



Faculty Of Dentistry

# **RESEARCH PLAN**

**2021-2026**

**Beni-Suef University**

# RESEARCH PLAN

## Statement of Problem:

The Faculty of Dentistry recognizes the ever-evolving landscape of oral healthcare and the need to continuously improve dental practices, techniques, and patient outcomes. However, there is a gap between current dental research efforts and the rapid advancements in dental technology and treatment methodologies. This gap hinders the faculty's ability to provide cutting-edge education and training to its students, as well as to contribute substantially to the advancement of the field.

Additionally, while the faculty possesses a wealth of expertise in various dental disciplines, there is a lack of systematic collaboration and coordination among researchers from different domains. This siloed approach limits the potential for interdisciplinary breakthroughs and integrated solutions to complex oral health issues.

## Methodology:

### 1. Team Assignment:

Form cross-disciplinary research teams consisting of faculty members, researchers, and students from different dental specialties. Foster a collaborative environment where team members can share knowledge, ideas, and expertise to address multifaceted challenges.

### 2. Time Schedule:

Develop a detailed timeline outlining the various phases of the research plan. Assign specific milestones, deadlines, and responsibilities to ensure progress is consistently monitored.

### 3. Planning:

- Research Development Plan: Define the objectives, scope, and expected outcomes of the research plan. Identify key research areas such as epidemiology, dental materials, AI, stem cells, diagnostics, and dental implants.
- Research Plan: Break down each research area into specific projects and studies. Allocate resources and assign teams based on expertise. Ensure each project aligns with the faculty's overall research goals.

**4. Dissemination:** Outline strategies for sharing research findings through academic publications, conferences, workshops, and public outreach initiatives.

**5. Approval:** Establish a review process to ensure all research projects adhere to ethical guidelines and receive necessary approvals before commencement.

## Background

Faculty of Dentistry, Beni-Suef university has a worldwide reputation for its high-quality faculty members and educational programs which attract the best students at national and regional level. The faculty is a national leader in dental education with graduates assuming leadership positions in the dental profession.

Beni-Suef University is a renowned institution of higher education located in Beni Suef, Egypt. Established in 2005, the university has rapidly grown to become a prominent center of academic excellence in the region. It offers a diverse range of undergraduate and postgraduate programs spanning various disciplines, including medicine, dentistry, engineering, arts, and sciences. With a commitment to providing quality education and fostering research and innovation, Beni-Suef University continuously strives to meet the evolving needs of its students and the community. The university boasts a dedicated faculty, state-of-the-art facilities, and a vibrant campus life that nurtures a conducive learning environment. As an esteemed seat of learning, Beni-Suef University plays a vital role in shaping the future of Egypt's knowledge landscape and producing graduates who are well-equipped to contribute positively to society.

## Research Vision

To attain global recognition as a preeminent hub of dental research, distinguished by its unparalleled excellence in advancing the frontiers of knowledge.

## Research Mission

The core research mission of the Faculty of Dentistry at Beni-suef University revolves around elevating the oral and dental health standards of the Egyptian population. This mission is achieved through the execution of top-tier research projects encompassing various dentistry disciplines and allied sciences. The faculty remains steadfast in its dedication to nurturing a cadre of ethical and proficient researchers, equipped with the essential knowledge, expertise, and professional conduct. The fruits of research and technological advancements are poised to be disseminated widely, ultimately contributing to the global realm of public knowledge, and thereby enhancing the faculty's international standing.

## Core Values:

**Integrity:** The quality of possessing honesty and steadfast moral principles.

**Cooperation:** Embodying empathy as a universally cherished team value, we foster a spirit of collaboration and harmonious work dynamics within the workplace.

**Commitment:** To groundbreaking innovation and unwavering excellence.

## Exploring Interdisciplinary Frontiers in Dentistry Research: A Comprehensive Research Plan

The field of dentistry is undergoing a remarkable transformation driven by advancements in technology, medical knowledge, and innovative approaches to oral healthcare. At the heart of this transformation lies the Faculty of Dentistry's commitment to pioneering research that pushes the boundaries of knowledge and practice. In alignment with this vision, this research plan outlines a comprehensive framework encompassing six pivotal topics that intersect to shape the future of dentistry: Epidemiology, Dental Materials, Artificial Intelligence, Stem Cells, Diagnostic Research, and Dental Implants.

As we embark on this multidisciplinary journey, we aim to bridge the gaps between traditional and contemporary dental practices, fostering a holistic understanding of oral health and treatment strategies. The intricate interplay of these six research domains holds the potential to revolutionize patient care, refine treatment methodologies, and introduce groundbreaking interventions. By synergistically exploring epidemiological patterns, harnessing the potential of advanced dental materials, leveraging artificial intelligence for diagnostics, unlocking the regenerative capabilities of stem cells, refining diagnostic techniques, and enhancing dental implant technologies, we are poised to usher in a new era of dental research and practice.

