

# **Maksillada Uygulanan Farklı All-on-4 Konseptlerinde Oklüzyon Tiplerine Göre Stres Dağılımlarının İncelenmesi**

Dt. Delâl Bozyel

Tez Danışmanı: Doç. Dr. Simge Taşar Faruk

Slide 1

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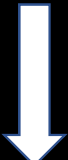
MOU2

Microsoft Office User, 28/07/2021



Günümüzde dental implantlar tam ve kısmi di siz hastaların rehabilitasyonunda sıklıkla tercih edilmekte olup, yüksek başarı oranları sergilemektedirler.





M.Ö. 2637  
M.Ö.3201

M.Ö. 600

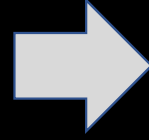
1800

1952

1990

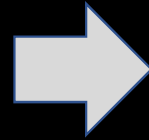


**Hasta ile  
li kili  
Faktörler**



- Ya
- Cinsiyet
- Sistemik Sağlık Durumu
- Sigara Kullanımı
- Kemik Kalitesi
- Oral Hijyen

**implant  
ile li kili  
Faktörler**



- Boy
- Çap
- Yüzey özellikleri
- Lokasyonu
- Yerleştirme Zamanı
- Yükleme Protokolü

# OSSEO NTEGRASYON BA ARI KR TERLER

Mobilite olmaması

Kemik kaybı  
miktarı  $< 0.2\text{mm}$

Radyolüsent  
görüntü olmaması

lk 5 yıl  $\rightarrow$  %85

lk 10 yıl  $\rightarrow$  %80

BA ARI

Albrektsson ve arkadaşları  
(1986)



(Lee ve di erleri, 2005)



# DENTAL MPLANTLARIN SINIFLANDIRILMASI

Cerrahi Açıdan  
Yükleme  
Zamanına Göre

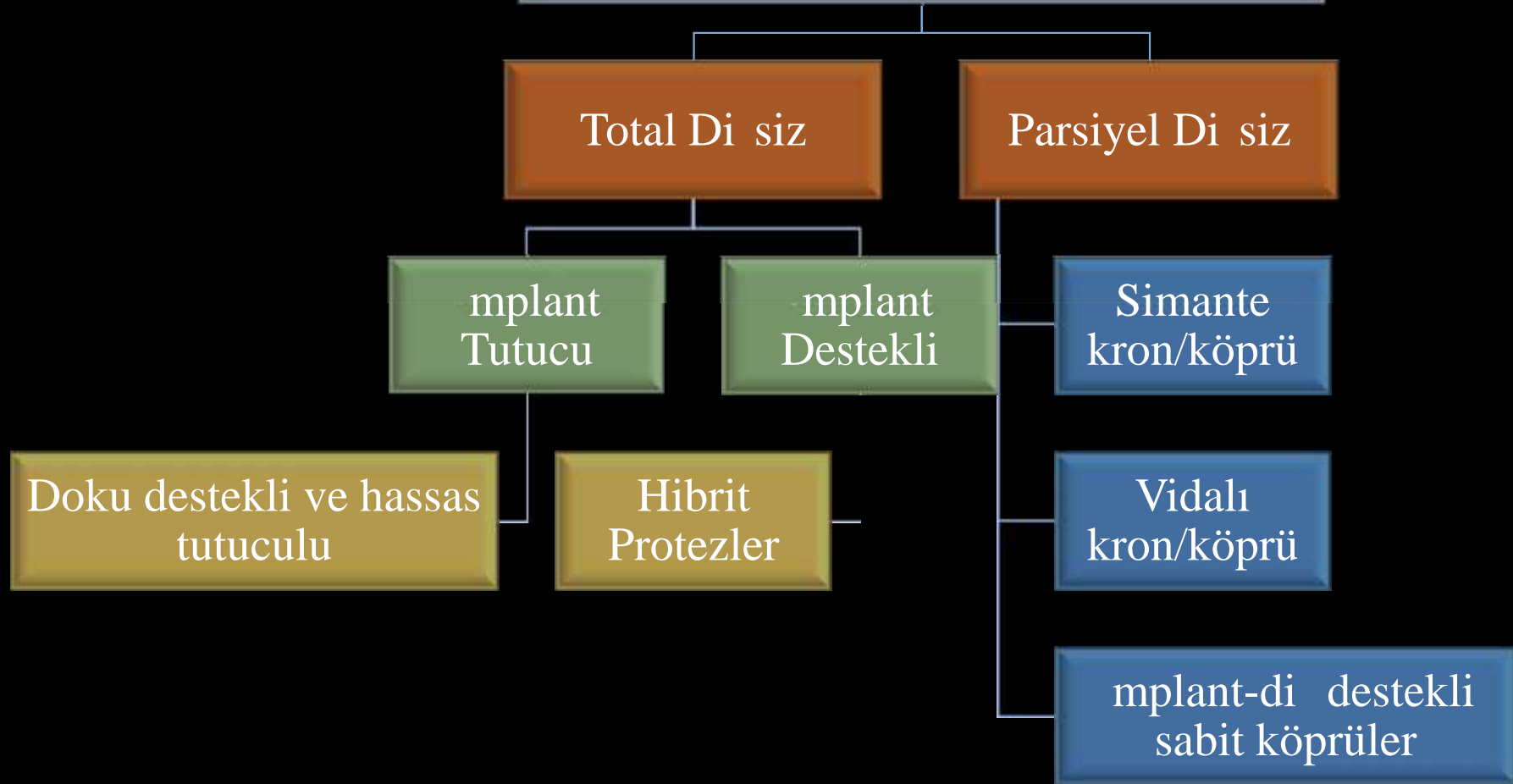
Kullanılan  
Materyale Göre

Yerle tirme  
Zamanına Göre

Protetik Yapıya  
Göre

Biyomekanik  
Faktörlere Göre

# DİKSİONLER GÖRE



# H BR T PROTEZLER



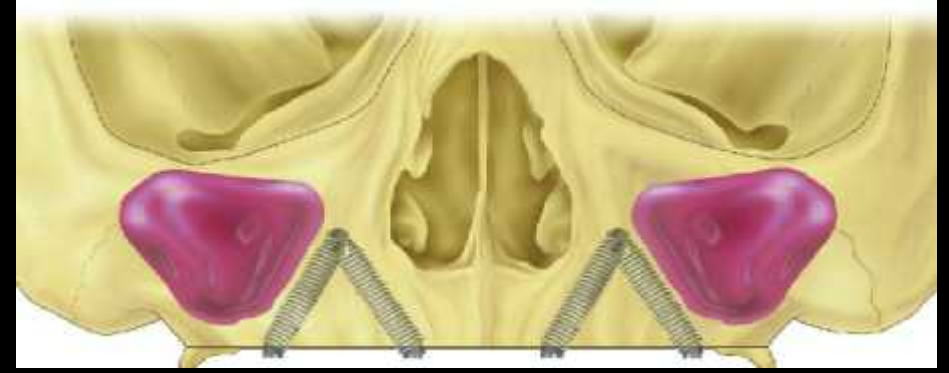
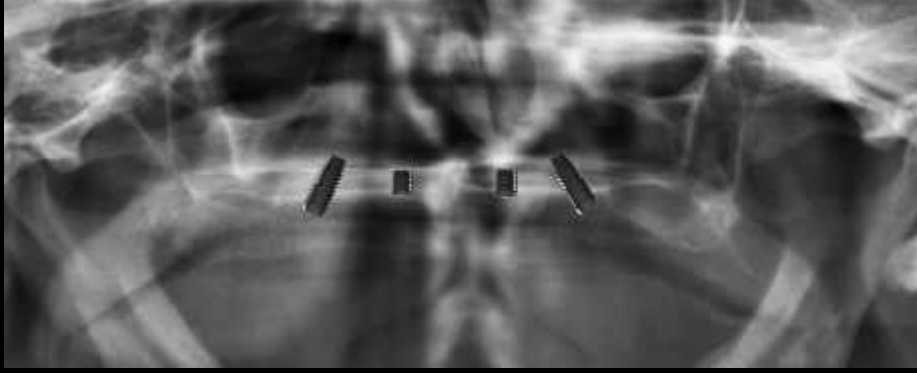
- ✓ Yüksek estetik özellik
- ✓ Dinamik kuvvetleri azaltma
- ✓ Tamiri kolay





Posterior  
↓  
distale e imlendirilmi implant

Anterior  
↓  
aksiyal implant



<b>Anterior</b>	<b>Posterior</b>
Kısa mplant	
Uzun Açılı mplant (M-4)	Uzun Açılı mplant

## MAKSİLLA

## MANDİBULA

Kemik Geni li i: 5 mm  
Kemik Yüksekli i: 10 mm

Kemik Geni li i: 5 mm  
Kemik Yüksekli i: 8 mm



# OKLÜZYON

Bilateral Balanslı  
Oklüzyon

Grup Fonksiyon  
Oklüzyon

Kanin Koruyuculu  
Oklüzuyon

**Sabit protetik restorasyon**

**Do al dentisyon**

**Misch, 1999**

Kar ılıklı koruyucu oklüzyon

Kar ılıklı koruyucu oklüzyon

**\* implant üstü sabit protez tedavisinde oklüzal kuvvetlerin dengeli dağılımı\***



- ❖ Maksimum bilateral interküsPAL temas
  - ❖ Sentrikte serbestlik
- ❖ Prematür temasların eliminasyonu



