University of Peradeniya

Using AI in determining alveolar bone loss in Dental X-rays to aid in periodontal diagnosis

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Introduction - The alveolar bone supports teeth but can deteriorate from periodontal diseases. This project develops AI algorithms to automate the evaluation of bone loss in dental radiographs, aiming to enhance diagnostic accuracy and efficiency. Collaboration with experts aims to transform periodontal disease management and improve patient outcomes.

Aim - To develop, implement, and evaluate an Artificial Intelligence (AI) algorithm capable of accurately identifying and quantifying alveolar bone loss in dental radiograph images, marking the percentage of bone loss for each affected tooth, and distinguishing between horizontal and angular patterns of bone loss.

The tooth consists of two primary parts: the crown and the root. The **orange-colored region** in the image known as the **alveolar bone**, which is the main focus of this research.
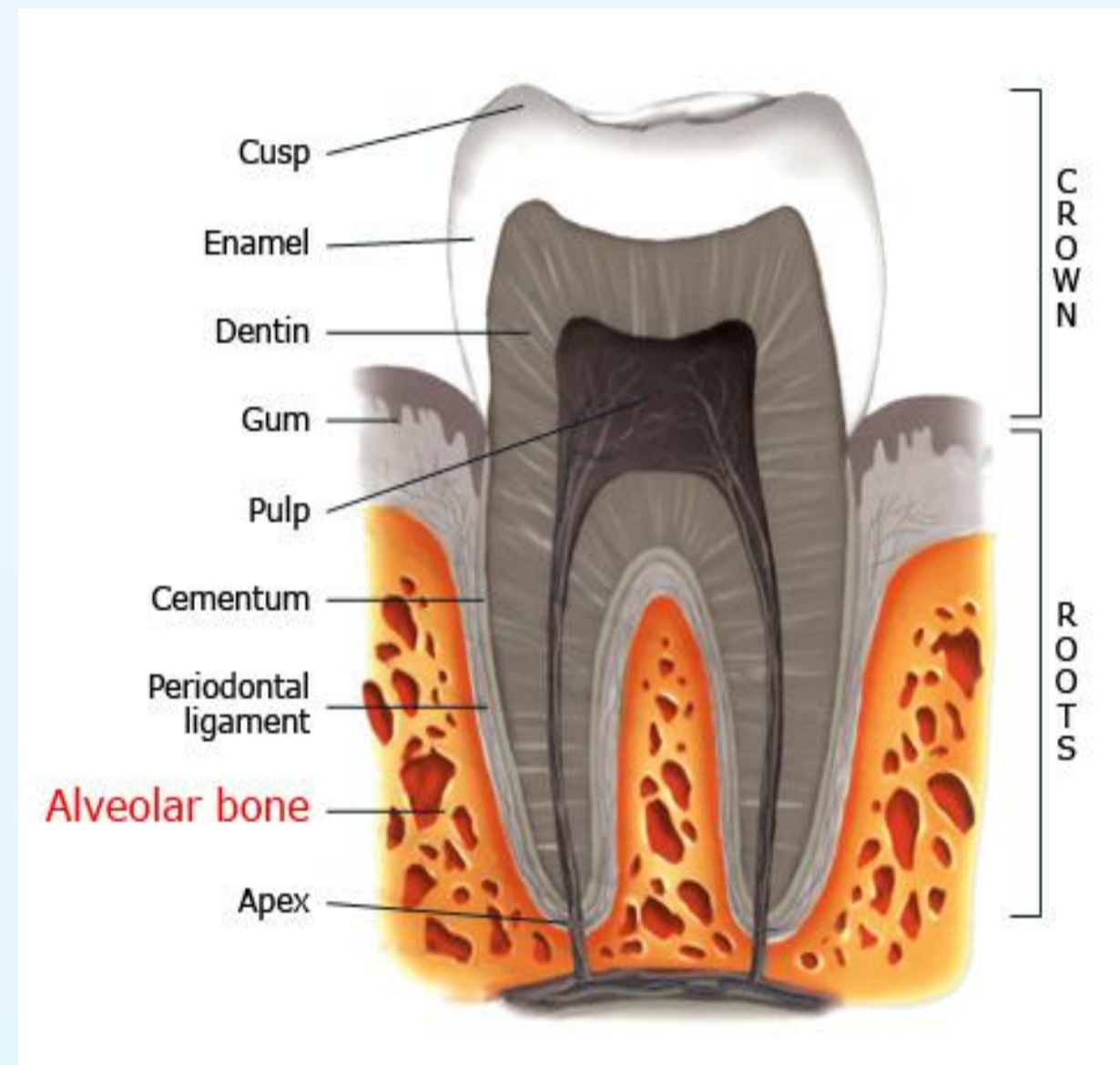
### What is Alveolar bone loss?
- **Reduction** in the bone that supports and surrounds teeth in the jaw.
- This loss can occur due to various factors, such **as periodontal (gum) disease** or other dental issues.
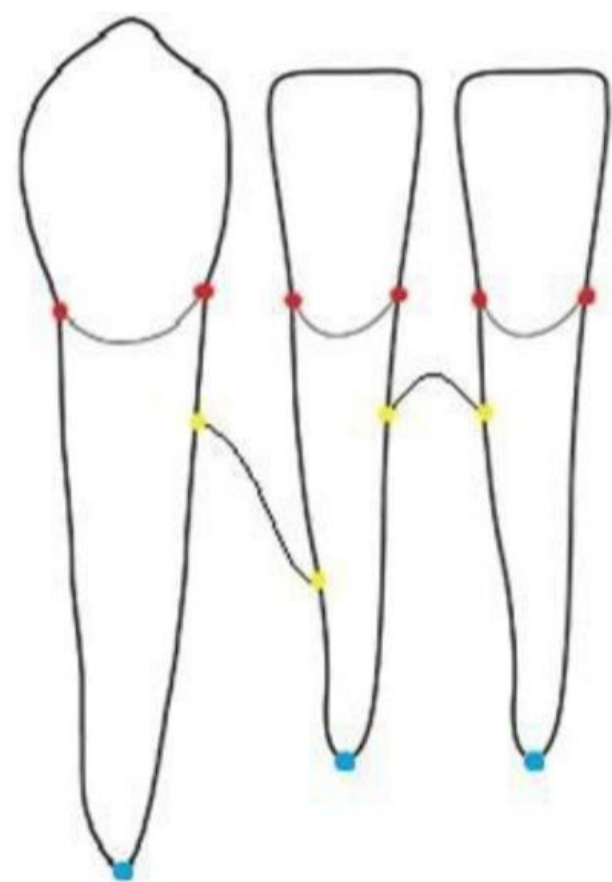