This research plan serves as a roadmap to guide our faculty members, researchers, and students in their pursuit of knowledge and innovation. Through collaborative efforts, rigorous inquiry, and the application of cutting-edge methodologies, we endeavor to unravel the complexities of oral health and disease while striving to elevate the standards of dental care worldwide. Our commitment to pushing the boundaries of conventional dentistry is unwavering, and this plan stands as a testament to our dedication to shaping a healthier, more vibrant future through pioneering research in the realm of dentistry.

### KEY FOR CODING

◇ ORAL PATHOLOGY	DOP
◇ ORAL BIOLOGY	DOB
◇ DENTAL MATERIALS	DBM
◇ ORTHODONTICS	ORTH
◇ PEDODONTICS and DENTAL PUBLIC HEALTH	PEDO
◇ ORAL AND MAXILLO FACIAL SURGERY	OMFS
◇ ORAL RADIOLOGY	ORAD
◇ ORAL MEDICINE	OMED
◇ PERIODONTOLOGY	PER
◇ FIXED PROSTHODONTICS	FPD
◇ OPERATIVE DENTISTRY	OPER
◇ ENDODONTICS	EN DO
◇ REMOVABLE PROSTHODONTICS	RPD

# SWOT ANALYSIS FOR RESEARCH PLAN



## SWOT ANALYSIS FOR RESEARCH PLAN , FACULTY OF DENTISTRY, BENI SUEF UNIVERSITY

### Strengths:

1. **Faculty Expertise:** The Faculty of Dentistry boasts a team of experienced and knowledgeable faculty members who bring diverse expertise to the field of dentistry, enhancing the quality of education and research.
2. **Modern Facilities:** The faculty is equipped with state-of-the-art laboratories, clinics, and research facilities, providing students with hands-on training and exposure to advanced dental technologies.
3. **Research Initiatives:** The faculty has a history of active engagement in research, contributing to the expansion of dental knowledge and advancements in oral healthcare practices.
4. **Collaborative Networks:** The faculty's partnerships with local healthcare institutions, dental clinics, and industry stakeholders foster collaborative research projects and clinical training opportunities.
5. **Location:** Situated within Beni Suef University, the faculty benefits from a conducive academic environment and access to university-wide resources.

### Weaknesses:

1. **Limited Funding:** Insufficient funding may hinder the faculty's capacity to invest in cutting-edge equipment, research projects, and faculty development programs.
2. **Outdated Curriculum:** The curriculum might need periodic revisions to align with rapidly evolving dental practices and incorporate emerging technologies.
3. **Faculty Development:** Ensuring consistent faculty development opportunities can be a challenge, impacting the faculty's ability to deliver the latest teaching methodologies.

### Opportunities:

1. **Demand for Quality Dental Care:** The growing awareness of oral health's impact on overall well-being creates an opportunity for the faculty to play a vital role in educating future dental professionals.
2. **Digital Dentistry:** Embracing digital tools and technologies in education and practice can enhance efficiency, accuracy, and patient outcomes.
3. **Interdisciplinary Collaboration:** Collaborating with other medical faculties can lead to comprehensive patient care and innovative research collaborations.
4. **Community Outreach:** Engaging in dental health awareness campaigns and community service can enhance the faculty's reputation and its contribution to society.

### Threats:

1. **Competition:** Increased competition from other dental schools may affect student enrollment and faculty recruitment efforts.
2. **Regulatory Changes:** Shifting regulations in the dental field can impact the curriculum, clinical practices, and licensing requirements.
3. **Technological Obsolescence:** Failure to integrate emerging technologies into education and practice could hinder the faculty's relevance and competitiveness.
4. **Economic Challenges:** Economic fluctuations and uncertainties may impact funding availability and resource allocation.

### TOWS STRATEGIC ALTERNATIVES MATRIX:

#### S-O Strategies:

1. **Build on Faculty Expertise (S1, S2, O2):** Leverage the skilled faculty and modern facilities to focus on research related to innovative dental treatments and technologies, capitalizing on the growing demand.
2. **Collaborative Research Ventures (S3, O3):** Form strategic partnerships with international dental research institutions to promote knowledge exchange and collaborative projects, enhancing the faculty's global reputation.

**W-O Strategies:**

1. **Develop Research Culture (W2, O1):** Establish a research-centric environment by initiating workshops, seminars, and incentives to encourage faculty and student involvement in research activities.
2. **Government Grants Utilization (W4, O4):** Seek government grants and funding opportunities to support research initiatives, addressing the limited research funding issue.

**S-T Strategies:**

1. **Defensive Positioning (S1, T1):** Strengthen the faculty's position by showcasing its established reputation, experienced faculty, and collaborative endeavors to fend off competition from other institutions.
2. **Research Diversification (S2, T2):** Invest in research projects that focus on staying up-to-date with rapidly evolving dental technologies, ensuring the faculty remains at the forefront of innovation.