# STRES ANALİZ YÖNTEMLERİ

Fotoelastik Yöntem

Holografik  
interferometre

Kırılma Vernik

Gerinim Ölçer

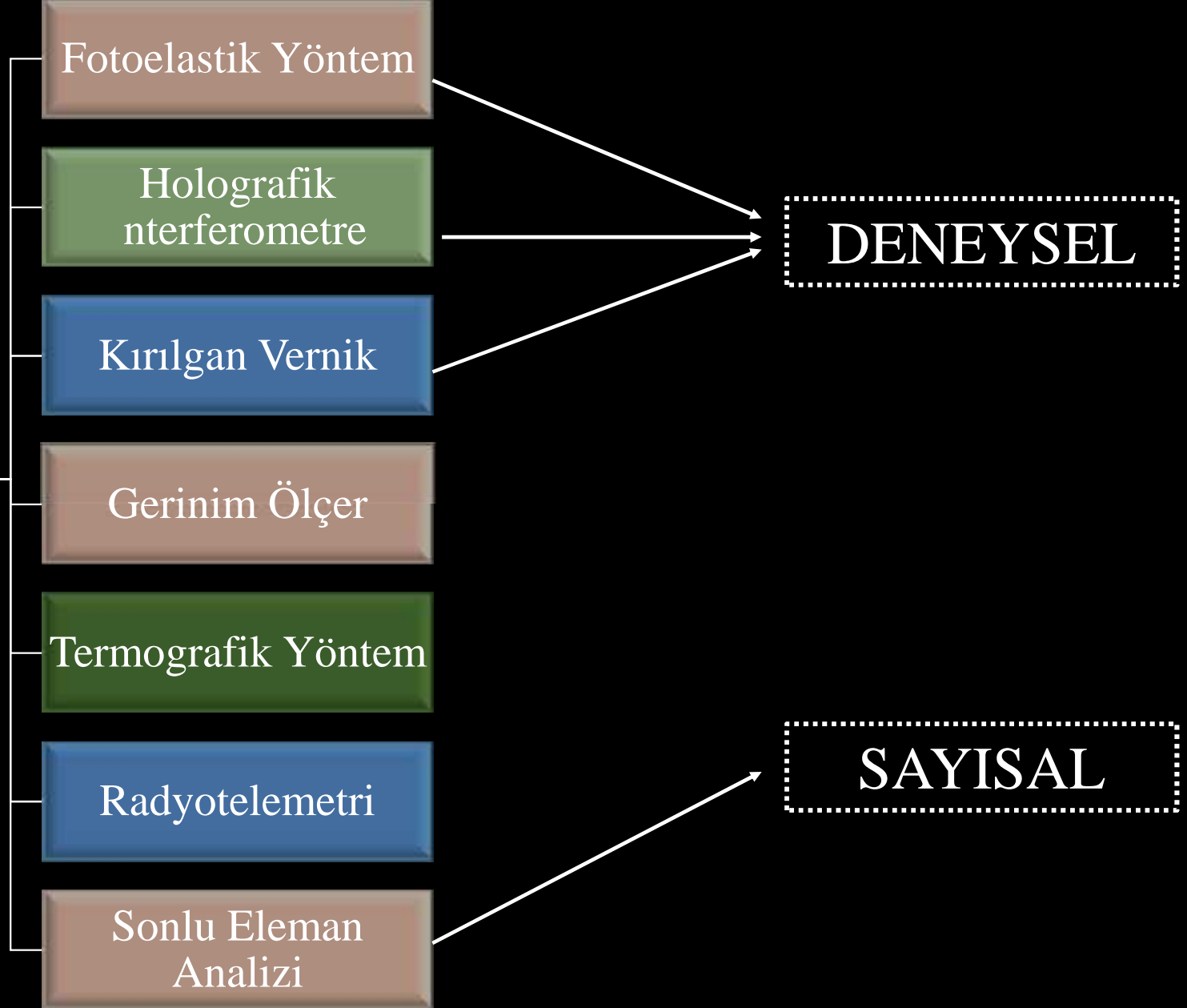
Termografik Yöntem

Radyotelemetri

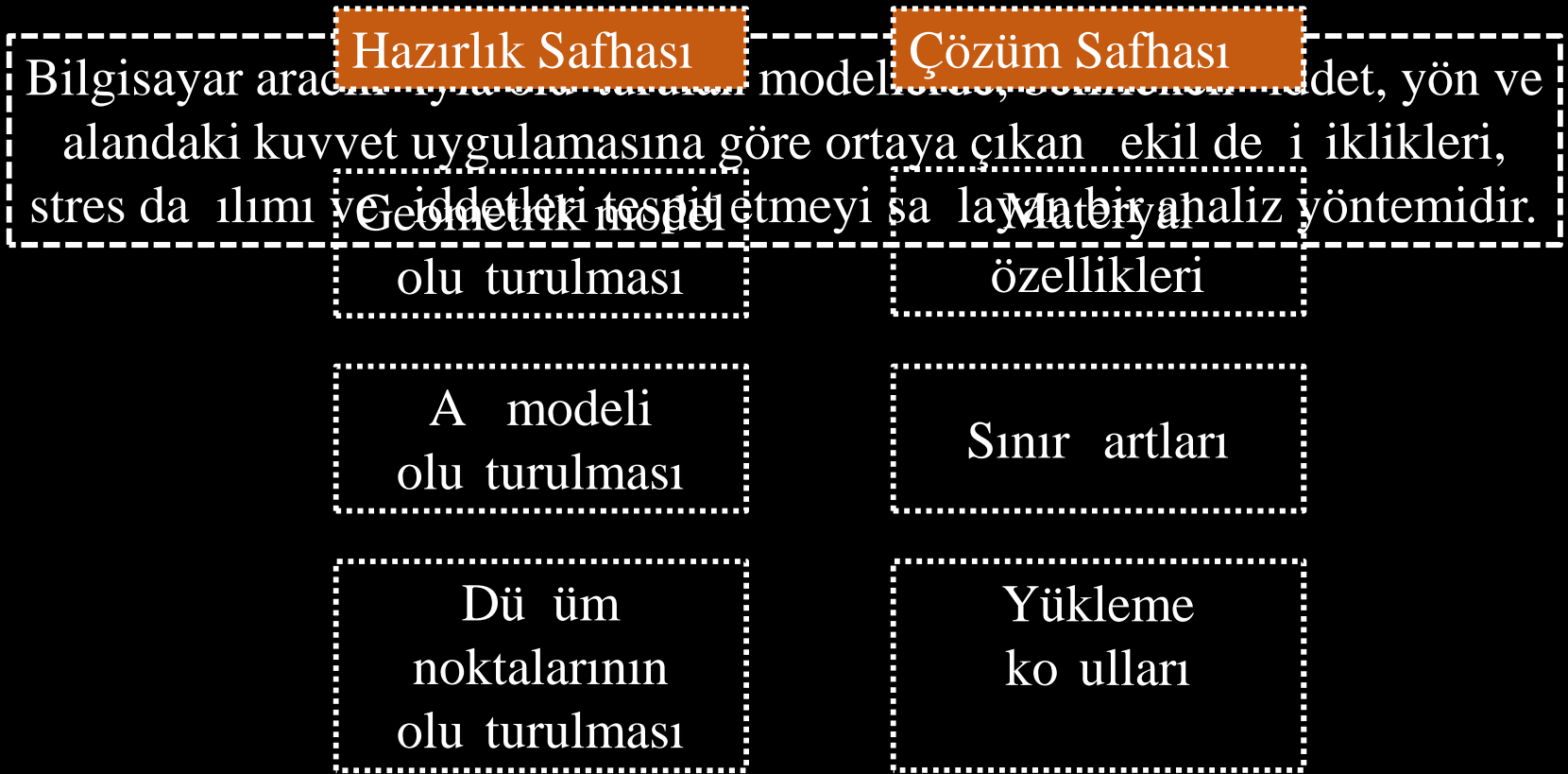
Sonlu Eleman  
Analizi

DENEYSEL

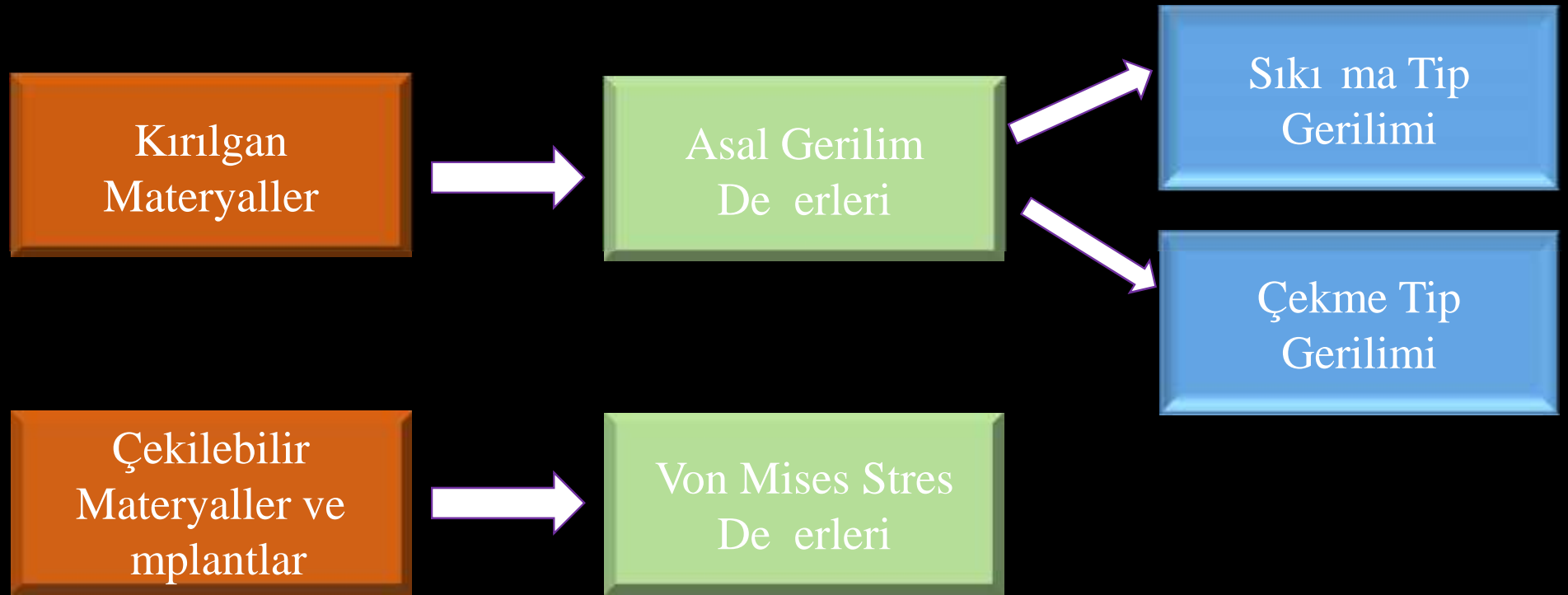
SAYISAL



# SONLU ELEMENLAR ANALIZ



# SONLU ELEMANLAR ANALİZ



# SONLU ELEMANLAR ANALİZ

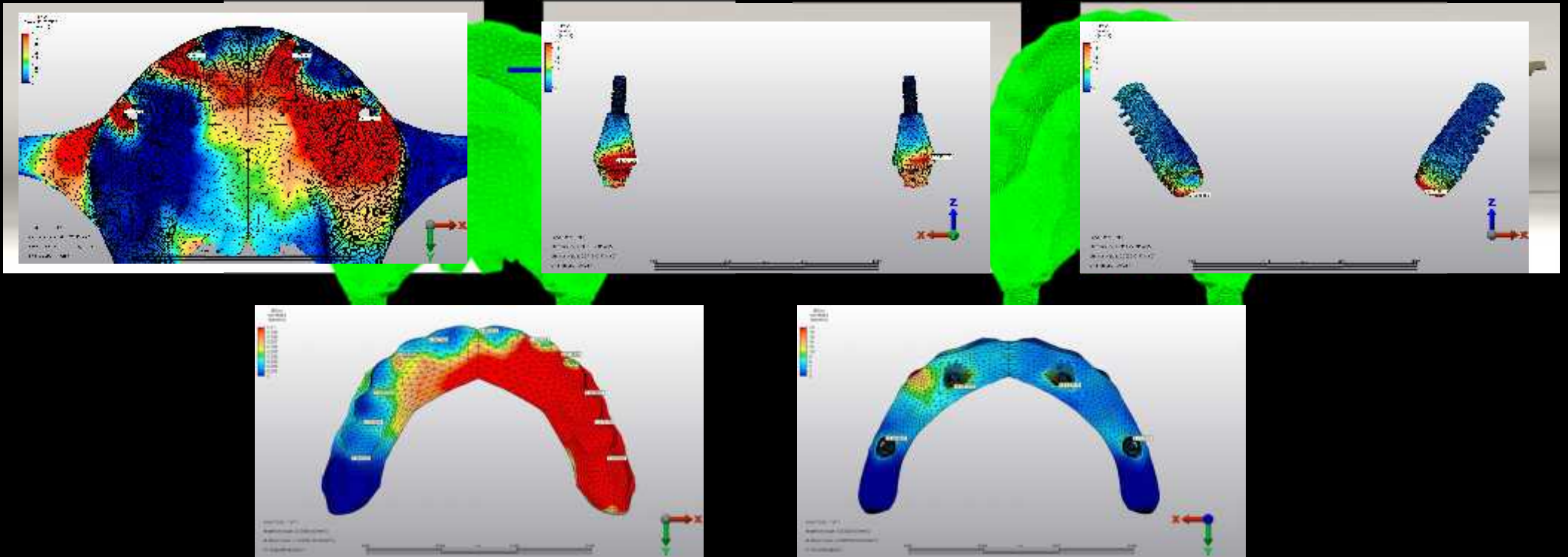
## İ Sonuçların Değerlendirilme Safhası



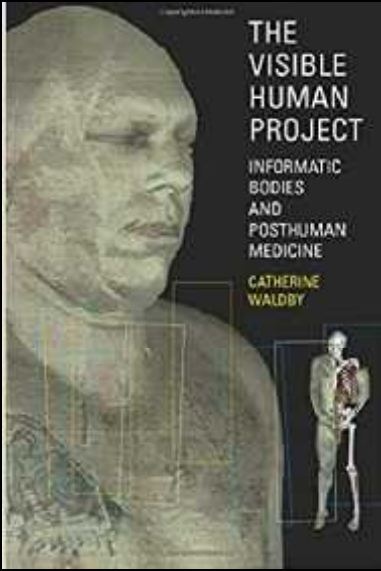
# GEREÇ VE YÖNTEM



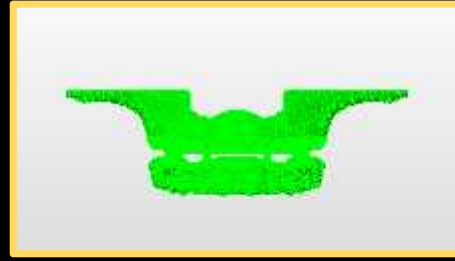
- Oklüzyonlara ve modellere göre üst yapılarda, alt yapılarda ve kemikte meydana gelen streslerin üç boyutlu sonlu elemanlar analizi



# HAZIRLIK SAFHASI



Visible Human Project verileriyle kemik dokuları olu turulması



Materyal bilgilerinin bilgisayara aktarılması



Kemik, üst yapı ve alt yapıların modellenmesi



Uyumlandırma yapılması

# HAZIRLIK SAFHASI

1 Intel Xeon ® R CPU 3,30 GHz i lemci, 500gb  
