



King Saud University, College of Dentistry
Department of Pediatric Dentistry and Orthodontics
Graduate Program in Orthodontics

Orthodontic Biomaterials and Treatment Mechanics Course

Course Code and Number: POS 540 (Orthodontic Seminar I)

Course Name: Orthodontic Biomaterials and Treatment Mechanics

Pre-Requisites: None

Course Level: Offered in the 2nd Semester of the 1st Year to the Graduate Students

Room: #441065 (University Dental Hospital, 1st Floor, beside the Library)

Time: Sundays, 10:00 am – 12:00 pm

Dates: January 17 – April 25, 2021

Course Director:	Office Hours	Office Location	Telephone	E-mail
Abdullah M. Aldrees BDS, DMSc	12:00–1:00 pm Monday, Tuesday	2A/49A	011 – 805-1975	amaldrees@ksu.edu.sa

COURSE DESCRIPTION

The course covers two aspects:

1. Introduction to the laws of mechanics and the typical tissue responses to force systems used in orthodontic appliances. In addition to the concept "system equilibrium", the implications for planning orthodontic anchorage, the mechanics of headgear designs, biomechanical approaches to the management of vertical occlusal issues, and the biomechanical principles of molar control in the transverse and anterior-posterior direction.
2. Techniques for studying materials, structure and properties of orthodontic wires and brackets, elastomeric ligatures and chains, adhesive resins and cements, in addition to orthodontic bonding to conventional and non-conventional surfaces, and the biocompatibility of different orthodontic materials.

COURSE GOAL

The goal of the course is to prepare graduate students with the scientific basis of physics and Newtonian mechanics to properly manipulate the orthodontic forces for optimum active tooth movement and anchorage.

COURSE OBJECTIVES

This course aims to qualify the students to:

1. Recognize the physical principles that govern the force mechanics in orthodontics.
2. Apply one-couple orthodontic appliances to produce well-defined forces and couples for controlled tooth movement in situations like canine extrusion and intrusion arches.
3. Predict the effect of one-couple orthodontic appliances and differentiate between consistent and inconsistent mechanics.
4. Analyze the two-tooth mechanics in statically-determinate force system, and determine the appropriate approach to use them in the utility arches and in the transverse dimension.
5. Identify the biomechanical concepts of anchorage reinforcement and extra-oral appliances that enable the proper use of headgears.
6. Compare the approaches to correct deep bite mechanically.
7. Describe the mechanical characteristics of treatment modalities that aim to correct the anteroposterior molar discrepancies.
8. Create space closure plans with understanding of the role of friction in orthodontic appliances.



STUDY PLAN AND REQUIREMENTS

To receive the maximum benefit from this course, the student must attend all seminars. All students are expected to complete the assignments and participate actively in the seminars.

Satisfactory completion of this course requires:

1. Attendance of classes is mandatory. Attending less than 75% of the classes deprives the student from taking the final examination (University Rules & Regulations). Attendance is checked every week.
2. A minimal passing grade of 70% must be achieved of the combined grades of all the exams and assignments.

COURSE EVALUATION

The students will be evaluated by their performance during the course. The total grade is 100%, and it is distributed as follows:

CONTINUOUS ASSESSMENT	FINAL EXAMINATION	TOTAL
Assignments / Quizzes	Written	
60	40	100

There will be at least six assignments, and a final written examination. The material covered in the examination will be based on the required textbooks and the reviewed literature. In the final written examination, all lecture materials presented during the semester will be included.

STUDENT EXPECTATION

Out of respect for our lecturers, it is kindly asked that students' attention is on the lecture being presented and they interact, as much as possible, with the presenter. Students are expected to present professionalism by not focusing attention on other materials. Students are expected to demonstrate punctuality for every class. Students are also expected to demonstrate preparedness for the sessions with respect to completing the assignments.

POLICY ON ATTENDANCE

Due to the interactive and participatory nature of this course, attendance at each class session is required. If you are unable to attend class due to a medical or family emergency, you should contact the course director and submit an excuse in writing. Student will not be allowed to enter the classroom if they are more than 10 minutes late.