**W-T Strategies:**

1. **Strengthen Ethical Framework (W3, T4):** Develop comprehensive ethical guidelines and protocols for dental research, mitigating potential ethical dilemmas and regulatory hurdles.
2. **Resource Optimization (W1, W2, T5):** Optimize resource allocation by prioritizing research initiatives that align with the faculty's strengths and opportunities, ensuring a prudent approach in uncertain budgetary condition

**Internal and External Matrix (IEM) :**

Factors	Internal	External
Strengths	3 (S1)	4 (O1)
Weaknesses	2 (W1)	3 (T1)
Opportunities	4 (S2)	3 (O2)
Threats	2(W2)	2 (T2)

**Based on the provided information, the following strategies should be :**

**1. Leverage Strengths to Exploit Opportunities (SO Strategy): \**

- Strengthen collaborations with local dental clinics and hospitals to provide practical training for students, addressing the growing demand for dental services (S1, O1).
- Establish partnerships with international dental institutions to exchange expertise, enhance faculty qualifications, and expand the global network (S1, O2).

## **2. Overcome Weaknesses to Exploit Opportunities (WO Strategy):**

- Allocate resources to improve the student-to-faculty ratio, enhancing the learning experience and attracting more students to meet the demand for dental services (W1, O1).
- Invest in faculty development programs to enhance expertise and improve curriculum quality, aligning with advances in dental technology (W1, O2).

## **3. Leverage Strengths to Mitigate Threats (ST Strategy):**

- Utilize the strong research culture to address regulatory changes and adapt the curriculum to new requirements (S2, T1).
- Collaborate with medical colleges to create interdisciplinary programs, mitigating the potential shortage of faculty members in specific specialties (S2, T2).

## **4. Minimize Weaknesses to Mitigate Threats (WT Strategy):**

- Allocate resources to address faculty recruitment and retention challenges, ensuring the availability of qualified faculty to counteract competition and regulatory changes (W2, T1).
- Enhance the curriculum with the latest dental technology and remote learning capabilities to navigate challenges such as economic downturns and changes in learning modes (W2, T2)

## **ACTION PLAN**

This action plan focuses on enhancing student learning experiences through faculty development initiatives, curriculum updates, and practical training opportunities in partnership with local dental clinics. Additionally, by embracing international collaborations, the faculty seeks to enrich its academic offerings and broaden its horizons, thus ensuring its resilience in the face of regulatory changes and emerging challenges. This integrated approach, driven by a range of responsible parties, underscores the faculty's commitment to excellence, innovation, and continuous improvement. Through diligent execution and consistent evaluation, the action plan strives to propel the Faculty of Dentistry towards sustained growth, enhanced research contributions, and a stronger position in the field of dental education and practice.

## **Strategy 1: Leverage Strengths to Exploit Opportunities (SO Strategy):**

**•Goal: Strengthen local and international collaborations to meet the growing demand for dental services and enhance global exposure.**

**Action: Establish a partnership committee to identify and initiate collaborations with local dental clinics and hospitals**

**Responsibility: Dean of the Faculty, Vice Dean for environmental & community service.**

**Action: Develop a comprehensive program for student internships and practical training in collaboration with local dental clinics.**

**Responsibility: Vice Dean for Post graduate program, Faculty Members.**

**Action: Create an international affairs office to facilitate partnerships with foreign dental institutions.**

**Responsibility: Vice Dean for Post graduate affairs**

**Action: Organize an annual international dental conference to foster knowledge exchange and collaboration.**

**Responsibility: Vice Dean for environmental & community service, Faculty Members.**

## **Strategy 2: Overcome Weaknesses to Exploit Opportunities (WO Strategy):**

**•Goal: Enhance faculty qualifications and improve the learning experience to capitalize on growth opportunities.**

**Action: Allocate resources to hire additional faculty members to reduce the student-to-faculty ratio.**

**Responsibility: Dean of the Faculty, Human Resources Department.**

**Action: Launch a faculty development program to enhance teaching methodologies and research capabilities.**  
**Responsibility: Vice Dean for environmental & community service, Teaching Staff.**

**Action: Formulate a curriculum enhancement task force to update the curriculum with the latest dental technology and techniques.**

**Responsibility: Vice Dean for student affair.**

### **Strategy 3: Leverage Strengths to Mitigate Threats (ST Strategy):**

**Goal: Utilize the faculty's strengths to address potential threats and maintain competitiveness.**

**Action: Establish a regulatory compliance task force to monitor and adapt the curriculum to meet changing regulatory requirements.**

**Responsibility: Curriculum Development Team.**

**Action: Initiate collaboration agreements with medical colleges to develop interdisciplinary programs.**

**Responsibility: Vice Dean for environmental & community service, Faculty Members.**

### **Strategy 4: Minimize Weaknesses to Mitigate Threats (WT Strategy):**

**Goal: Address weaknesses to mitigate potential threats and ensure long-term viability.**

**Action: Implement a faculty retention and development program to attract and retain qualified faculty members.**

**Responsibility: Dean of the Faculty, Human Resources Department.**

**Action: Invest in advanced technology and e-learning resources to ensure seamless adaptation to changing learning modes.**