Importance of the alveolar bone
- Dynamic Remodeling
- Periodontal Fiber Attachment
- Dissipation of Forces
- Tooth Support

Importance of Automating Bone Loss Detection
- Improved diagnostic accuracy
- Monitoring and Treatment Planning
- Early stage identification
- Helps with resource allocation
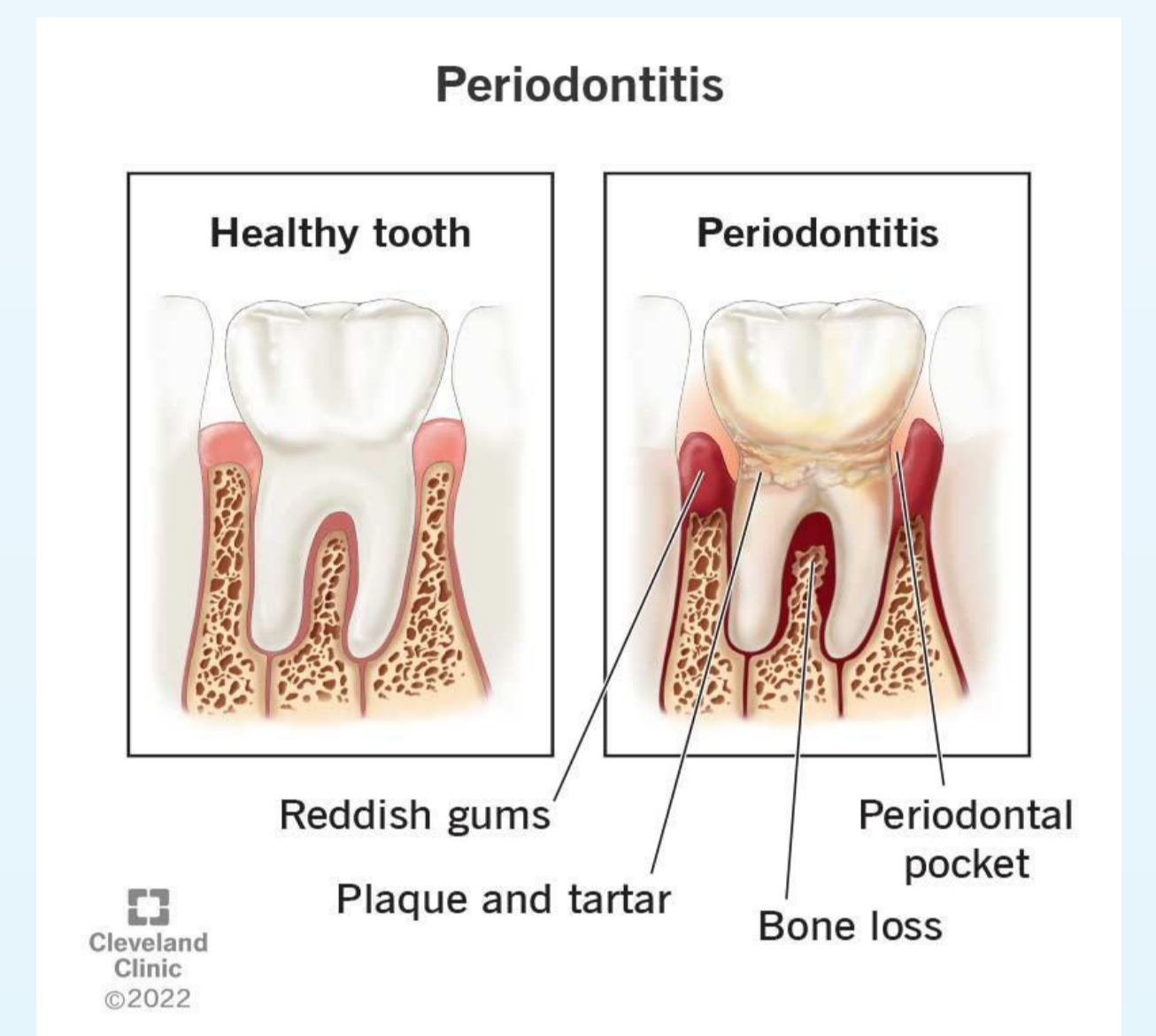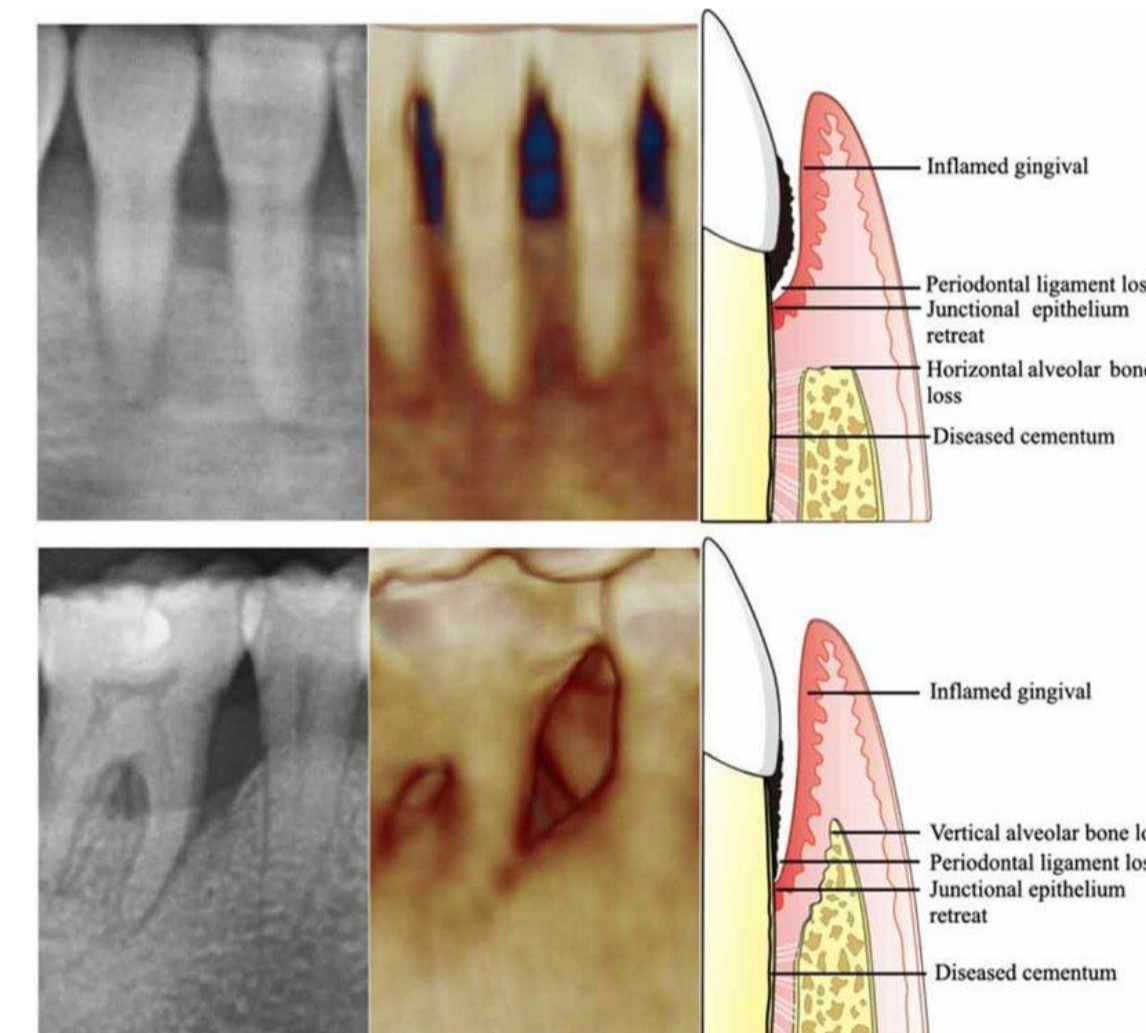