Hard disk 14 GB RAM donanımlı



4 Rhinoceros 4.0 3 boyutlu modelleme  
yazılımından



2 Windows 7 Ultimate Version Service Pack 1  
i letim sistemi olan bilgisayar



5 VRMesh Studio ve Algor SEA  
proanaliz

3 Activity 880 optik tarayıcısı ile 3 boyutlu  
tarama



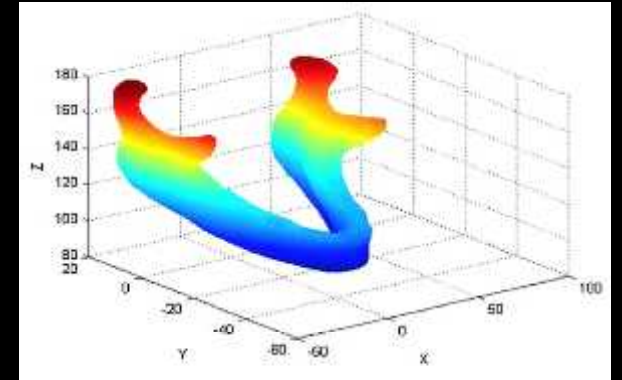


# HAZIRLIK SAFHASI

SmartOptics 3 boyutlu  
tarayıcı



nda  
r



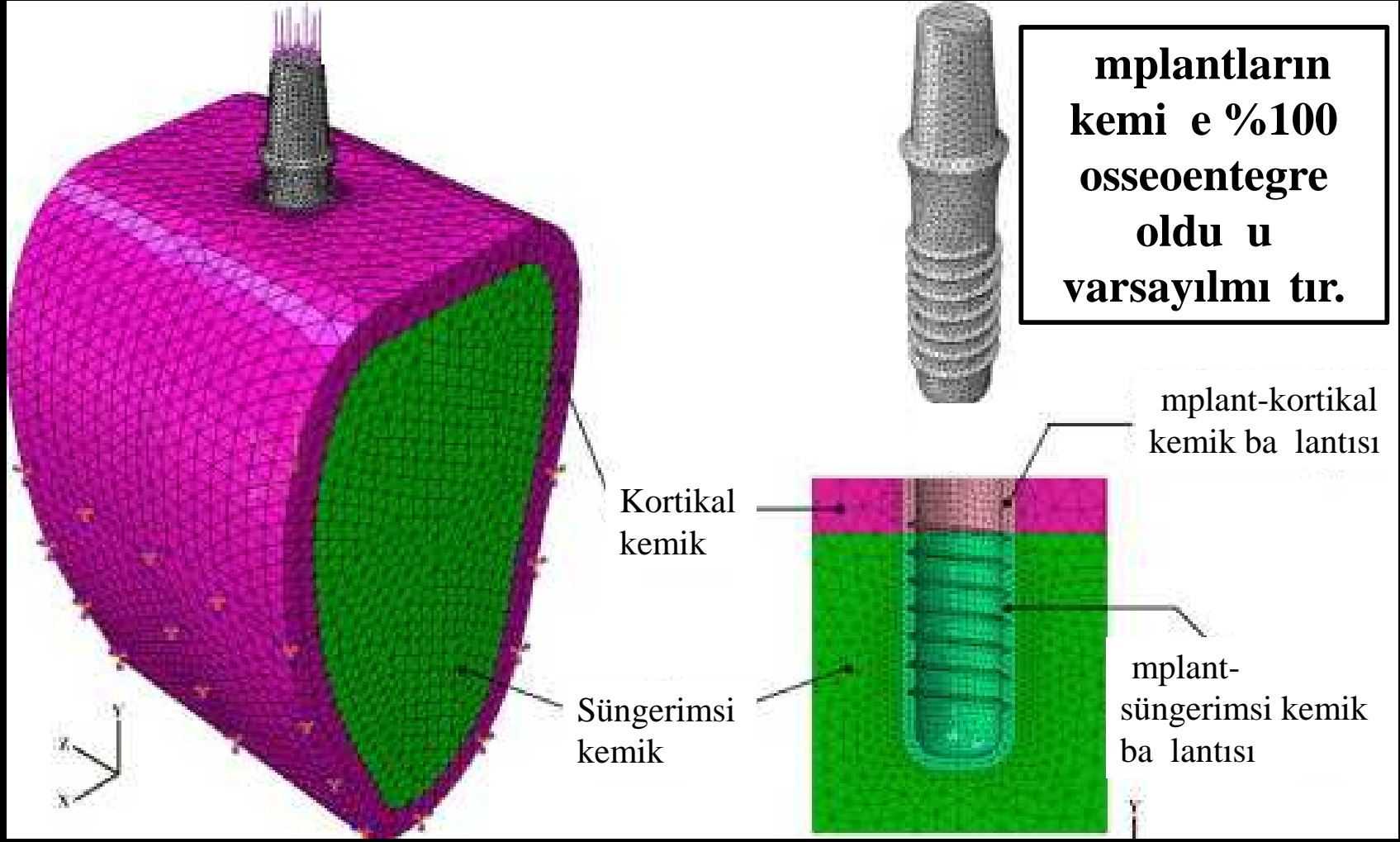
Boolean yöntemi  
(iki ayrı a ın üst üste binen veya çakı an  
nokta eliminasyonu)



Dört yüzlü ö eler a 1 olu turulması

(Graysmith ve Shaw, 1997)

# HAZIRLIK SAFHASI



## HAZIRLIK SAFHASI

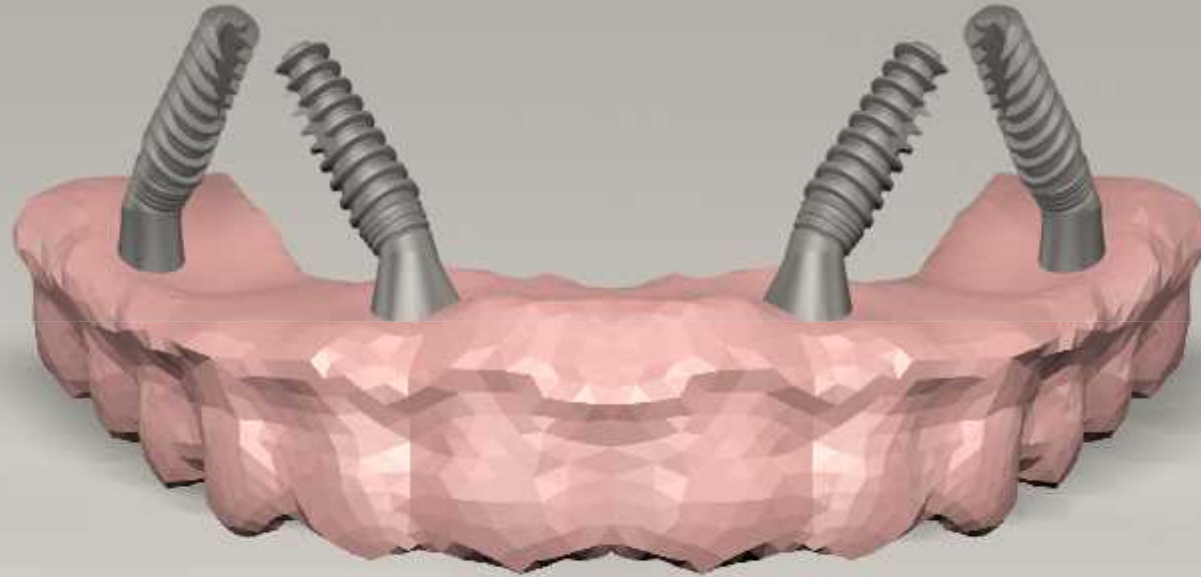
	Eleman/Dü üm Sayısı
<b>Model-1</b>	Dü üm sayısı = 239535 Eleman sayısı = 1287365
<b>Model-2</b>	Dü üm sayısı = 236975 Eleman sayısı = 1264149
<b>Model-3</b>	Dü üm sayısı = 235680 Eleman sayısı = 1210772

Modeller ve kemik için  
mümkün oldu unca fazla  
eleman sayısı seçilmi tir.