**Responsibility: IT Department, Teaching Staff.**

**Action: Establish a task force to explore diversified funding sources to mitigate financial challenges.**

**Responsibility: Dean of Faculty, Finance Department.**

## FACULTY RESEARCH PLAN

### Topic 1: Analyzing epidemiology and determinants of diseases within populations.

Epidemiologic studies hold paramount significance, not merely for assessing the current disease burden but also for unraveling potential susceptibility variations across diverse populations. The conducted research will furnish valuable insights into the oral health status of the Egyptian populace over time, empowering governmental policymakers to gain comprehensive understanding and address dental healthcare requirements more effectively. Moreover, the research endeavors will foster the development of essential communication skills, attitudinal awareness, and practical experiences that are pivotal in fulfilling collaborative and consultative responsibilities in the future careers of aspiring oral epidemiologists.

#### FACULTY GOALS

##### **1.1. Detecting the Prevalence and Incidence Rate of Primary Oral and Dental Issues in the Population of Egypt**

PER: Investigate the frequency and occurrence of periodontal and peri-implant ailments within the faculty domain, observing patients in both general and specialized clinics

PER: Examine the prevalence and incidence rates of periodontal and peri-implant conditions in the Egyptian populace on a national scale

OMED: Research the occurrence and frequency of oral manifestations linked to environmental factors and personal habits across the Egyptian population

OMED: Study the prevalence and incidence of autoimmune and immunologically mediated conditions impacting the oral cavity among the Egyptian populace

PEDO: Explore the prevalence and incidence of dental caries and other common oral and dental disorders in Egyptian children, both within the faculty setting and across the nation

OP: Investigate the frequency and occurrence of prevalent oral pathological conditions within the Egyptian population

PRO: Evaluate the occurrence of completely and partially edentulous individuals, correlating the findings with their ages and potential local or systemic predisposing factors.

PRO: Assess patient requirements for different types of prostheses and gauge their contentment with the treatment they receive.

OMFS: Examine the prevalence, distribution, and patterns of trauma, orofacial region diseases, and tumors in the orofacial area among the Egyptian populace.

## **1.2. Detection of risk factors for different oral and dental diseases**

OMED: Investigate the correlation between varying environmental factors, personal habits, systemic conditions, and fluctuations in oral health status.

PEDO: Explore and identify potential risk factors associated with dental caries and prevalent oral and dental conditions in children across Egypt.

OP: Analyze the interplay of genetic factors alongside various risk contributors such as tobacco usage, among others, in the context of oral pathological conditions.

OP: Probe into novel dimensions within the molecular biology realm concerning oral premalignant and malignant lesions, odontogenic cysts and tumors, and conditions affecting the bone structure.

PRO: Investigate the intricate relationship connecting the extent of partial or complete edentulism with the frequency of temporomandibular joint disorders.

ORAD: Utilize varying parameters, field of view, and software options (both proprietary and third-party) in Cone Beam Computed Tomography to uncover risk factors for dental caries and periodontal diseases.

OPER: Unearth diverse risk elements contributing to caries incidence and formulate innovative methodologies for assessing caries risk.

OPER: Illuminate the spectrum of risk factors underpinning non-carious lesions, crafting new approaches for the assessment of their associated risks.

FPD: Identify and dissect potential risk factors linked to Temporomandibular joint disorders, contributing to a comprehensive understanding of their etiology.

### **1.3. Enhancing Oral Health Among the Egyptian Population: Focus on Dental Caries, Non-Carious Lesions, Temporomandibular Joint Disorders, and Periodontal Diseases**

PER: Prevent periodontal and peri-implant diseases among Egyptian population

PEDO: Prevent dental caries and other common oral and dental diseases in Egyptian children.

OPER: Evaluate and compare the performance of conventional and newly introduced preventive and therapeutic approaches used in clinical practice.

OPER: Establish innovative preventive measures.

OPER: Evaluate and compare different biological approaches in managing incipient dental caries.

OPER: Evaluate and assess different methods for prevention of dental non-carious lesions.

OPER: Evaluate and compare different approaches in managing dental non-carious lesions

FPD: Prevent temporomandibular joint disorders due to impaired occlusion among Egyptian population.

### **1.4. Early detection and prevention of oral cancer**

OMED: Study incidences or prevalence of potentially malignant and malignant lesions of the oral cavity in the Egyptian population

OMED: Assess the efficacy and safety of chemo preventive interventions for malignant transformation.

OMED: Apply highly updated technologies on a molecular level that enhance the screening, early detection, and likelihood of oral tumors.

OMED: Use the molecular biological concepts in promoting prevention of the oral tumors.

OMED: Correlate the oral tumors with the social and economic demographics to help minimize the prevalence of oral tumors.

OP: Evaluate the effectiveness of different methods or markers used in the early detection of oral cancer.

OP: investigate the protective and therapeutic effects of some naturally available food substance in experimental animals.

ORAD: Detect oral cancer early using recent innovations in MRI, CT, CBCT, and nuclear medicine.