Bone Loss Magnitude

$$Bone\ Loss\ Percentage = \frac{Distance\ from\ CEJ\ to\ AEAC}{Distance\ from\ CEJ\ to\ APEX} \times 100\%$$

- CEJ
- AEAC
- APEX

This measurement is essential in diagnosing and planning treatment for periodontal disease. The magnitude is assessed by comparing the current bone level to the original bone level around the teeth.

Bone Loss Pattern

1. **Horizontal**
   Horizontal alveolar bone loss is the pattern of bone loss more commonly seen in periodontitis.

2. **Vertical**
   Can be identified as a deformity in the alveolus extending apically along the root of the affected tooth from the alveolar crest.

Dataset Information

Ethical approval - The ethical clearance was obtained from the ethics review committee, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka (ERC/FDS/2023/45).
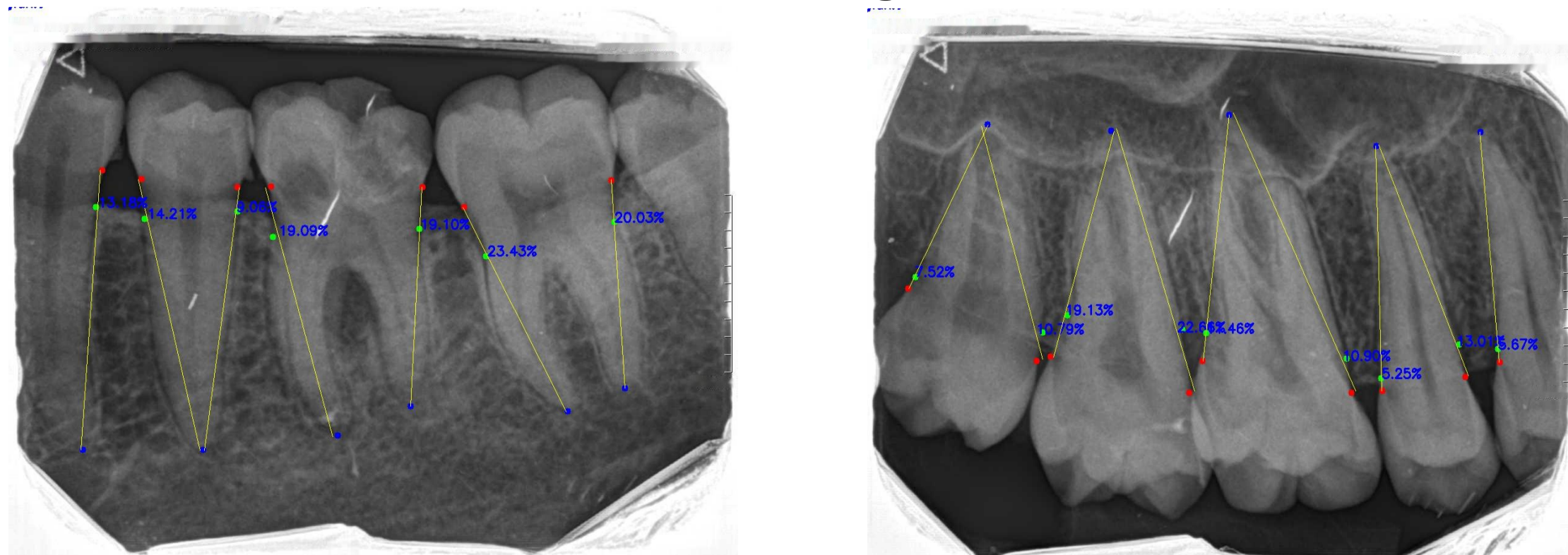
Image Collection -

