Journal of Dentistry and Oral Epidemiology

(ISSN: 2770-0453) *Open Access*

Technical Proposal Volume 6 – Issue 1

A Simplified Tooth Identification System for Artificial Intelligence and Speech-Based Dental Documentation Systems

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Received date: 23 March, 2026 | **Accepted date:** 16 June, 2026 | **Published date:** 22 June, 2026

Citation: Praneeth Kumar D and Mounika SVM. (2026) A Simplified Tooth Identification System for Artificial Intelligence and Speech-Based Dental Documentation Systems 6(1): doi https://doi.org/10.54289/JDOE2600104

Abstract

Accurate identification of teeth is essential for clinical communication, documentation, treatment planning, and digital data management in dentistry. Currently used tooth numbering systems such as the FDI World Dental Federation notation, Universal Numbering System, and Palmer Notation Method were developed primarily for manual charting and traditional clinical communication. However, with the increasing adoption of artificial intelligence, digital dental records, and speech-to-text clinical documentation systems, these traditional methods may present limitations in machine readability and voice recognition accuracy.

This paper proposes a simplified and structured tooth identification method designed specifically for potential compatibility with artificial intelligence platforms, digital dental software, and speech-based clinical documentation. The proposed system emphasizes logical anatomical orientation, reduced ambiguity, and compatibility with modern digital technologies. As a conceptual framework, the system is intended to stimulate discussion regarding future technology-oriented dental notation methods and requires validation through clinical and software-based studies.

Abbreviations: ASR: Automatic Speech Recognition, JST: Jaw-Side-Tooth

Introduction

The FDI two-digit system is widely used internationally, while the Universal numbering system is predominantly used in the United States **[1,2]**. The Palmer notation method is also commonly used in orthodontics and pediatric dentistry **[3]**. While the FDI notation system has long functioned as a reliable global standard, the evolution of digital dentistry and speech-to-text technologies has prompted consideration of more intuitive and error-resistant approaches.

Traditional systems such as the Universal Numbering System and the Zsigmondy-Palmer notation have each contributed significantly to dental communication—offering simplicity

and quadrant-based visualization respectively. However, both present limitations when integrated with AI-driven platforms, particularly in speech recognition and rapid data entry, where similar-sounding numbers or symbols can lead to ambiguity. Over the years, several tooth numbering systems have been developed and adopted globally.

Although these systems are effective for clinical communication, they were designed in an era before digital health records, artificial intelligence diagnostics, and voice-based medical documentation.

Dentistry is transforming thanks to AI, which is improving diagnosis accuracy, personalizing treatment regimens, and organizing data more efficiently **[4,5]**.

Dental charting systems are fundamental to clinical dentistry. They enable practitioners to identify teeth accurately during diagnosis, treatment planning, and record maintenance.

As dentistry enters the era of digital dentistry, artificial intelligence, and automated charting, new challenges arise:

- Difficulty in speech recognition due to similar sounding numbers
- Lack of standardized compatibility with AI-based imaging systems
- Complexity in digital database indexing
- Variability across international systems

Automatic speech recognition (ASR) has emerged as a transformative technology in modern healthcare, enabling clinicians to convert spoken language into written text with increasing efficiency and accuracy. With the growing demand for detailed and timely clinical documentation, particularly in specialties such as orthodontics where records are extensive and terminology is highly specialized, ASR offers a promising solution to reduce administrative burden and improve workflow **[6]**.

Speech-to-text systems used in modern clinical environments require clear phonetic differentiation and structured identifiers. Similarly, artificial intelligence models used for radiographic interpretation and automated charting benefit from logically structured and anatomically meaningful data labeling systems.

As technology evolves, AI integration in healthcare is expected to expand, leading to further improvements in patient care and outcomes. This demonstrates the potential to revolutionize healthcare delivery and improve patient outcomes **[7]**.

Therefore, there is a need for a simplified, AI-compatible tooth identification system that can integrate effectively with modern digital dentistry technologies. This proposed revision aims to bridge that gap by introducing a clearer, more distinguishable format that minimizes confusion between teeth with similar numerical representations.

Proposed Tooth Identification System

The proposed system follows **a three-component** structure:

Jaw – Side – Tooth Number

Format:

J-S-T

Where:

J = Jaw

S = Side

T = Tooth position from midline

Jaw Identification

Code	Description
U	Upper jaw (Maxilla)
L	Lower jaw (Mandible)

Side Identification

Code	Description
R	Right side
L	Left side

Tooth Position

Teeth are numbered from the midline outward, which corresponds with natural anatomical orientation.

Number Tooth

1. Central incisor
2. Lateral incisor
3. Canine
4. First premolar
5. Second premolar
6. First molar
7. Second molar
8. Third molar

Examples

Tooth	Code
Maxillary right central incisor	U-R-1
Maxillary right first molar	U-R-6
Maxillary left canine	U-L-3

Mandibular left second premolar	L-L-5
Mandibular right third molar	L-R-8

Primary Dentition

For primary teeth, the prefix P is added before the code.

Examples:

Tooth	Code
Primary maxillary right central incisor	P-U-R-1
Primary mandibular left second molar	P-L-L-5

Advantages for Artificial Intelligence Applications

Artificial intelligence systems used in dentistry rely heavily on structured and labeled datasets. The proposed tooth identification system offers several potential advantages for machine learning environments, although these proposed benefits require validation through future studies.