## **Topic 2: Assessment and Advancement of Dental Instrument Techniques, Medical Practices, and Materials.**

The continuous quest for a biologically compatible restorative material has resulted in a bewildering array of options in the dental market. Foundational knowledge concerning the physical attributes, antimicrobial capabilities, and biomechanical properties of dental and craniofacial biomaterials is crucial for the advancement of effective and clinically viable dental materials. Recent times have seen the introduction of diverse treatment modalities and methodologies for addressing oral, dental, and maxillofacial conditions. The assessment of these novel approaches and innovations in this domain remains a significant area of exploration

### **FACULTY GOALS**

#### **2.1. Biocompatibility evaluation as obtained by the cell culture techniques, organ-culture host environment and mimicry to the reactions obtained when the materials are tested under conditions which reflect their clinical use.**

OB: Explore the effectiveness and safety of new materials, equipment and technologies in such a way to improve dental and medical health care, as well as improve the personal and social status.

OP: Assess tissue response to newly developed materials and drugs used in management of various dental and oral conditions.

ENDO: investigate cytotoxicity and/or neurotoxicity and/or biocompatibility of different/new irrigants, sealers, repair materials, obturation materials or bleaching agents.

FPD: Evaluate new materials from biological aspects.

DBM: Evaluate new biomaterials from the biological response.

#### **2.2. Assessment of the behavior of dental materials based on macro/micro/ nano structure.**

OB: Develop new modalities in assessment of the biocompatibility and behavior of the used dental material on a micro and nano level.

OP: Compare tissue response to dental materials and drugs based on nano structure with those based on macro structure.

DBM: Assess the behavior of biomaterials/dental tissue interaction at different scales.

### **2.3. Innovation and evaluation of recent techniques and designs in dental practice**

PER :Assess and critique emerging techniques in the management of gingival deformities.

PER: Critically evaluate novel approaches in addressing periodontal defects, including horizontal defects, intra-osseous defects, and furcation defects.

PED0 : Analyze and appraise innovative strategies for managing dental caries and prevalent oral and dental conditions in Egyptian children.

OP : Investigate and interpret tissue responses to recent advancements in dental practice methods.

PRO: Devise and appraise inventive techniques and designs for occlusal appliance therapy.

PRO: Develop and assess new design concepts and treatment modalities for removable and maxillofacial prostheses.

PRO: Innovate and evaluate novel appliances for sleep-disordered breathing management.

PRO: Introduce fresh treatment paradigms and their application in extra and intraoral maxillofacial prosthodontics.

PRO: Pioneering the integration of 3D printing within the realm of prosthodontics.

OMFS: Investigate the utilization of tissue engineering principles in maxillofacial reconstruction.

OMFS: Appraise the application and outcomes of advanced distraction osteogenesis techniques for maxillofacial deformities.

OMFS: Innovate diverse modalities for the treatment of temporomandibular joint (TMJ) diseases.

OMFS: Evaluate the neuromuscular and skeletal responses in relation to orthognathic and TMJ surgeries.

OMFS: Scrutinize advanced techniques in facial implants and their impact on facial reconstruction and rehabilitation.

OMFS: Explore new strategies for tumor treatment and subsequent reconstruction.

OMFS: Research and analyze enhanced techniques in orthognathic surgery.

OMFS: Examine the effects of new approaches in cleft lip and palate surgery on surrounding structures.

OMFS: Study the efficacy of emerging techniques, medications, and computer-controlled local anesthesia in pain management.

OMFS: Evaluate the implementation of computer-guided soft and hard tissue reconstruction in oral and maxillofacial surgery.

OMFS: Assess and refine existing methods for managing infections in the orofacial and head-neck region.

OMFS: Elaborate on the surgical immune responses following various interventions in OMFS.

OMFS: Review and adapt to the latest approaches in maxillary sinus problems and treatments.

OMFS: Analyze innovative bone augmentation techniques for jawbone reconstruction.

OMFS: Investigate soft tissue and neck responses to interventions in maxillofacial trauma among children.

OMFS: Create and assess simplified techniques for managing trauma in pediatric cases.

OMFS: Evaluate and advance technology and techniques for treating post-traumatic residual deformities.

ORTH: Assess different treatment modalities for temporomandibular joint disorders (TMD).

ORTH: Evaluate novel techniques, such as soft laser and Botox usage, along with new appliance designs.

ORTH: Critically analyze enhancement techniques, both clinically and through animal models, to optimize orthodontic outcomes.

ORTH: Establish evidence-based treatment protocols for various malocclusions.

ORTH: Examine the application of mini screws and plates across different orthodontic treatment scenarios.

ORTH: Investigate the stability and failure causes related to mini screws and mini plates.

ORAD: Radiographically evaluate the reliability and effectiveness of various dental practice techniques, including surgical and tissue engineering methods.

OPER: Critique advanced designs in tooth preparations.

OPER: Introduce innovative tooth preparation designs in alignment with recent modifications in restorative materials.

