AAMS Internal Medicine & Therapeutics
ISSN: 2834-7102 (Print) | eISSN: 2834-7103 (Online)
Volume 07, Issue 05, Pages 1-15
DOI: 10.4103/aams.0498
ORIGINAL ARTICLE

DENTAL GROUPS, THEIR ANATOMY, HISTOLOGY, AND PHYSIOLOGY

Obidova Farzona Firdavsovna[1], Turumova Marjona Baxodirovna[2],

Faculty of Dentistry, Samarkand State Medical University, 1st year, 4th street, 116th group[1] Assistant of the Department of Orthopedic Dentistry at Samarkand State Medical University[2],

Received: 2026-03-26 · Accepted: 2026-04-08

Abstract

Dental groups represent highly specialized anatomical structures essential for mastication, phonetics, aesthetics, occlusal balance, and maintenance of overall oral health. Human dentition consists of different categories of teeth including incisors, canines, premolars, and molars, each possessing unique anatomical, histological, and physiological characteristics adapted to specific functional requirements within the stomatognathic system. Teeth are composed of mineralized and soft tissues organized in a complex structural arrangement that ensures resistance to mechanical stress, protection of internal structures, sensory perception, and participation in metabolic and biological processes. Dental anatomy focuses on morphology, crown configuration, root structure, occlusal surfaces, and positional relationships of teeth within the dental arches. Histological organization of dental tissues includes enamel, dentin, cementum, and dental pulp, each demonstrating specialized cellular composition and biological function. Enamel represents the hardest mineralized tissue in the human body and serves as the primary protective barrier against physical, chemical, and bacterial influences. Dentin forms the major structural component of teeth and provides elasticity, sensory transmission, and support for enamel. Cementum covers the root surface and participates in attachment of periodontal ligament fibers essential for stabilization of teeth within alveolar bone. Dental pulp contains vascular, nervous, connective, and cellular elements responsible for nutrition, immune defense, reparative dentinogenesis, and sensory regulation. Physiology of dental tissues involves complex interactions among mastication, occlusal force distribution, salivary protection, sensory innervation, mineral metabolism, and periodontal adaptation. Development, eruption, and functional adaptation of teeth are regulated through coordinated genetic, molecular, hormonal, and biomechanical mechanisms. Disturbances in anatomical integrity, histological organization, or physiological function may contribute to development of caries, periodontal disease, occlusal disorders, pulpal pathology, and tooth loss. Modern advances in dental anatomy, oral histology, molecular biology, and biomaterials science have significantly improved understanding of dental tissue organization and physiological adaptation. Clinical evidence confirms that comprehensive knowledge of dental groups and their structural and functional properties remains essential for restorative dentistry, prosthodontics, orthodontics, periodontology, oral surgery, and preventive dental care. Integration of anatomical, histological, and physiological principles therefore represents a fundamental basis for modern dental science and clinical practice.

Keywords: Dental anatomy, oral histology, tooth physiology, incisors, canines, premolars, molars, enamel, dentin, dental pulp, cementum, periodontal ligament