## ÇÖZÜM SAFHASI

	Poisson's Oranı	Elastik Modülü
<b>Titanyum implant</b>	0.35	110000
<b>Titanyum Altyapı</b>	0.28	110000
<b>Kortikal Kemik</b>	0.30	13700
<b>Süngerimsi Kemik</b>	0.30	1370
<b>PMMA</b>	0.35	3000

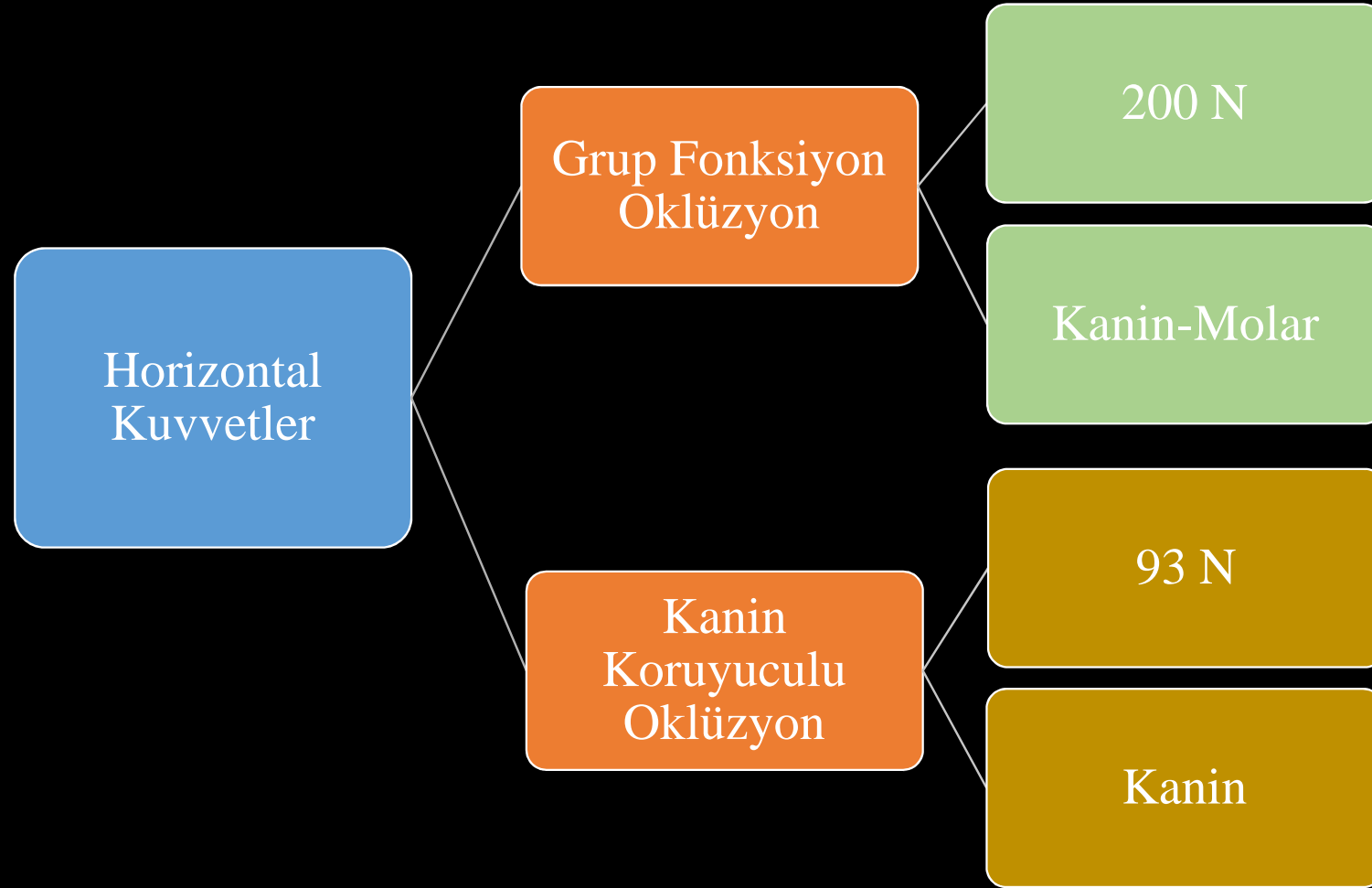
## Grup Fonksiyon Oklüzyon



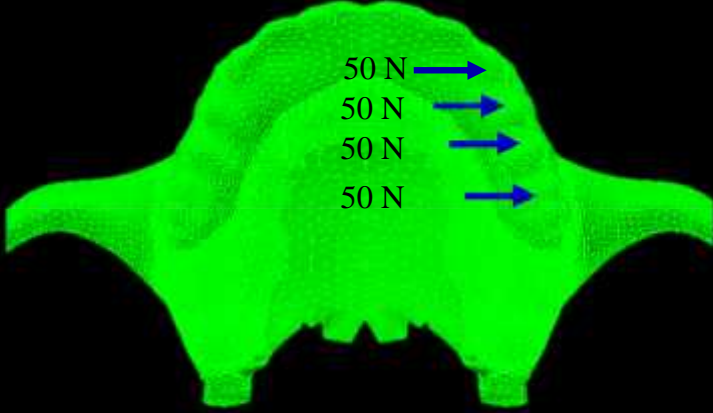
Model-3

## Kanin Koruyuculu Oklüzyon

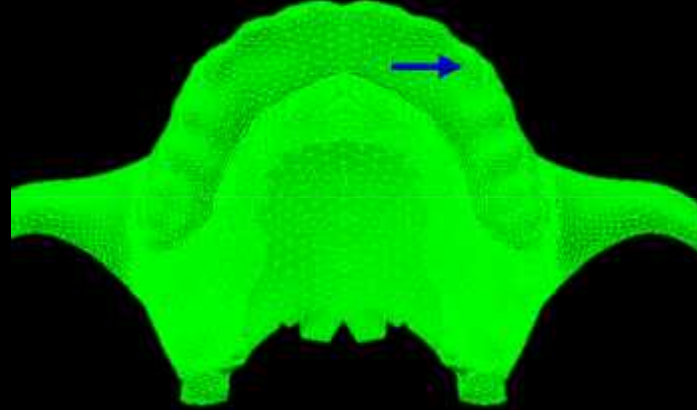
# ÇÖZÜM SAFHASI



# YÜKLEME KOULLARI



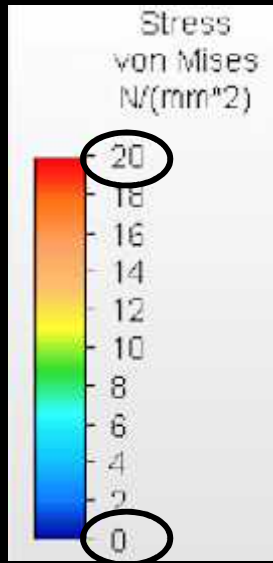
200 N



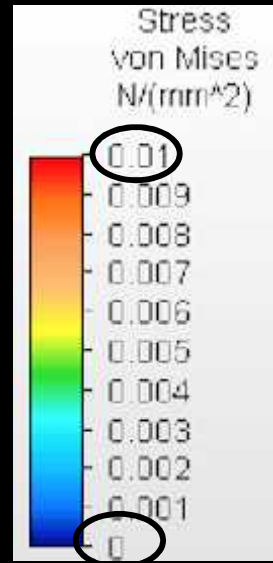
93 N

# SONUÇLARIN DEĞERLENDİRİLMESİ

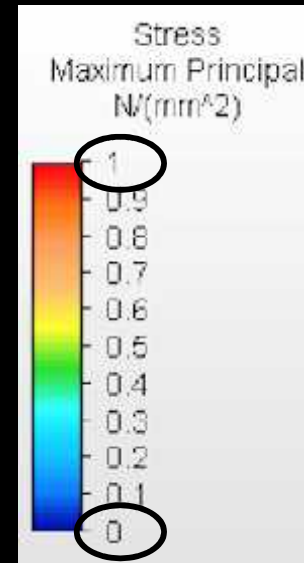
## SAFHASI



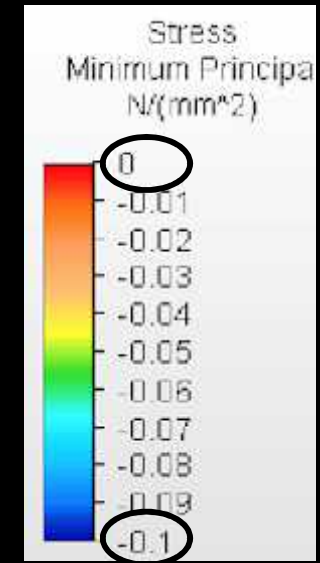
Maksimum asal gerilimler  
0.1-0/ 0-1 N/mm<sup>2</sup>



Minimum asal gerilimler  
0-1 N/mm<sup>2</sup>



von Mises stresler  
0-1 / 0-20 N/mm<sup>2</sup>





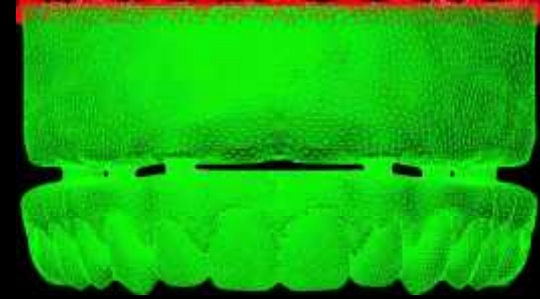
## SONUÇLARIN DEĞERLENDİRİLMESİ SAFHASI

Elde edilen değerler sayısal kararla tırmaya tabi tutulmuştur.

Sonlu eleman analizi çalışmalarında elde edilen sayısal değerler sabit değerler olduğundan, istatistiksel analizler gerekmemektedir.

# STANDARD ZASYON

- Osseointegrasyon seviyesi (%100)
- Kemik tipi (atrofik premaksilla)
- Sınır ko ulları (çene kemi i sabit)
- Kuvvet miktarı (200 N ve 93 N)
- Kuvvet yönü (Horizontal)

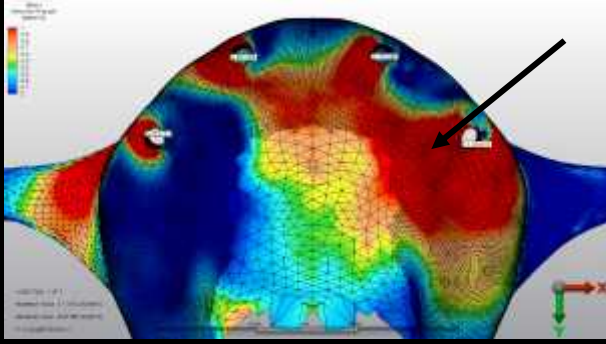


**BULGULAR**

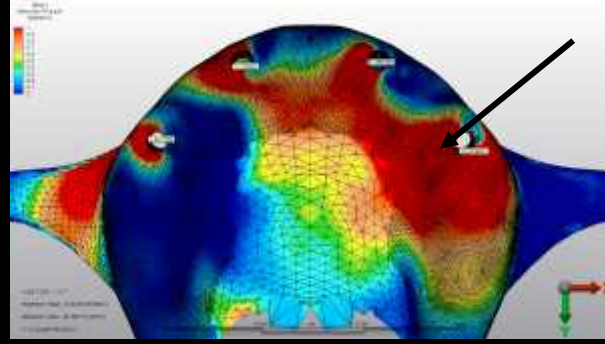
## ALVEOLER KEMİK (Pmax)

Grup Fonksiyon Oklüzyon	Mpa	Dengeleyen taraf-Posterior	Dengeleyen taraf-Anterior	Çalışan Taraf-Anterior	Çalışan Taraf-Posterior
Model-1	Kortikal Kemik	6,45	6,99	5,72	21,83
	Süngerimsi Kemik	0,36	0,68	0,44	2,34
Model-2	Kortikal Kemik	6,69	7,73	6,09	22,83
	Süngerimsi Kemik	0,34	0,48	0,30	2,19
Model-3	Kortikal Kemik	7,78	7,22	7,19	21,95
	Süngerimsi Kemik	0,21	0,40	0,43	1,89