OPER: Assess the impact of contemporary caries removal concepts and techniques on recurrent caries, pulp, and periodontal tissues.

OPER: Evaluate the mechanical performance of recent restorative materials and techniques under different oral conditions.

OPER: Examine esthetic treatment modalities for correcting esthetic disorders involving shape, size, and color.

OPER: Analyze the long-term durability and prognosis of various restorative materials and clinical treatment approaches.

ENDO: Investigate the shaping capacity of new instruments and biomechanical preparation techniques in various conditions, including different canal curvatures and oval canals.

ENDO: Examine smear layer removal, debridement, and apical debris extrusion following different/new irrigation techniques, instruments, and retreatment techniques.

ENDO: Investigate the dissolution and removal efficiency of different obturating materials using diverse procedures.

ENDO: Study the utilization of technologies like CBCT in detecting complex root canal systems.

ENDO: Investigate pain and periapical healing in relation to various irrigation techniques, instruments, obturation techniques, and single vs. multiple visit approaches.

ENDO: Monitor pulp and periapical status and therapy outcomes through molecular markers.

FPD (Fixed Prosthodontics): Employ innovative construction techniques for crowns and fixed partial dentures.

FPD: Evaluate new designs from physical, mechanical, and biological perspectives.

FPD: Apply optimal strategies for reconstructing mutilated vital teeth.

FPD: Utilize reinforcing materials and techniques to maintain the integrity of mutilated non-vital teeth.

FPD: Formulate esthetic treatment methods using cutting-edge digital smile design technology.

FPD: Assess new protocols for diverse restorations.

FPD: Examine advancements in the field of restorative esthetics.

FPD: Incorporate digital technology into various aspects of fixed prosthodontics.

#### **2.4. Innovation and evaluation of physical properties of new materials, instruments and devices used in dental armamentarium.**

OPER: Evaluate and assess recent dental instruments and tools used in Con-servative dentistry.

OPER: Establish innovative instrumentation for tooth preparation and restora-tion.

ENDO: investigate physicochemical properties of different/new endodontic obturation materials, sealers, and root repair materials.

ENDO: Investigate surface topographic changes of different endodontic enlarging instruments on exposure to various conditions e.g. autoclave sterilization, irrigants, canal preparation.

FPD: Evaluate new materials from physical aspects.

## **2.5. Evaluation of the antimicrobial and immunologic effects of new dental materials or techniques**

OP: Determine the effect of new materials and drugs on the type and number of inflammatory cells.

ENDO: investigate the antimicrobial and/or immunologic effect of different/ new irrigants, or chelators, or herbal extracts or intracanal medication.

ENDO: investigate the antimicrobial effect of innovated sealer types or core materials.

ENDO: Assess microbial eradication potential of different/ new irrigation and/ or instrumentation techniques.

DBM: Evaluate the antimicrobial effects of new biomaterials and natural products on dental tissues.

## **2.6. Assessing the efficacy of new materials and medicines in vitro and in clinical trials**

OMED: Evaluate and innovate medicines and technologies for treatment of oral diseases.

OMED: Assess the efficacy and safety of herbal medicine or alternative technologies to treat oral mucosal lesions

OMED: Assess the efficacy and safety of interventions managing oral complications of cancer treatment.

DBM: Evaluate, characterize, and optimize novel dental materials and techniques: Nano-dental materials, Remineralizing materials, Direct and indirect restorative materials and Dental adhesives.

DBM: Utilize natural alternatives and/or natural additives to commercially available dental materials.

OB: Boost the innovation of various hard and soft tissue grafts in reconstruction of hard and soft tissue defects.

OB: Update the knowledge about new materials, equipment, and technologies in treatment of most dental and oral diseases.

PRO: Investigate the in vitro behavior and clinical treatment outcome of injectable flexible resin peek, peek in removable and maxillofacial prostheses.

ORTH: Evaluate clinically and through animal model different new materials used to maximize orthodontic treatment effects.

ORAD: Assess radiographically both chemical and physical properties of new materials used in clinical trials by radiographic analysis of the effect of such materials whether on bone formation, volume gain, healing, etc.

OPER: Evaluate the esthetic stability of recent anterior esthetic restorative materials.

OPER: Evaluate the effect of new restorative materials on recurrent caries, pulp and periodontal tissue.

ENDO: investigate pain and/or periapical healing with different/new intracanal medication, or therapeutics, irrigation materials or obturation or retreatment materials.

ENDO: investigate pulp reaction and/or maturogenesis using new capping materials or bleaching agents.

ENDO: investigate smear layer removal and/or debridement and/or apical extrusion of debris after different/new irrigants or intracanal medication or retreatment materials (solvents).

FPD: Assess bonding materials for different restorations.

### **Topic 3: Oral health in the perspective of systemic health**

Systemic health is often closely linked to the state of the oral cavity; many systemic diseases and conditions have oral manifestations. Likewise, oral microbiological infections may also affect one's general health status. Better understanding of this correlation will help both dental and medical professionals to determine the best approach to patient care.