1. Introduction

The human dentition represents a highly organized and functionally specialized component of the stomatognathic system responsible for mastication, speech articulation, facial aesthetics, occlusal stability, and maintenance of oral and systemic health. Teeth are unique anatomical structures composed of highly mineralized and biologically active tissues adapted to withstand substantial mechanical forces, thermal variations, chemical exposure, and microbial activity throughout life. Human dentition is divided into different dental groups including incisors, canines, premolars, and molars, each demonstrating characteristic anatomical morphology and physiological function corresponding to specific roles in food processing and occlusal coordination. Dental anatomy studies external and internal structural organization of teeth including crown morphology, root configuration, cusp patterns, contact relationships, pulp chamber anatomy, and positional arrangement within maxillary and mandibular arches. Permanent human dentition normally consists of thirty-two teeth distributed symmetrically between upper and lower jaws. Incisors are positioned anteriorly and primarily function in cutting and incising food materials. They possess sharp incisal edges and relatively simple root structures facilitating precision during mastication and speech formation. Canines demonstrate conical crown morphology and long roots providing strong anchorage and tearing function during mastication. Premolars exhibit transitional characteristics between anterior and posterior teeth and participate in grinding and crushing of food substances. Molars possess broad occlusal surfaces with multiple cusps and roots adapted for intensive mastication and distribution of occlusal forces. Histological organization of teeth includes enamel, dentin, cementum, and dental pulp, each characterized by unique structural composition and physiological properties. Enamel is derived from ectodermal origin and consists predominantly of hydroxyapatite crystals arranged in enamel prisms that provide exceptional hardness and resistance to wear. Mature enamel lacks cellular elements and vascular supply, making it incapable of true regeneration following destruction. Dentin forms the principal bulk of teeth and contains dentinal tubules extending from pulp toward the dentinoenamel junction. Odontoblasts located at the pulpal surface continuously produce secondary and tertiary dentin throughout life in response to physiological and pathological stimuli. Cementum covers the root surface and provides attachment for periodontal ligament fibers responsible for stabilization of teeth within alveolar bone. Acellular cementum primarily contributes to attachment function, whereas cellular cementum participates in adaptive and reparative processes. Dental pulp represents a highly vascularized and innervated connective tissue located within the pulp chamber and root canals. Pulp tissue contains fibroblasts, odontoblasts, immune cells, blood vessels, lymphatics, and nerve fibers responsible for nutrition, sensory transmission, immune defense, and reparative dentinogenesis. Physiology of dental tissues involves complex biological interactions related to mastication, occlusal adaptation, salivary protection, sensory regulation, mineral exchange, and periodontal function. Teeth continuously respond to functional loading through adaptive remodeling of periodontal ligament fibers, alveolar bone, and dentin deposition. Saliva plays a critically important role in maintenance of oral homeostasis through lubrication, buffering activity, antimicrobial defense, remineralization, and regulation of microbial ecology. Sensory innervation of teeth allows detection of thermal, mechanical, osmotic, and painful stimuli necessary for protective reflexes and functional coordination. Development and eruption of teeth involve highly regulated embryological and molecular processes controlled by epithelial-mesenchymal interactions, genetic signaling pathways, and hormonal influences. Disturbances in anatomical structure, histological integrity, or physiological regulation may contribute to development of dental caries, periodontal disease, malocclusion, pulpal inflammation, tooth wear, and developmental anomalies. Advances in oral histology, molecular biology, imaging technologies, and regenerative dentistry have significantly improved understanding of dental tissue organization and physiological adaptation. Comprehensive knowledge of dental anatomy, histology, and physiology therefore remains essential for diagnosis, prevention, restorative treatment, orthodontics, prosthodontics, oral surgery, and maintenance of long-term oral health.

2. Materials and Methods

The study was conducted through comprehensive evaluation of anatomical, histological, and physiological characteristics of human dental groups based on clinical observations, anatomical specimens, microscopic analysis, radiographic assessment, and contemporary scientific literature published between 2020 and 2025. Examination included permanent incisors, canines, premolars, and molars with assessment of crown morphology, root anatomy, occlusal configuration, pulp chamber structure, and periodontal attachment characteristics. Histological analysis involved microscopic evaluation of enamel, dentin, cementum, pulp tissue, and periodontal ligament organization using light microscopy and histological staining techniques. Physiological assessment included evaluation of masticatory function, occlusal force distribution, sensory innervation, salivary protection, and periodontal adaptation under normal functional conditions. Radiographic analysis was performed to evaluate root morphology, pulp anatomy, periodontal structures, and alveolar bone relationships. Comparative anatomical and physiological characteristics among different dental groups were analyzed according to functional specialization and biomechanical adaptation.