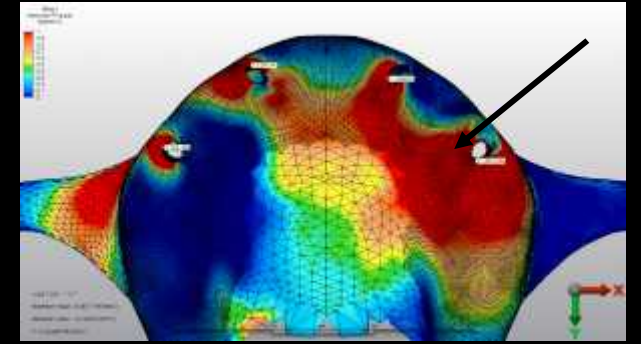
Kanin Koruyuculu Oklüzyon	Mpa	Dengeleyen taraf-Posterior	Dengeleyen taraf-Anterior	Çalışan Taraf-Anterior	Çalışan Taraf-Posterior
Model-1	Kortikal Kemik	5,52	5,73	3,38	4,75
	Süngerimsi Kemik	0,26	0,20	0,21	0,79
Model-2	Kortikal Kemik	6,70	6,45	3,43	4,87
	Süngerimsi Kemik	0,21	0,12	0,18	0,75
Model-3	Kortikal Kemik	6,58	3,73	3,70	5,68
	Süngerimsi Kemik	0,17	0,19	0,20	0,57



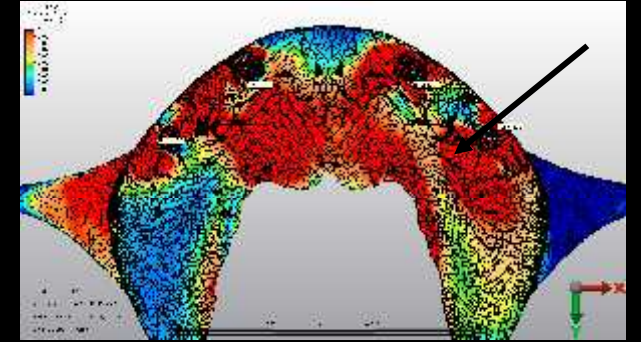
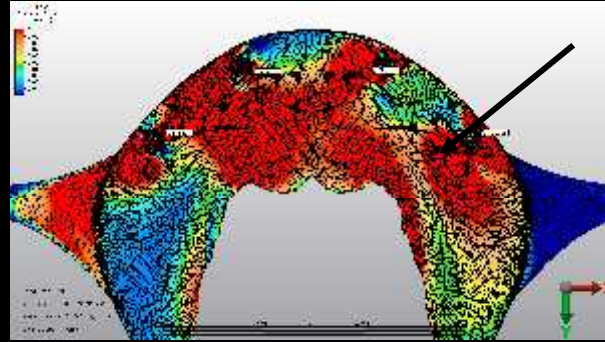
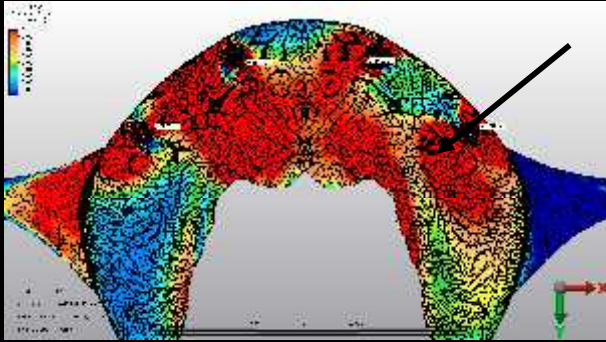
Model-1



Model-2



Model-3

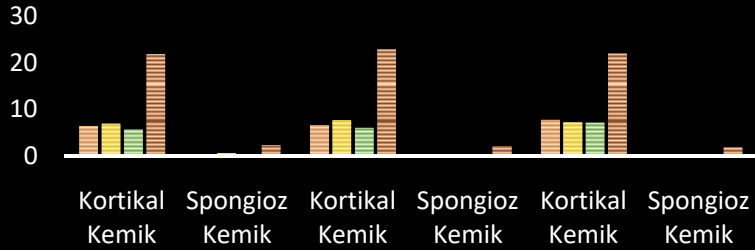


Kortikal Kemik

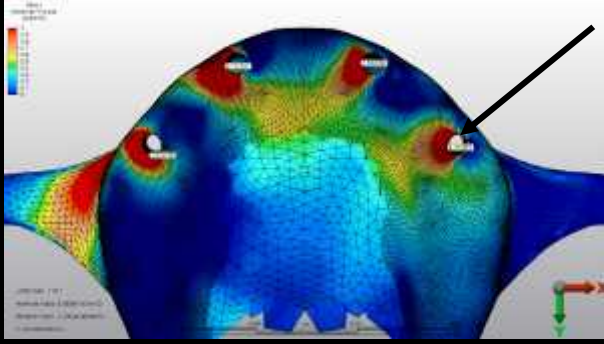
Süngerimsi Kemik

Pmax Stres De erleri

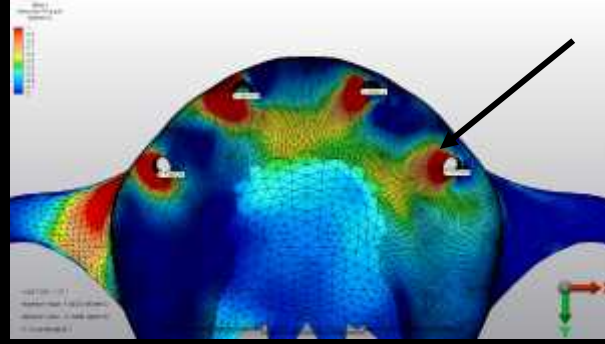
■ Dengeleyici taraf-Posterior    ■ Dengeleyici taraf-Anterior  
■ Çalışan Taraf-Anterior    ■ Çalışan Taraf-Posterior



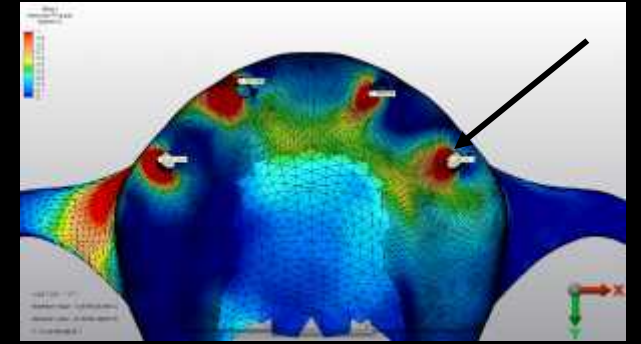
**Grup  
Fonksiyon  
Oklüzyon**



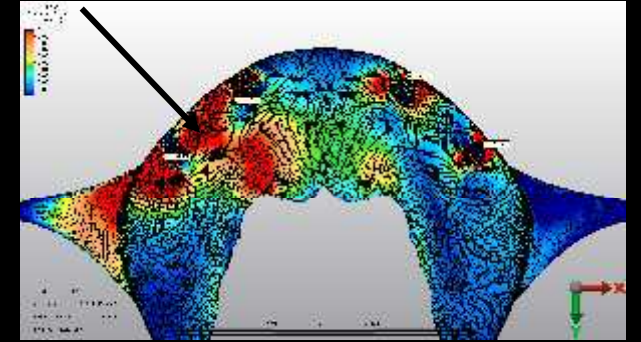
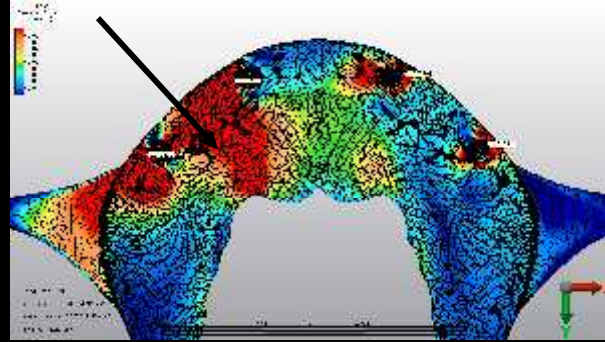
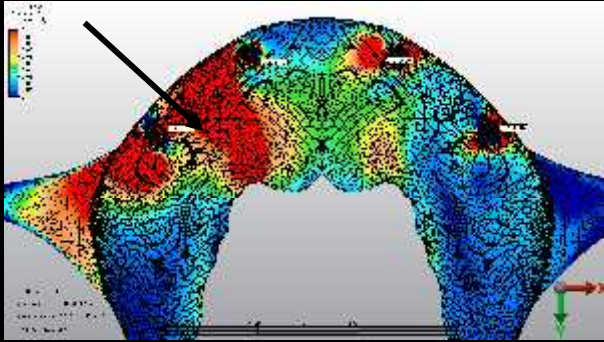
Model-1



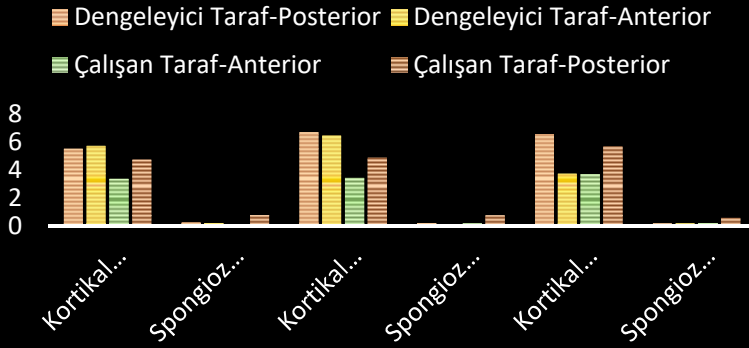
Model-2



Model-3



Pmax Stres De erleri



Kortikal Kemik

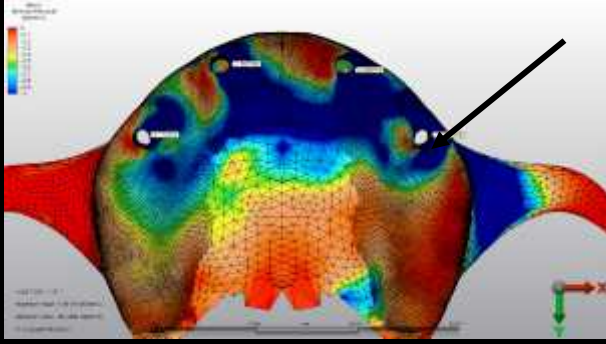
Süngerimsi Kemik

**Kanin  
Koruyuculu  
Oklüzyon**

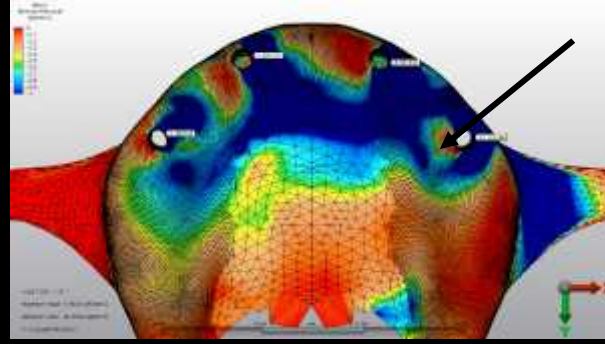
# ALVEOLER KEMİK (P<sub>min</sub>)

Grup Fonksiyon Oklüzyon	MPa	Dengeleyen Taraf- Posterior	Dengeleyen Taraf- Anterior	Çalı an Taraf- Anterior	Çalı an Taraf- Posterior
Model-1	Kortikal Kemik	-3,71	-7,50	-6,45	-26,25
	Süngerimsi Kemik	-0,64	-0,28	-0,34	-1,05
Model-2	Kortikal Kemik	-3,38	-6,80	-8,33	-27,18
	Süngerimsi Kemik	-0,67	-0,37	-0,32	-1,02
Model-3	Kortikal Kemik	-5,34	-9,24	-3,36	-28,92
	Süngerimsi Kemik	-0,39	-0,40	-0,39	-0,75