#### **FACULTY GOALS**

#### **3.1. Examining the Influence of Oral and Dental Conditions on Overall Health: Exploring ways to unify oral health promotion and care with other health domains through the shared risk factor perspective, focusing on systemic health implications.**

PER: investigate the impact of periodontal diseases on cardiovascular diseases, rheumatoid arthritis, pulmonary diseases, and renal diseases.

PER: investigate the impact of systemic diseases and conditions on periodontitis including obesity, stress and nutritional deficiencies.

PEDO: investigate the impact of dental caries and other common oral and dental diseases in children and children with special health care needs.

ORAD: Search for evidence of association between oral health and general health status using radiographic assessment.

OPER: investigate the influence of dental hard tissue lesions on health promotion of patients with systemic diseases.

OPER: Evaluate the influence of systemic diseases and their treatment side effects on dental caries incidence and prevention.

### **3.2. Evaluation of the impact of treatment of diseases of oral and craniofacial origin on minimizing the development of physical and psychosocial diseases.**

PER: Evaluate the impact of treatment of periodontal diseases on individuals' quality of life.

PEDO: Evaluate the impact of full oral rehabilitation on children's quality of life.

OP: Study the side effects of different treatment modalities and medications adopted during treatment of different oral diseases and neoplasms.

OPER: investigate the influence of treatment modalities of dental hard tissue lesions on health promotion of patients with systemic diseases.

## **Topic 4: Stem cells in reconstruction of hard and soft tissues**

Research endeavors within this thematic focus aim to enhance the precision of alveolar and facial reconstruction throughout the entire process, spanning from initial planning to final implementation. These efforts strive to formulate a comprehensive framework for effectively addressing and rectifying dental and craniofacial deformities. The research conducted in this field encompasses both laboratory-driven investigations and clinically rooted studies. A significant portion of this work is dedicated to mapping out the complete patient journey, thus lending a translational essence and impact to the findings.

## FACULTY GOALS

### **4.1. Development of suitable three-dimensional scaffold for the maintenance of cellular viability and differentiation for applications in tissue engineering**

DBM: Prepare, characterize, and optimize tissue engineering scaffold.

OPER: Study cellular viability and its differentiation when using different scaffolds with pulp-derived cells.

OPER: investigate the effectiveness of different scaffolds in regenerative procedures of enamel, dentin, and pulp.

OP: Examine and monitor changes in morphology and functions, following the use of stem cells in the reconstruction of hard and soft tissue.

### **4.2. Evaluation of the safety and effectiveness of the tissue engineered product in experimental animals.**

PER: Evaluate safety and effectiveness of tissue-engineered product in induced and naturally occurring periodontal and peri-implant defects in experimental animal models.

ORAD: Assess reconstructed and tissue engineered hard and soft tissues in experimental studies.

FPD: Evaluate safety and effectiveness of tissue-engineered product in edentulous ridge resorption and peri-implant defects in experimental animal models.

PER: Evaluate the use of stem cells in regeneration of gingival deformities and periodontal defects (intra-osseous, furcation defects).

0MED: Use of stem cells in management of different oral mucosal lesions

0MED: introduce new drug delivery methods to maximize the effect of the use of stem cells treatments.

0B: Use the stem cells as a regenerative substitute for diseased dental and oral tissues.

ORAD: Assess radiographically reconstructed hard and soft tissues using stem cells.

FPD: Evaluate the use of stem cells in regeneration of residual ridge defects.

## **Topic 5: Dental implants**

Ensuring the systematic incorporation of any implant system into regular clinical practice is of utmost importance. This necessitates a comprehensive assessment of the system's performance through rigorous scrutiny of extensive, long-term follow-up clinical studies. Literature has extensively examined both immediate and delayed loadings, along with diverse techniques for bone augmentation. Looking ahead, the emphasis shifts towards refining implant therapy with a patient-centric approach that prioritizes efficiency in reducing time and discomfort, while optimizing aesthetics and ensuring enduring positive outcomes.

### FACULTY Goals

#### **5.1. Evaluation of different innovative techniques of guided implant surgery**

PR0: Evaluate the application and accuracy of computer aided implant surgical guide (3D printing versus milled).

ORAD: Evaluate radiographically different innovative techniques of guided im-plant surgery.

FPD: Apply and assess computer-guided planning for implant placement in conjunction with abutment and supra-structure designs.

FPD: Assess biomechanics of different implant supra-structures.

#### **5.2. Investigation and innovation in prosthodontics aspect of dental implants**

PRO: innovate and evaluate new strategies for implant placement and rest-oration.

PRO: Evaluate biomechanical technical risks in implant prosthodontics.

PRO: Evaluate new occlusal consideration in implant prosthodontics.

ORAD: Evaluate post-prosthetic implant imaging to reveal any alveolar bone changes.

FPD: Evaluate different materials and designs for implant supra-structures.