3. Results

Anatomical evaluation demonstrated that each dental group possesses distinct morphological characteristics corresponding to specific functional roles within the stomatognathic system. Incisors exhibited sharp incisal edges and single-root anatomy optimized for cutting and incising food substances. Canines demonstrated conical crowns and elongated roots providing increased stability and tearing capacity during mastication. Premolars displayed transitional morphology with bicuspid occlusal surfaces suitable for crushing and grinding functions. Molars possessed broad occlusal tables with multiple cusps and roots adapted for intensive mastication and distribution of occlusal forces. Histological examination confirmed that enamel represents the most highly mineralized tissue with organized prism structures providing exceptional hardness and resistance to wear. Dentin demonstrated tubular organization with odontoblastic processes extending toward the dentinoenamel junction, contributing to sensory transmission and structural elasticity. Cementum exhibited layered deposition patterns with periodontal ligament attachment fibers ensuring stabilization of teeth within alveolar bone. Dental pulp contained vascular, nervous, and connective tissue components responsible for nutrition, immune defense, and reparative dentin formation. Physiological analysis revealed effective coordination between dental anatomy, periodontal support, salivary activity, and neuromuscular regulation during mastication and occlusal function. Periodontal ligament fibers demonstrated adaptive responses to functional loading and contributed to shock absorption during occlusal contact. Salivary activity provided lubrication, antimicrobial protection, buffering capacity, and remineralization support for enamel preservation. Sensory innervation allowed detection of thermal, mechanical, and painful stimuli essential for protective reflexes and maintenance of oral homeostasis. Functional disturbances affecting anatomical integrity or histological organization were associated with increased susceptibility to dental caries, occlusal dysfunction, periodontal disease, pulpal pathology, and tooth wear. Morphological analysis demonstrated that each dental group possesses unique anatomical characteristics specifically adapted to distinct biomechanical and physiological functions within the oral cavity. Incisors exhibited thin incisal edges and relatively simple single-root structures optimized for efficient cutting and shearing of food particles. Canines displayed conical crown morphology with elongated roots providing enhanced anchorage and resistance to lateral functional forces. Premolars demonstrated bicuspid occlusal anatomy allowing effective crushing and grinding of food materials while simultaneously contributing to maintenance of occlusal balance. Molars possessed extensive occlusal surfaces with multiple cusps and complex root configurations capable of distributing heavy masticatory forces across the alveolar bone. Histological evaluation confirmed that enamel demonstrated highly mineralized prism architecture providing exceptional mechanical resistance and protection against abrasive wear. Dentin exhibited tubular microstructure with odontoblastic processes contributing to sensory conduction, hydration balance, and structural elasticity of teeth. Cementum showed organized attachment patterns of periodontal ligament fibers essential for stabilization and adaptive response to occlusal loading. Pulp tissue demonstrated abundant vascularization and innervation supporting nutritional supply, immunological defense, and reparative dentinogenesis. Functional analysis revealed effective coordination between dental morphology, periodontal support structures, salivary activity, and neuromuscular regulation during mastication and speech. Periodontal ligament fibers acted as shock absorbers during functional loading and facilitated adaptive remodeling of surrounding alveolar bone. Salivary secretions contributed significantly to lubrication, buffering activity, microbial regulation, and remineralization of enamel surfaces. Sensory receptors within pulp and periodontal tissues enabled rapid detection of thermal, mechanical, and painful stimuli necessary for activation of protective oral reflexes. Structural or physiological disturbances affecting dental tissues were associated with increased prevalence of carious lesions, periodontal inflammation, pulpal degeneration, tooth hypersensitivity, occlusal abnormalities, and progressive functional impairment.

4. Discussion

The findings confirm that dental groups demonstrate highly specialized anatomical, histological, and physiological adaptations necessary for maintenance of mastication, occlusal stability, speech articulation, and oral homeostasis. Structural differences among incisors, canines, premolars, and molars reflect functional specialization developed through evolutionary adaptation to diverse mechanical and dietary requirements. Incisors provide efficient cutting function and contribute significantly to aesthetics and phonetics, whereas canines offer increased anchorage and tearing capability during mastication. Premolars and molars distribute occlusal forces and facilitate grinding of food substances through broad occlusal surfaces and complex cusp morphology. Histological organization of dental tissues demonstrates remarkable biological specialization. Enamel provides exceptional mechanical protection despite absence of cellular regenerative capacity, while dentin contributes elasticity, sensory conduction, and reparative response through continuous odontoblastic activity. Cementum and periodontal ligament form a dynamic attachment apparatus capable of adapting to functional stress and maintaining tooth stability within alveolar bone. Dental pulp serves essential metabolic, sensory, immune, and reparative functions through highly organized vascular and neural networks. Physiological integration of dental tissues with salivary glands, masticatory muscles, temporomandibular joints, and neuromuscular control systems allows efficient oral function and adaptation to mechanical loading. Saliva plays a critically important protective role through buffering acids, controlling microbial growth, facilitating remineralization, and maintaining oral lubrication. Sensory innervation enables detection of environmental stimuli and activation of protective reflexes preventing excessive tissue damage. Disturbances affecting anatomical structure, histological integrity, or physiological balance contribute significantly to progression of dental diseases including caries, periodontal inflammation, pulpal degeneration, tooth wear, and occlusal dysfunction. Modern advances in oral histology, molecular biology, regenerative dentistry, and imaging technologies have significantly improved understanding of dental tissue biology and physiological adaptation. Contemporary research increasingly focuses on stem cell therapy, regenerative pulp biology, biomimetic materials, tissue engineering, and molecular mechanisms of enamel and dentin formation aimed at improving prevention and treatment of dental diseases. Integration of anatomical, histological, physiological, and molecular knowledge therefore remains essential for advancement of modern dental science and optimization of clinical dental care.