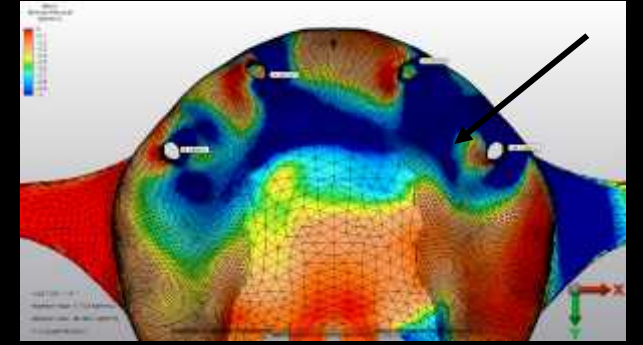
Kanin Koruyuculu Oklüzyon	Mpa	Dengeleyen Taraf- Posterior	Dengeleyen Taraf- Anterior	Çalı an Taraf- Anterior	Çalı an Taraf- Posterior
Model-1	Kortikal Kemik	-3,20	-4,41	-4,73	-8,71
	Süngerimsi Kemik	-0,42	-0,18	-0,17	-0,29
Model-2	Kortikal Kemik	-3,35	-4,17	-6,40	-9,32
	Süngerimsi Kemik	-0,45	-0,22	-0,19	-0,46
Model-3	Kortikal Kemik	-4,56	-4,69	-3,73	-9,31
	Süngerimsi Kemik	-0,27	-0,21	-0,14	-0,27



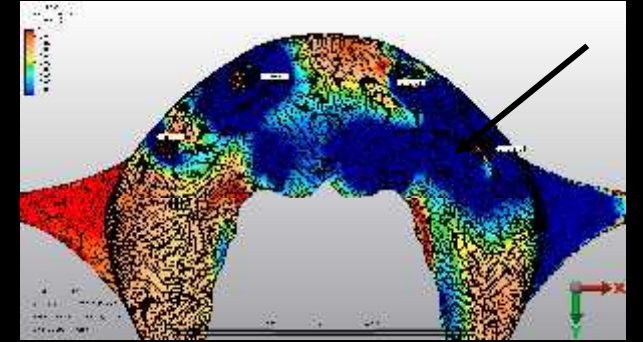
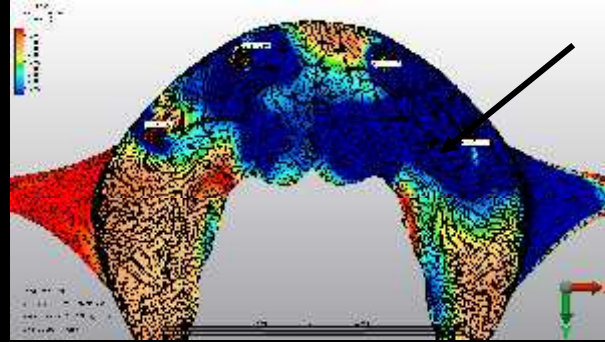
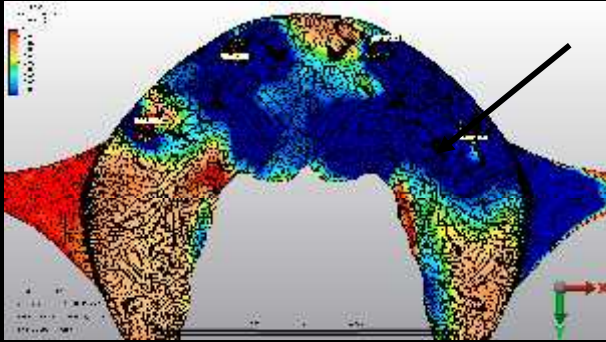
Model-1



Model-2



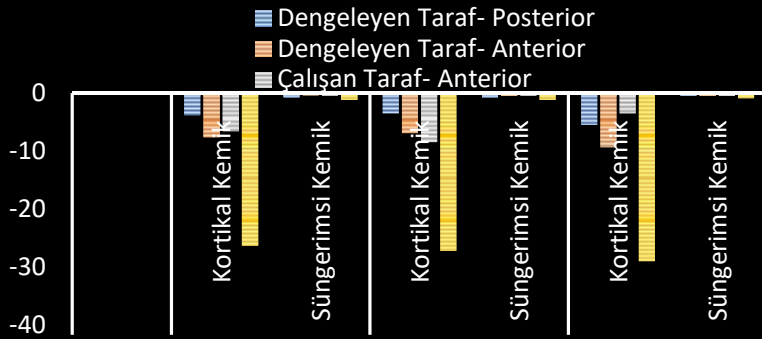
Model-3



Kortikal Kemik

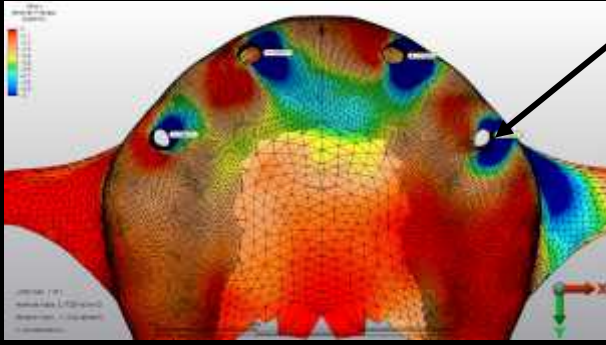
Süngerimsi Kemik

Pmin Stres De erleri

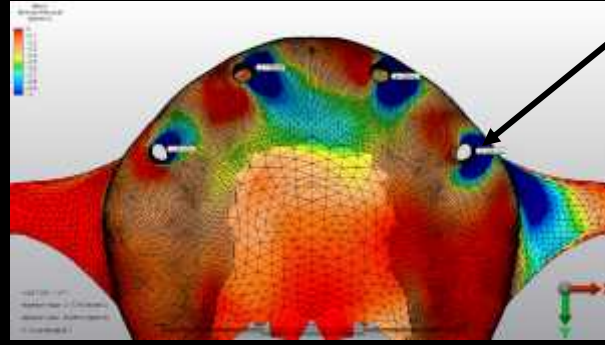


Grup  
Fonksiyon  
Oklüzyon

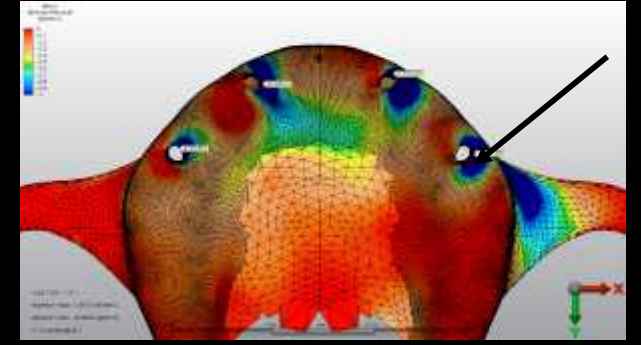




Model-1

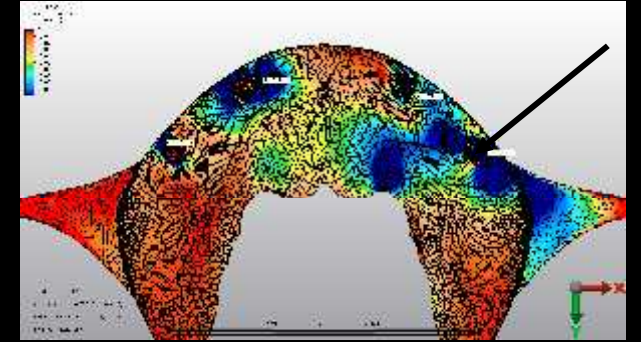
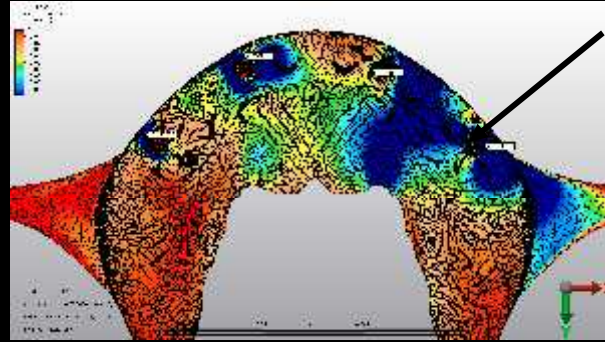
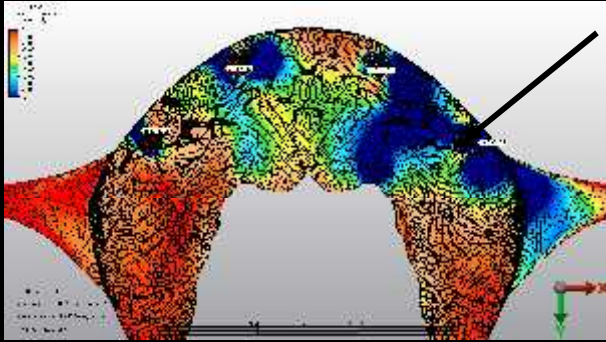


Model-2



Model-3

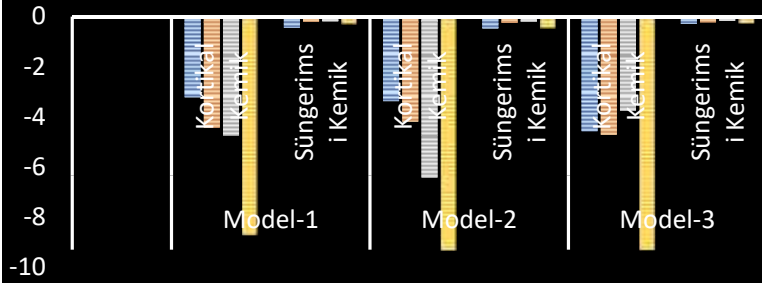
Kortikal Kemik



Süngerimsi Kemik

- Dengeleyen Taraf- Posterior
- Dengeleyen Taraf- Anterior
- Çalışan Taraf- Anterior
- Çalışan Taraf- Posterior

Pmin Stres De erleri



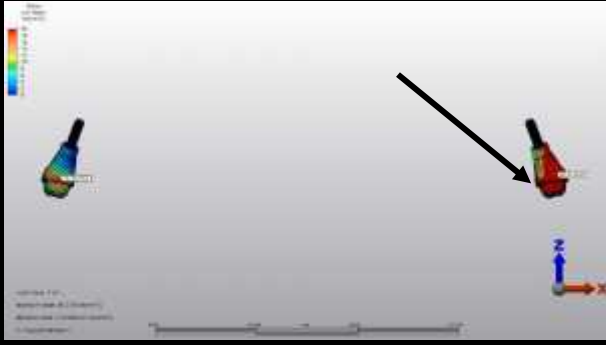
**Kanin  
Koruyuculu  
Oklüzyon**

# ABUTMENT (von Mises)

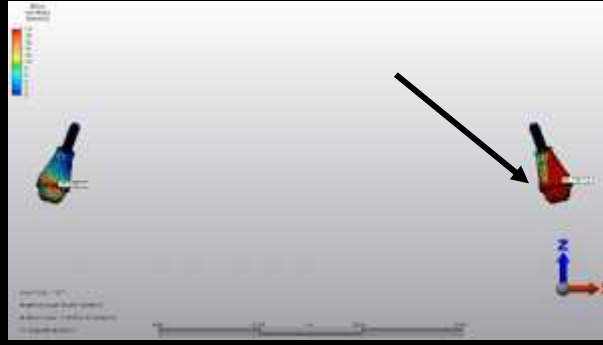
Grup Fonksiyon Oklüzyon	Mpa	Dengeleyen Taraf	Çalışan Taraf
Model-1	Posterior	18,26	80,95
	Anterior	20,78	35,35
Model-2	Posterior	19,33	82,15
	Anterior	22,05	35,16
Model-3	Posterior	17,76	86,29
	Anterior	29,3	28,71