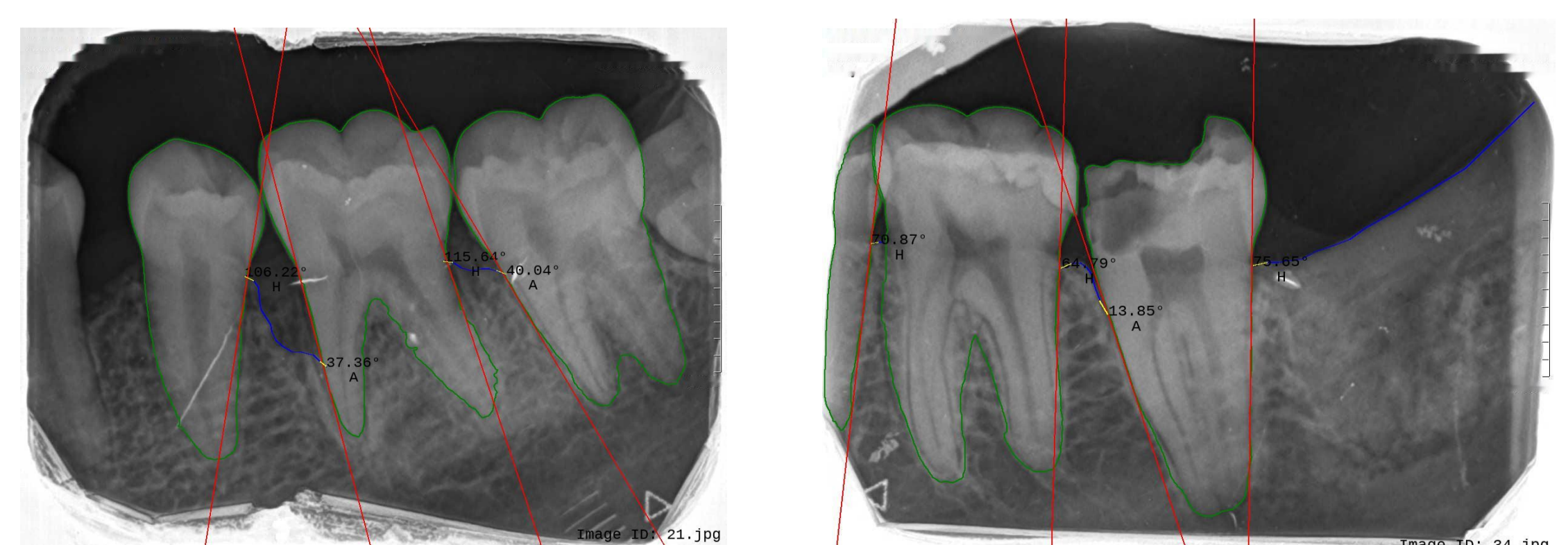| Collected by	Dental surgeons in the clinic
Image conditions	IOPA radiograph
Image labeled, categorized, and annotated by	Teeth, Bone line and the CEJ, APEX, and teeth and bone line intersection points.

Anonymizing radiographs - Anonymized images using a local AI algorithm and renamed all images.

Implementation

Bone Loss Magnitude

Bone Loss Pattern

Contact details

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