GRADE DISPUTE AND POLICY ON MAKE-UPS/REMEDIATION

If a grade that is assigned to an exam or a question and/or its answer is to be disputed by a student, it must be done so in writing within 24 hours after receiving the results. A specific rationale for why a question or answer requested to be reviewed should be included. Any global changes in grading will be considered for the entire class. Excused absences that are unavoidable will be offered an alternate final examination with different questions (including essays and short notes), and the level of difficulty between the original and the makeup exam will be similar but not the same. Students who fail to get 70% of total course grade will get a "F" grade and they will have to re-take the course since that remediation at the graduate level courses is not permitted.

STUDENT ACADEMIC INTEGRITY, SCHOLASTIC DISHONESTY, AND PROFESSIONALISM

Scholastic misconduct is broadly defined as "any act that violates the right of another student in academic work or that involves misrepresentation of your own work. Scholastic dishonesty includes, (but is not necessarily limited to), cheating on assignments or examinations; depriving another student of necessary course materials; or interfering with another student's work." Students are expected to govern their conduct toward their colleagues, faculty, and other professionals with integrity, mutual respect, and honor. Scholastic misconduct will result in failure of the course and the course will be required as a retake during the following year. Professionalism behavior in attendance and active participation will be monitored and recorded in the weekly evaluation.



COMMUNICATION

All individual and full class communication will be through your e-mail accounts. Announcements intended for the whole class will be sent by e-mail. It is a requirement of the course to check your e-mail daily. While in class, please silence your cell phones.

RECOMMENDED TEXTBOOK

- Biomechanics in Orthodontics: Principles and Practice
Ram S. Nanda, Yahya Tosun
Publisher: Quintessence Pub. Co.; 1st Edition, 2010
ISBN: 978-0867155051
- Selected Chapters from:
The Biomechanical Foundation of Clinical Orthodontics
Charles J. Burstone, Kwangchul Choy
Publisher: Quintessence Pub. Co.; 1st Edition, 2015
ISBN: 978-0867156515
- Chapter 9: Mechanical Principles in Orthodontic Force Control, Pages 276 - 309
Contemporary Orthodontics
William R. Proffit, Henry W. Fields, Brent E. Larson, David M. Sarver
Publisher: Mosby; 6th Edition, 2018
ISBN: 978-0323543873

Additional Reading:

1. The ground rules for arch wire design. Isaacson RJ, Lindauer SJ, Davidovitch M. Semin Orthod. 1995 Mar;1(1):3-11.
2. One-couple orthodontic appliance systems. Lindauer SJ, Isaacson RJ. Semin Orthod. 1995 Mar;1(1):12-24.
3. Two-couple orthodontic appliance systems utility arches: a two-couple intrusion arch. Davidovitch M, Rebellato J. Semin Orthod. 1995 Mar;1(1):25-30.
4. Two-couple orthodontic appliance systems: torqueing arches. Isaacson RJ, Rebellato J. Semin Orthod. 1995 Mar;1(1):31-36.
5. Two-couple orthodontic appliance systems: activations in the transverse dimension. Rebellato J. Semin Orthod. 1995 Mar;1(1):37-43.
6. Two-couple orthodontic appliance systems: transpalatal arches. Rebellato J. Semin Orthod. 1995 Mar;1(1):44-54.

REFERENCES

1. *January 17, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 1
Seminars in Orthodontics 1995; Vol. 1 (1): 3-8
The Biomechanical Foundation of Clinical Orthodontics; Chapter 2 + 3.
2. *January 24, 2021*
Seminars in Orthodontics 1995; Vol. 1 (1): 12-24
The Biomechanical Foundation of Clinical Orthodontics; Chapter 16.
3. *January 31, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 3
Seminars in Orthodontics 1995; Vol. 1 (1): 25-54
The Biomechanical Foundation of Clinical Orthodontics; Chapter 15.
4. *February 14, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 5
The Biomechanical Foundation of Clinical Orthodontics; Chapter 4 + 11.
5. *February 21, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 6 + 7
Seminars in Orthodontics 1995; Vol. 1 (1): 25-30
The Biomechanical Foundation of Clinical Orthodontics; Chapter 6 + 7.
6. *March 7, 2020*
Biomechanics in Orthodontics: Principles and Practice; Chapter 8.
The Biomechanical Foundation of Clinical Orthodontics; Chapter 5.
7. *March 14, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 9.
The Biomechanical Foundation of Clinical Orthodontics; Chapter 14.
8. *March 29, April 4, 2021*
Orthodontic Applications of Biomaterials; A Clinical Guide. Theodore Eliades, William A. Brantley. Woodhead Publishing; 1st Edition 2017. ISBN: 978-0081003831.
Orthodontic Materials: Scientific and Clinical Aspects. William A. Brantley, Theodore Eliades. Thieme; 1st Edition 2001. ISBN: 978-0865779297.
The Biomechanical Foundation of Clinical Orthodontics; Chapter 20.
9. *April 11, 2021*
Biomechanics in Orthodontics: Principles and Practice; Chapter 4
The Biomechanical Foundation of Clinical Orthodontics; Chapter 19.
10. *April 18, 2021*
The Biomechanical Foundation of Clinical Orthodontics; Chapter 18
Orthodontic Biomechanics: Treatment of Complex Cases Using Clear Aligner. Tarek El-Bialy, Sam Daher, Donna Galante; 1st Edition 2016. ISBN: 978-1681083124.