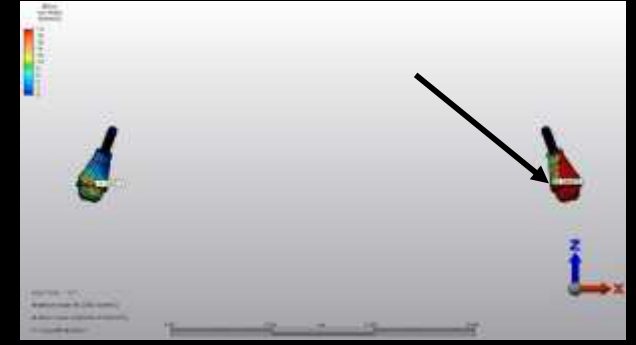
Kanin Koruyuculu Oklüzyon	Mpa	Dengeleyen Taraf	Çalışan Taraf
Model-1	Posterior	11,86	26,42
	Anterior	14,88	15,27
Model-2	Posterior	12,53	27,03
	Anterior	16,74	15,6
Model-3	Posterior	10,68	23,78
	Anterior	15,72	16,96



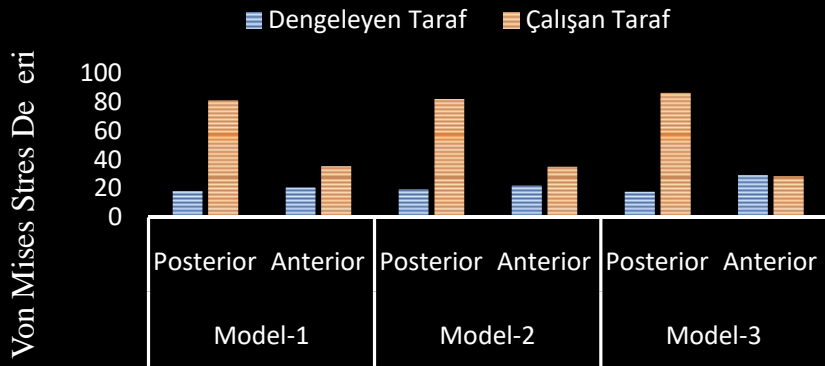
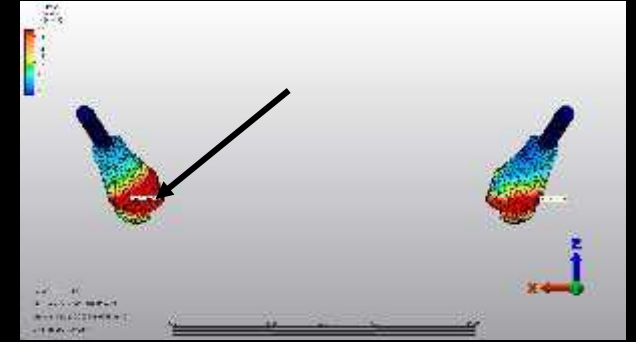
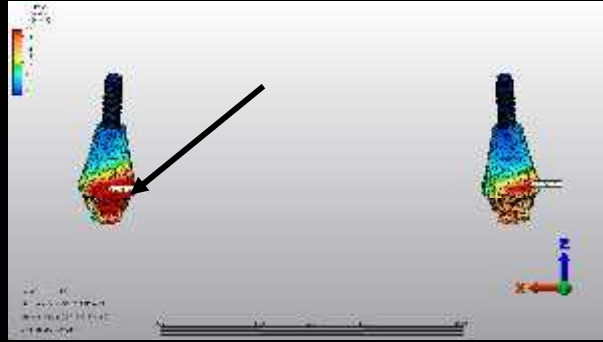
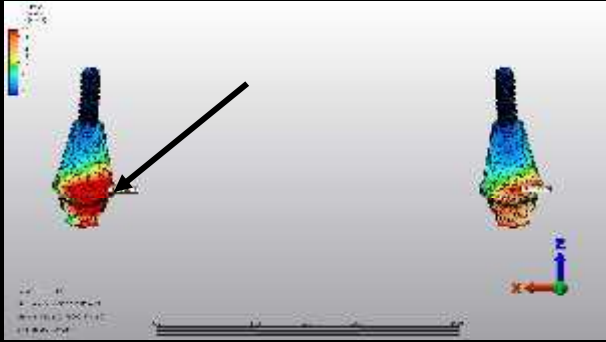
Model-1



Model-2



Model-3



**Grup  
Fonksiyon  
Oklüzyon**



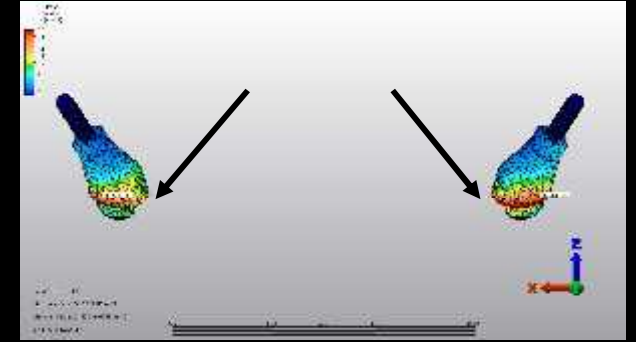
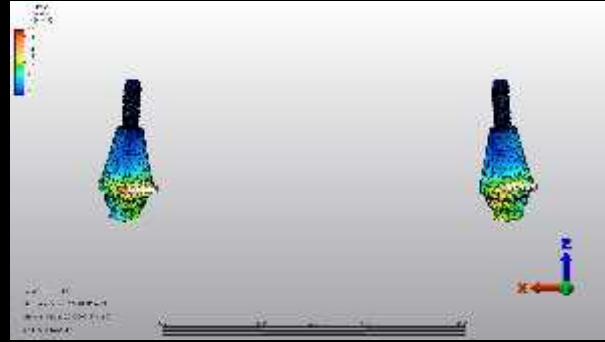
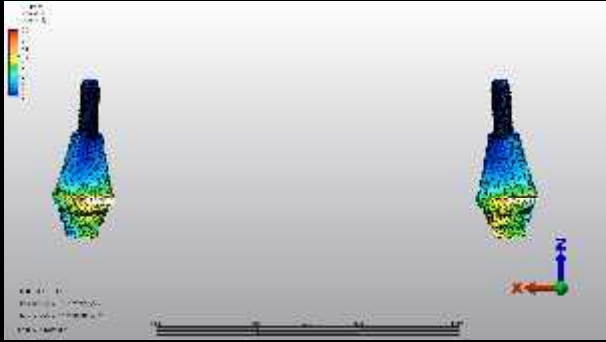
Model-1



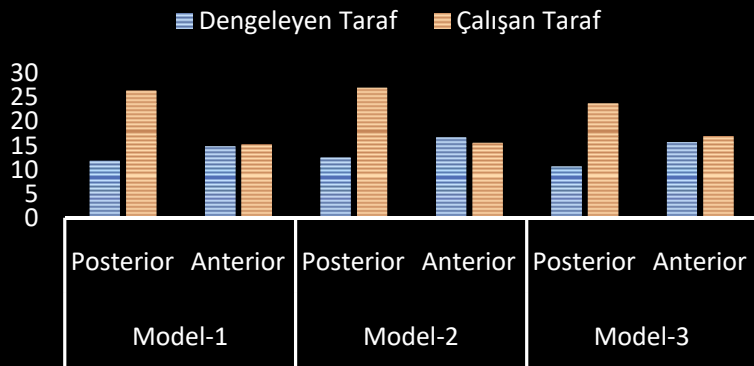
Model-2



Model-3



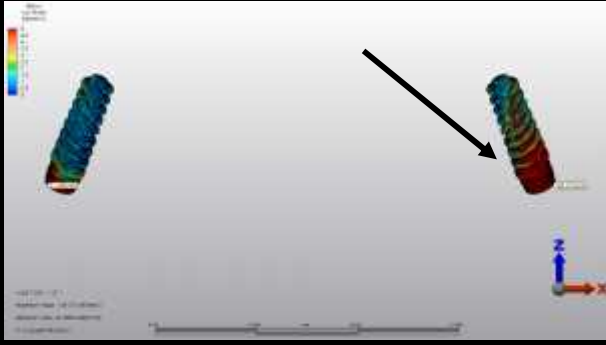
Von Mises Stres Değeri



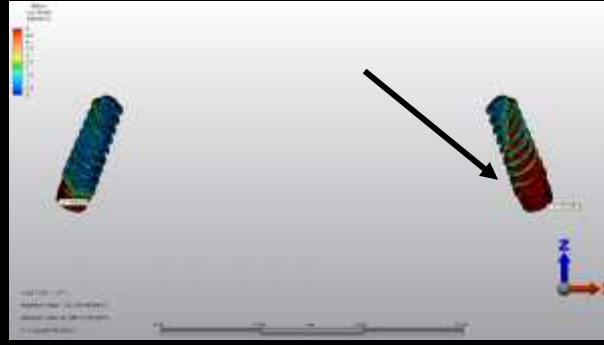
**Kanin  
Koruyuculu  
Oklüzyon**

# MPLANT (von Mises)

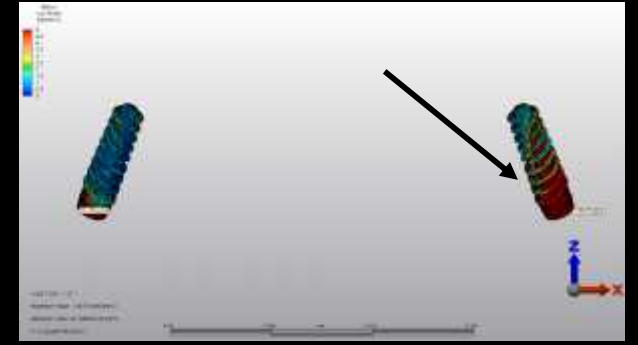
Grup Fonksiyon Oklüzyon	Mpa	Dengeleyen Taraf	Çalı an Taraf
Model-1	Posterior	21,50	139,37
	Anterior	33,53	45,31
Model-2	Posterior	22,18	132,25
	Anterior	33,59	48,20
Model-3	Posterior	20,25	139,87
	Anterior	27,58	34,62
Kanın Koruyuculu Oklüzyon	Mpa	Dengeleyen Taraf	Çalı an Taraf
Model-1	Posterior	15,79	39,29
	Anterior	18,99	23,72
Model-2	Posterior	17,77	36,88
	Anterior	19,77	23,35
Model-3	Posterior	16,44	38,42
	Anterior	20,72	17,36