1. Structured Data Architecture

The three-component system provides hierarchical labeling, which allows easier indexing in databases and training datasets.

Example:

U-R-6

Immediately identifies:

- Jaw
- Side
- Tooth type

This may improve dataset organization for AI models used in radiograph analysis and automated charting by providing a structured and hierarchical labeling format.

2. Improved Speech Recognition Compatibility

Speech-to-text documentation is becoming increasingly common in medical practice.

Traditional systems such as:

"tooth twenty-six"

May be misinterpreted by speech recognition software.

However, the proposed format:

"U R six"

May provide clearer phonetic separation and potentially reduce recognition errors; however, formal validation studies are required to confirm this benefit.

3. International Standardization Potential

Because the system uses simple alphabetic and numeric identifiers, it is easily understood across different languages and educational backgrounds.

This could potentially facilitate global digital standardization, particularly in tele-dentistry and cross-border dental consultations.

4. Compatibility With Dental Software

- Modern dental practice management software and AI diagnostic tools require structured data input. The proposed system may be readily integrated with:
- Electronic dental records
- AI radiograph interpretation tools
- Voice-based clinical documentation
- Dental education software

Discussion

The evolution of dentistry toward digital workflows necessitates reconsideration of traditional documentation systems. While existing tooth numbering systems remain clinically effective, they were not designed with modern digital technologies in mind. A dot separator between two digits of the FDI system was proposed to prevent misinterpretation between FDI and Universal Numbering systems especially in spoken communication. This proposal addresses confusion that arises particularly in global dental institutions where clinicians trained under both systems work together.

The authors point out a critical speech problem: FDI notation "17" is pronounced "one-seven," but in written form it may be read as "seventeen" — which in the Universal Numbering system refers to a completely different tooth (lower left third molar). This ambiguity directly compromises speech-to-text dental documentation accuracy **[8]**.

AI is a promising and growing technology in the field of dentistry, and it can reduce dental practitioners workload and improve precision in diagnosis, decision making, treatment planning, and disease prognosis. In reality, AI is just a tool that may be programmed to perform exceptionally well. Its successful integration necessitates a safe and controlled integration process, which, in turn, requires dental and continuing education training. AI also plays a critical role in incorporating aspects of these technologies. As various dental disciplines develop AI systems, their future in the healthcare system is promising and offers a significant aid to oral health professionals **[7]**.

Artificial intelligence applications in dentistry are expanding rapidly in areas such as:

- radiographic interpretation
- caries detection
- orthodontic planning
- implant planning
- automated dental charting

For such systems, consistent and logical data labeling is essential.

The proposed tooth identification system emphasizes anatomical clarity, phonetic simplicity, and digital compatibility. Although it does not aim to replace established systems immediately, it may serve as a conceptual digital-oriented alternative for emerging technologies. The potential benefits described in this manuscript remain theoretical and require further validation before conclusions regarding superiority or practical effectiveness can be drawn.

Further research is required to evaluate the feasibility and effectiveness of this system in:

- speech recognition accuracy
- dental software integration
- AI dataset labeling
- clinical usability among practitioners

Future validation studies may compare the proposed JST system with existing tooth numbering methods in terms of transcription accuracy, clinician acceptance, learning efficiency, and compatibility with digital dental record systems. Pilot investigations involving AI-assisted image annotation and automated charting platforms may further determine whether the structured format offers measurable advantages in digital workflows.

ASR (Automatic Speech Recognition) systems can introduce clinically important errors, particularly in the transcription of tooth-related terminology. Misinterpretation of tooth numbers or similar-sounding dental terms may lead to incorrect clinical records, which can affect diagnosis and treatment planning in orthodontics. Even with good overall accuracy, these domain-specific errors remain a concern, highlighting the need for careful human verification of transcribed records (O'Kane et al., 2025) **[6]**.

Limitations

The present study introduces a conceptual tooth identification framework and does not include experimental, clinical, or software-based validation. The proposed Jaw-Side-Tooth (JST) system has not yet been evaluated for speech-recognition accuracy, clinician usability, interoperability with existing dental software, or performance in artificial intelligence applications.

Furthermore, the widespread adoption of any new notation system may present challenges because established systems such as the FDI, Universal, and Palmer methods are deeply integrated into dental education, clinical practice, and electronic health record systems worldwide.

Therefore, the advantages discussed in this manuscript should be considered theoretical and hypothesis-generating. Future studies involving dental practitioners, students, speech-recognition platforms, and AI-based dental software are necessary to determine the feasibility, reliability, and practical utility of the proposed system.

Conclusion

The proposed Jaw-Side-Tooth (JST) system represents a conceptual approach to tooth identification designed with emerging digital dentistry applications in mind. By emphasizing anatomical orientation, phonetic clarity, and structured labeling, the system may offer potential advantages for speech-based documentation, electronic dental records, and artificial intelligence applications.

However, these proposed benefits remain theoretical and have not yet been validated through experimental, clinical, or software-based studies. Consequently, the system should be viewed as a hypothesis-generating framework rather than a proven alternative to existing tooth notation systems.

Future research involving speech-recognition platforms, AI-assisted dental applications, software integration, and clinician usability assessments is required to evaluate the practical effectiveness and adoption potential of the proposed system.

As dentistry continues to embrace digital transformation, the JST system may serve as a foundation for exploring technology-oriented tooth identification methods that complement existing standards while supporting emerging

digital workflows.

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