to run for?
July 2024 to April 2025

Who is funding the study?
IRCCS Istituto Tumori "Giovanni Paolo II" (Italy)

Who is the main contact?
Prof. Francesco Inchingolo, francesco.inchingolo@uniba.it

# Contact information

### Type(s)
Public, Scientific, Principal investigator

### Contact name
Prof Francesco Inchingolo

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# Additional identifiers

### Protocol serial number
1737/CEL, ADMA-PERIO-CVD-2024

# Study information

### Scientific Title
Machine learning analysis of asymmetric dimethylarginine (ADMA) levels in patients with periodontitis and cardiovascular disease: a cross-sectional study

### Acronym

ADMA-PERIO-CVD

## Study objectives
1. To investigate the synergistic effects of periodontitis and cardiovascular disease on serum asymmetric dimethylarginine (ADMA) levels and to develop a machine learning algorithm capable of predicting ADMA concentrations from clinical and radiographic parameters.
2. To quantify the correlation between periodontal inflammatory burden (measured by PISA) and ADMA levels in patients with and without cardiovascular disease.
3. To identify differential ADMA regulatory pathways between cardiovascular and non-cardiovascular cohorts through biomarker pattern analysis.
4. To validate the accuracy of artificial intelligence-based ADMA prediction compared to conventional clinical assessment.
5. To develop a simplified clinical risk score (Periodontal-ADMA Risk Score [PARS]) for identifying patients at risk of elevated ADMA levels.
6. To evaluate the relationship between salivary and serum ADMA levels as a potential non-invasive diagnostic approach.
7. To assess the association between radiographic periodontal parameters (bone loss patterns, furcation involvement) and systemic endothelial dysfunction markers.

## Ethics approval required
Ethics approval required

## Ethics approval(s)
Approved 15/07/2024, Comitato Etico Locale IRCCS Istituto Oncologico "Gabriella Serio" (IRCCS Istituto Tumori "Giovanni Paolo II", Bari, 1001, Italy; +39 (0)80 555 5111; comitatoetico@oncologico.bari.it), ref: 1737/CEL

## Primary study design
Observational

## Study design
Observational cross-sectional case-control study

## Study type(s)
Diagnostic

## Health condition(s) or problem(s) studied
Periodontitis, cardiovascular disease, endothelial dysfunction, asymmetric dimethylarginine (ADMA) elevation

## Interventions
This is an observational cross-sectional study with no interventions. Participants undergo a single visit including:
1. Clinical periodontal examination (probing depth, clinical attachment level, bleeding on probing, plaque index)
2. Blood sample collection for ADMA analysis via high-performance liquid chromatography (HPLC)
3. Medical history and cardiovascular assessment

Total duration: One visit (approximately 2 hours)
No follow-up required (cross-sectional design)

### Intervention Type
Other

### Primary outcome(s)
Serum ADMA levels as a biomarker of endothelial dysfunction measured using high-performance liquid chromatography (HPLC) at baseline (single assessment)

### Key secondary outcome(s)
1. Periodontal parameters (probing depth, clinical attachment level, bleeding on probing, plaque index) measured using UNC-15 probe at baseline (single assessment)
2. Inflammatory markers (hs-CRP, IL-6, TNF-α) measured using ELISA at baseline (single assessment)
3. Machine learning algorithm accuracy for ADMA prediction based on clinical parameters, assessed at study completion

### Completion date
30/04/2025

## Eligibility

### Key inclusion criteria
1. Age 18-75 years
2. Minimum 16 natural teeth present
3. For periodontitis groups:
3.1. ≥40% sites with CAL ≥2mm and PD ≥4mm
3.2. Radiographic evidence of bone loss
3.3. ≥40% sites with bleeding on probing
4. For CVD groups:
4.1. ≥50% stenosis of at least one coronary artery (angiographically verified)
4.2. OR history of documented coronary intervention
5. For healthy controls:
5.1. No systemic disease
5.2. ≤10% sites with bleeding on probing
5.3. No sites with PD ≥4 mm
6. Ability to provide informed consent
7. Willing to complete all study procedures

### Participant type(s)
Healthy volunteer, Patient

### Healthy volunteers allowed
No

### Age group
Adult

### Lower age limit
18 Years

### Upper age limit

75 Years

### Sex
All

### Total final enrolment
140

### Key exclusion criteria
1. Antibiotic or anti-inflammatory medication within 3 months prior to enrollment
2. Pregnancy or lactation
3. Uncontrolled diabetes (HbA1c >7.5%)
4. Current smoking >10 cigarettes/day
5. Systemic conditions affecting periodontal health (e.g., immunosuppression)
6. Active cancer treatment
7. Chronic kidney disease (eGFR <30 ml/min/1.73m²)
8. Periodontal treatment within 6 months
9. Unable to provide informed consent
10. Severe cognitive impairment
11. Active substance abuse
12. Participation in other clinical studies within 30 days

### Date of first enrolment
01/09/2024

### Date of final enrolment
28/02/2025

## Locations

### Countries of recruitment
Italy

### Study participating centre
**AOU Consorziale Policlinico di Bari - Unità Operativa Malattie Odontostomatologiche**
Piazza Giulio Cesare, 11
Bari
Italy
70124

## Sponsor information

### Organisation
IRCCS Istituto Tumori "Giovanni Paolo II"

# Funder(s)

**Funder type**
Hospital/treatment centre

**Funder Name**
IRCCS Istituto Tumori "Giovanni Paolo II"

# Results and Publications

**Individual participant data (IPD) sharing plan**
Will IPD be shared?
Yes - De-identified participant data will be made available

What data will be shared?
De-identified individual participant dataset
Data dictionary defining all variables
Statistical analysis plan
Analytical code (R/Python scripts)

When will data become available?
6 months after primary publication (estimated April 2026)

For how long?
5 years from publication date

With whom will data be shared?
Researchers with methodologically sound proposals
For meta-analyses and systematic reviews
For validation of AI algorithms
Upon reasonable request with appropriate ethics approval

How to access?
Submit proposal to: francesco.inchingolo@uniba.it
Proposal must include:

Research question
Analysis plan
Ethics approval (if applicable)

Data use agreement must be signed
Data provided via secure transfer

Repository:
Primary: Institutional repository (Policlinico Bari)
Secondary: Consider deposit in Zenodo or Figshare for DOI assignment
Clinical data: May submit to BioLINCC or similar clinical data repository

FAIR Principles Compliance:
Findable: DOI assigned, metadata in repositories
Accessible: Clear access procedures defined
Interoperable: Standard formats (CSV, JSON)
Reusable: Clear licensing (CC-BY 4.0 for publications)

Restrictions:
No attempt to re-identify participants
No commercial use without separate agreement
Acknowledgment of original study required
No data sharing that violates participant consent

Additional Dissemination:
Study summary for participants (lay language)
Press release through institutional communications
Social media dissemination (@uniba_it, @policlinicobari)
Policy brief if findings have public health implications

## IPD sharing plan summary

Stored in publicly available repository