COURSE SCHEDULE

Week	Date	Content
1.	2021 JAN 17 1442 06 04	COURSE INTRODUCTION: BIOMATERIALS & TREATMENT MECHANICS LECTURE: UNDERSTANDING FORCES AND MOMENTS, PRINCIPLES OF STATICS
2.	2021 JAN 24 1442 06 11	<i>Biomechanics</i> LECTURE: FORCE APPLICATION AND TOOTH MOVEMENT
3.	2021 JAN 31 1442 06 18	<i>Biomechanics</i> LECTURE: TWO-COUPLE MECHANICS
4.	2021 FEB 7 1442 06 25	<i>Biomechanics</i> DR. GERALD S. SAMSON LECTURE: ADDITIVE AND SUBTRACTIVE FORCES*
5.	2021 FEB 14 1442 07 02	<i>Biomechanics</i> LECTURE: ANCHORAGE CONSIDERATIONS, MOLAR CONTROL, EXTRAORAL FORCES
6.	2021 FEB 21 1442 07 09	<i>Biomechanics</i> LECTURE: STAGE 1 TREATMENT MECHANICS: ALIGNMENT, LEVELING, CORRECTION OF VERTICAL AND TRANSVERSE DISCREPANCIES
7.	2021 FEB 28 1442 07 16	<i>Biomechanics</i> DR. GERALD S. SAMSON LECTURE: DEEP BITE CORRECTION*
8.	2021 MAR 7 1442 07 23	<i>Biomechanics</i> LECTURE: STAGE 2 TREATMENT MECHANICS: CORRECTING MOLAR RELATIONSHIP
9.	2021 MAR 14 1442 08 01	<i>Biomechanics</i> LECTURE: STAGE 3 TREATMENT MECHANICS: SPACE CLOSURE
10.	2021 MAR 21 1442 08 08	<i>Biomaterials – LECTURE; Dr. Mohammed S. Alkatheeri, Division of Dental Biomaterials, KSU</i> A REVIEW OF DENTAL BIOMATERIALS STRUCTURES <small>Inter-atomic Bonding, Crystal Lattices and Structures, Structural Defects, Surface Properties, Mechanical Properties, Biocompatibility and its Measurements</small>
11.	2021 MAR 28 1442 08 15	<i>Biomaterials</i> LECTURE: 1. Bonding with Orthodontic Adhesives, 2. Orthodontic Ligatures and Chains - Paul Gange, Lecture: Reducing Bond Failures with the Proper Materials and Techniques**
12.	2021 APR 4 1442 08 22	<i>Biomaterials</i> LECTURE: PRINCIPLES OF STRUCTURES AND PROPERTIES OF ORTHODONTIC WIRES <small>Desirable Properties, Wire Alloys, Brackets Slot-Archwire Friction</small>
13.	2021 APR 11 1442 08 29	<i>Biomechanics</i> LECTURE: THE ROLE OF FRICTION IN ORTHODONTIC APPLIANCES
14.	2021 APR 18 1442 09 06	<i>Biomechanics</i> LECTURE: ADVANCED APPLIANCE THERAPY; TAD's, CLEAR ALIGNERS
15.	2021 MAY 23 1442 10 11	FINAL EXAMINATION

*Dr. Gerald S. Samson Lectures available at: <https://gnathosce.com>

**Mr. Paul Gange, Lecture, AAO 2015 Annual Session, San Francisco, May 15-19, 2015.