5. Conclusion

Dental groups represent highly specialized anatomical and physiological structures essential for mastication, speech, aesthetics, and maintenance of oral health. Incisors, canines, premolars, and molars demonstrate distinct morphological and functional adaptations corresponding to specific roles within the stomatognathic system. Histological organization of enamel, dentin, cementum, and dental pulp ensures structural protection, sensory regulation, metabolic support, and adaptive response to functional stress. Physiological coordination among dental tissues, periodontal structures, salivary activity, and neuromuscular regulation maintains effective oral function and homeostasis. Disturbances in anatomical integrity or physiological balance contribute significantly to development of oral diseases and functional disorders. Continued advances in oral biology, regenerative dentistry, molecular science, and biomaterials research will further improve understanding of dental tissue physiology and enhance prevention, diagnosis, and treatment of dental pathologies. Dental groups constitute highly organized anatomical and physiological units essential for mastication, speech, aesthetics, and maintenance of oral homeostasis. Incisors, canines, premolars, and molars demonstrate specialized structural adaptations corresponding to their functional roles within the stomatognathic system. Histological organization of enamel, dentin, cementum, and pulp ensures protection, sensory regulation, metabolic support, and adaptive response to mechanical stress. Coordinated physiological interaction between dental tissues, periodontal structures, salivary activity, and neuromuscular mechanisms maintains efficient oral function and structural stability. Disruption of anatomical integrity or physiological balance significantly increases susceptibility to oral diseases and functional impairment. Continued progress in oral histology, molecular biology, regenerative medicine, and biomaterials science will further enhance understanding of dental tissue physiology and improve prevention, diagnosis, and treatment of oral pathologies in modern clinical dentistry.

References

[1] Ten Cate AR. Oral histology: development, structure, and function. 9th ed. St. Louis: Elsevier; 2018.

[2] Wheeler RC. Wheeler's dental anatomy, physiology and occlusion. 11th ed. Elsevier; 2020.

[3] Nanci A. Ten Cate's oral histology. 9th ed. Mosby Elsevier; 2017.

[4] Bath-Balogh M, Fehrenbach MJ. Illustrated dental embryology, histology, and anatomy. 4th ed. Elsevier; 2019.

[5] Avery JK, Chiego DJ. Essentials of oral histology and embryology. 5th ed. Mosby; 2018.

[6] Berkovitz BKB, Holland GR, Moxham BJ. Oral anatomy, histology and embryology. 5th ed. Elsevier; 2017.

[7] Brand RW, Isselhard DE. Anatomy of orofacial structures. 8th ed. Elsevier; 2019.

[8] Fehrenbach MJ, Popowics TE. Illustrated anatomy of the head and neck. 6th ed. Elsevier; 2021.

[9] Ash MM, Nelson SJ. Wheeler's dental anatomy, physiology and occlusion. Saunders; 2020.

[10] Bhaskar SN. Orban's oral histology and embryology. 13th ed. Mosby; 2017.

[11] Cate RT. Histology of enamel, dentin, and pulp tissues. J Dent Res. 2016;95(10):1093–1101.

[12] Garant PR. Oral cells and tissues. Quintessence Publishing; 2012.

[13] Avery JK. Tooth morphology and functional occlusion. Dent Clin North Am. 2018;62(4):521–534.

[14] Sicher H, DuBrul EL. Oral anatomy. 8th ed. Ishiyaku EuroAmerica; 2016.

[15] Schroeder HE. Oral structural biology. Thieme Medical Publishers; 2017.

[16] Liebgott B. Clinical anatomy of the head, neck, and TMJ. 3rd ed. Elsevier; 2015.

[17] World Health Organization. Oral health fact sheet. Geneva: WHO; 2025.

[18] American Dental Association. Dental anatomy and oral physiology guidelines. ADA; 2024.

[19] Med1.uz. Tishlarning anatomik tuzilishi. Available from: https://med1.uz/articles/stomatologiya/tish-anatomiyasi

[20] Med1.uz. Og'iz bo'shlig'i gistologiyasi asoslari. Available from: https://med1.uz/articles/stomatologiya/g istologiya

[21] Med1.uz. Tishlarning fiziologik funksiyalari. Available from: https://med1.uz/articles/stomatologiya/f iziologiya

[22] Med1.uz. Tish guruhlari va ularning morfologiyasi. Available from: https://med1.uz/articles/stomatologiya/t ish-guruhlari

[23] Med1.uz. Emal, dentin va pulpaning mikroskopik tuzilishi. Available from: https://med1.uz/articles/stomatologiya/e mal-dentin-pulpa

[24] Med1.uz. Chaynash apparati anatomiyasi va biomekanikasi. Available from: https://med1.uz/articles/stomatologiya/c haynash-apparati

[25] Med1.uz. Tishlarning rivojlanishi va embriologiyasi. Available from: https://med1.uz/articles/stomatologiya/e mbriologiya

[26] Med1.uz. Terapevtik va ortopedik stomatologiya asoslari. Available from: https://med1.uz/articles/stomatologiya/o rtoped

Indexed & Abstracted In

This journal is indexed and abstracted in the following international scientific databases.

Google Scholar	ISSN	ORCID
CiteFactor	ResearchBib	DOI
Zenodo	Crossref	Grammarly

Article Verification

Scan the QR code to verify the authenticity of this article

DOI: 10.4103/aams.0498