### **5.3. Investigation of new surgical techniques and implant design to achieve better bone and soft tissue quality and patient satisfaction at implant site.**

PER: investigate new techniques for implant site development and management of alveolar defects.

PER: investigate new surgical techniques to improve esthetics and patient satisfaction at implant sites.

PER: Evaluate novel implant materials and surface modification techniques for dental implant in vivo.

DBM : Evaluate, characterize and optimize novel implant materials and surface modification techniques for dental implant in vitro.

OB: Assess the tissue reaction in response to the implant.

OP: Evaluate tissue response to newly developed implant surgical techniques and materials.

PRO : Evaluate the treatment outcome of new implant designs.

ORAD: Evaluate radiographic imaging planning in varying computer-guided and aided surgeries.

FPD : investigate new techniques for implant site development and management of alveolar defects.

FPD: investigate new surgical and prosthodontic techniques to improve white and pink esthetics which leads to patient satisfaction.

FPD: Evaluate different materials and designs for implants.

### **Topics 6: Diagnostic research**

This research area aims at developing innovative ways of detecting and diagnosing dental diseases and conditions such as caries, periodontal diseases, pulp and apical diseases with emphasis on the assessment of the sensitivity and specificity of the evolved diagnostic tools and techniques.

## **FACULTY Goals**

### **6.1. Assessment of new diagnostic techniques in dentistry**

OMED: Measure the sensitivity and specificity of noninvasive techniques, devices, and biological markers in screening malignant changes in oral mucosal lesions.

PEDO: Assess new diagnostic techniques in pediatric dentistry.

OP: Evaluate the accuracy of new techniques applied in diagnosis of different pathological conditions.

ORTH: Evaluate and compare 2D, 3D, and 4D imaging techniques in orthodontic diagnosis, treatment planning and prediction of treatment outcomes.

ORTH: Use stereo-photogrammetry soft tissue analysis for orthodontic patients with different skeletal and dental malocclusion, facial asymmetry and comparing pre and post treatment changes.

ORAD: Assess the role of new diagnostic imaging techniques in diagnosis and follow-up of oral and maxillofacial diseases and abnormalities.

OPER: Assess the performance of recent diagnostic tools for early detection of dental caries.

OPER: Evaluate the performance of different diagnostic tools and techniques for detection of recurrent caries.

OPER: Assess recent diagnostic tools and techniques for caries examination of deep carious dentin during cavity preparation.

## **6.2. Development of innovative diagnostic techniques in dentistry**

PER: Evaluate and develop chair side tests for detection of biomarkers associated with the pathogenesis of periodontal and peri-implant diseases.

PER: Evaluate and develop chair side tests for assessment of microbiologic and immunologic effects of treatment of periodontal diseases.

OMED: identify new diagnostic criteria using mainly molecular diagnostic biological markers for autoimmune and immunologically mediated disorders affecting oral cavity.

PEDO: Develop new diagnostic techniques in pediatric dentistry.

ORAD: Develop innovative diagnostic imaging techniques in diagnosis and follow-up of oral and maxillofacial diseases and abnormalities.

OPER: Develop innovative diagnostic tools and techniques for early detection of dental caries.

OPER: Develop innovative diagnostic tools and techniques for diagnosis of last layer of carious dentin during cavity preparation.

FPD: Apply diagnostic and analytic tools of occlusion and load distribution of natural dentition and artificial fixed restorations.

FPD: Assess of the therapeutic role of fixed prosthodontics in management of occlusion problems.

## **Topics 7: Integrating Artificial Intelligence in Various Sections of Dentistry**

The Faculty of Dentistry aims to leverage the potential of artificial intelligence (AI) to advance various subfields within dentistry. This research plan outlines a comprehensive approach to integrating AI technologies into the departments of Fixed Prosthodontics, Removable Prosthodontics, Orthodontics, Oral Biology, Oral Pathology, Oral Radiology, Endodontics, Dental Biomaterials, Restorative Dentistry, Oral Medicine, and Oral Surgery.

### **FACULTY Goals**

FPD: Develop AI-based algorithms for designing optimal prosthetic restorations.

FPD: Create tools for predicting material compatibility and longevity of prosthetic devices.

ORTH: Design AI models for predicting treatment outcomes and planning personalized orthodontic interventions.

ORTHO: Develop virtual treatment simulation platforms for patient engagement.

ORD: Build AI systems for detecting oral diseases, anomalies, and tumors from radiographic and histopathological images.

OPATH: Develop tools to analyze genomic data and predict oral disease predisposition.

ENDO: Create AI models for automated diagnosis of pulpal and periapical conditions

ENDO: Develop tools for treatment planning and outcome prediction in complex endodontic cases.

DBM: Implement AI for designing and predicting material properties of dental restorations.

DBM: Develop AI-guided approaches for minimal intervention dentistry.

OMFS: Build AI systems for early detection of oral mucosal disorders and oral cancer.

OMFS: Develop surgical planning tools using AI-assisted 3D imaging and virtual simulations.



**Research Plan**  
**FACULTY OF DENTISTRY**  
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