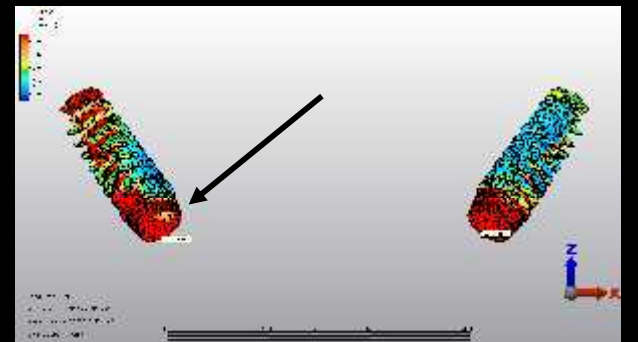
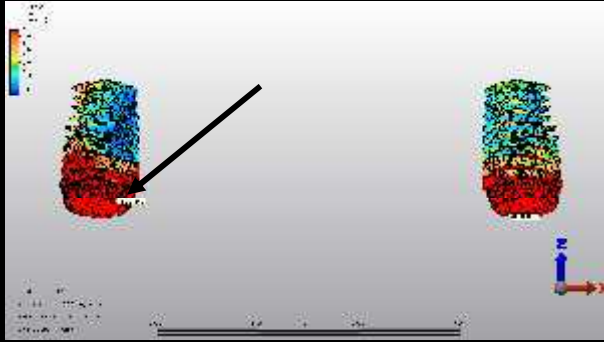
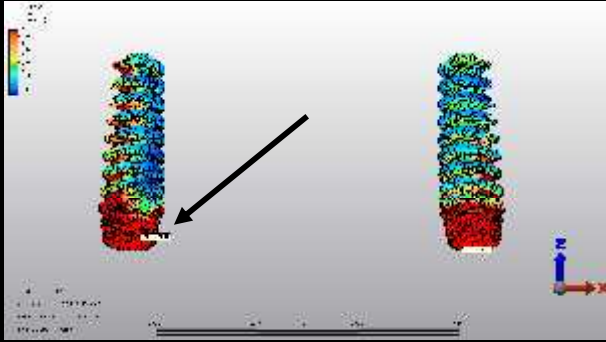
Model-1



Model-2

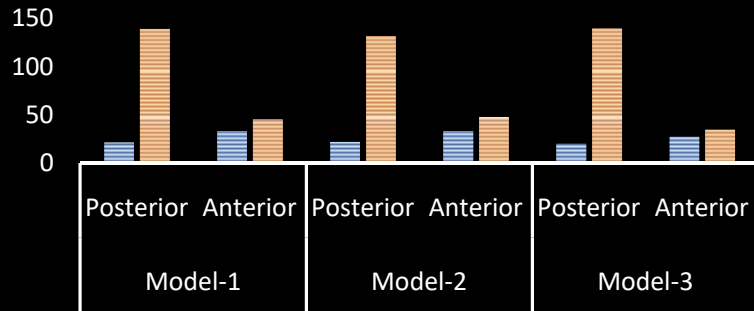


Model-3

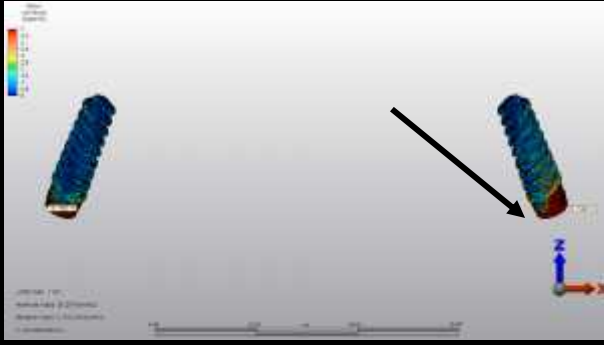


■ Dengeleyen Taraf ■ Çalışan Taraf

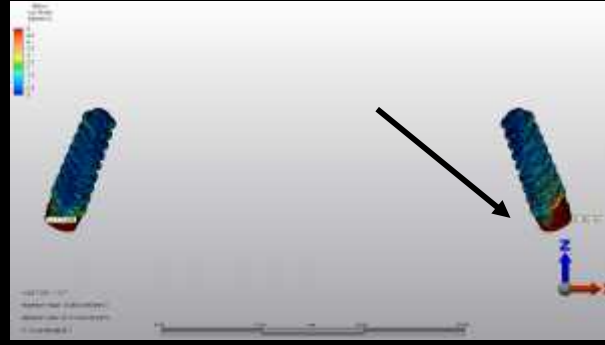
Von Mises Stres De eri



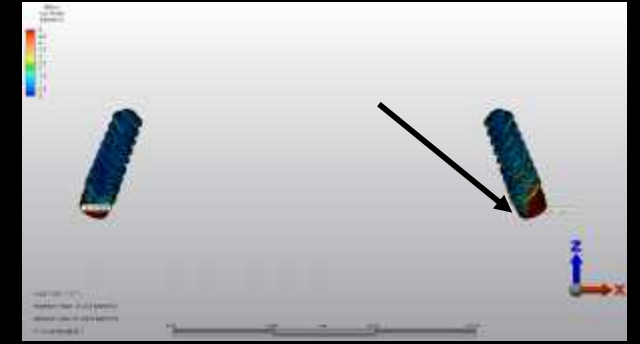
**Grup  
Fonksiyon  
Oklüzyon**



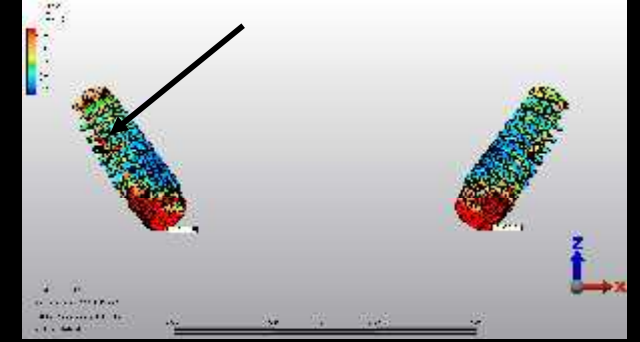
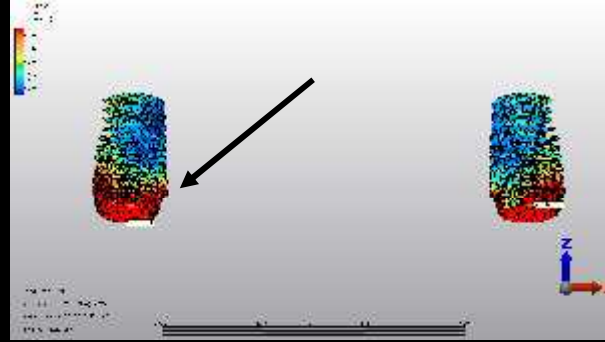
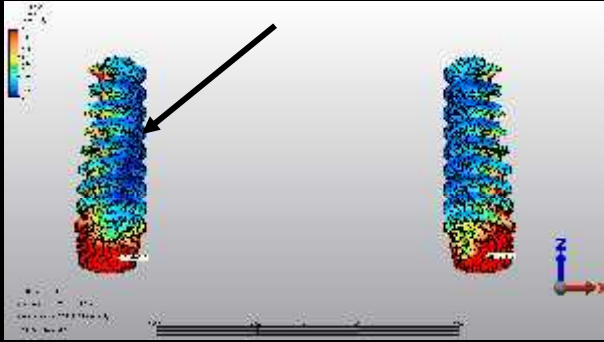
Model-1



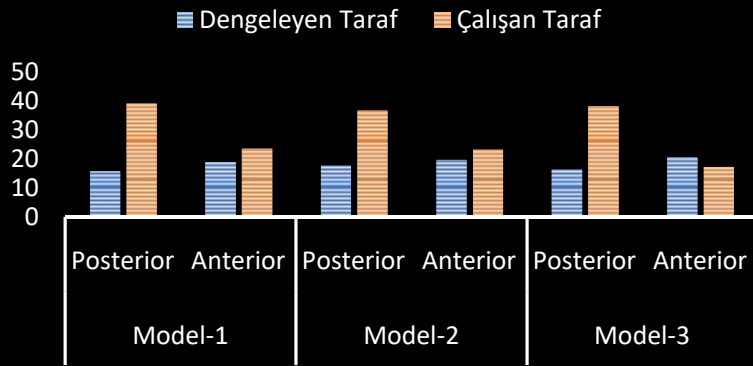
Model-2



Model-3



Von Mises Stres Değeri

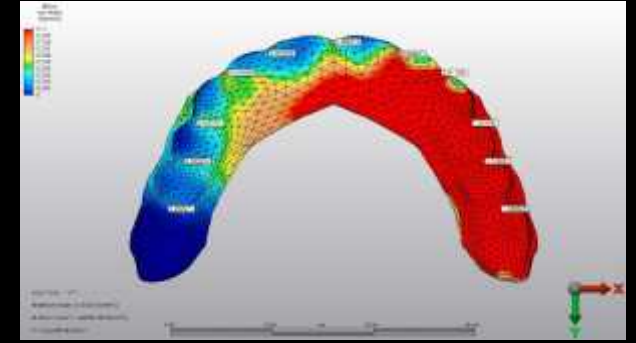
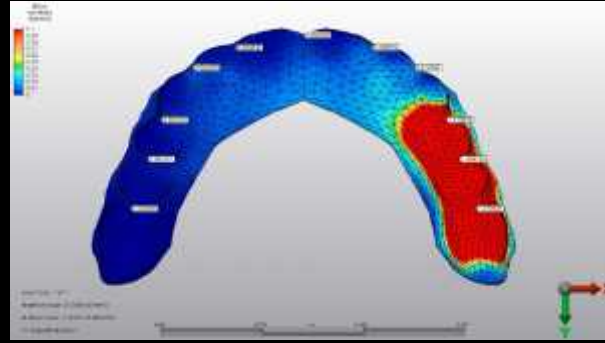
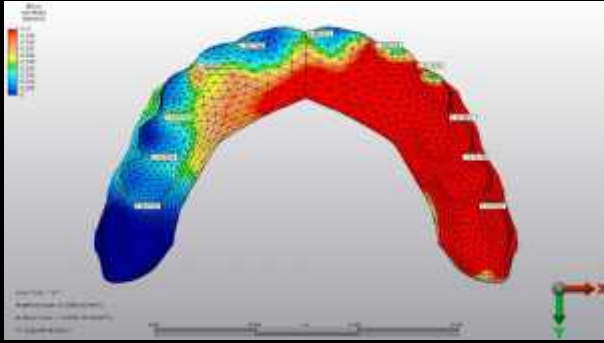


**Kanın  
Koruyuculu  
Oklüzyon**

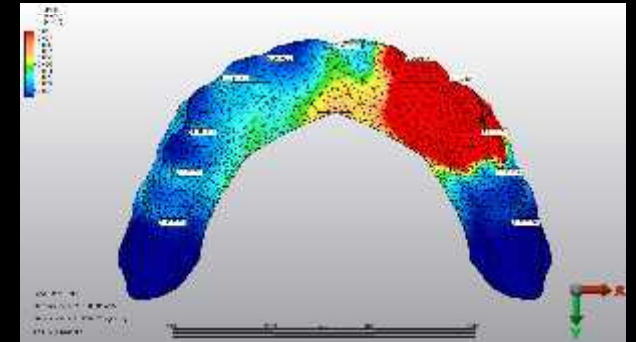
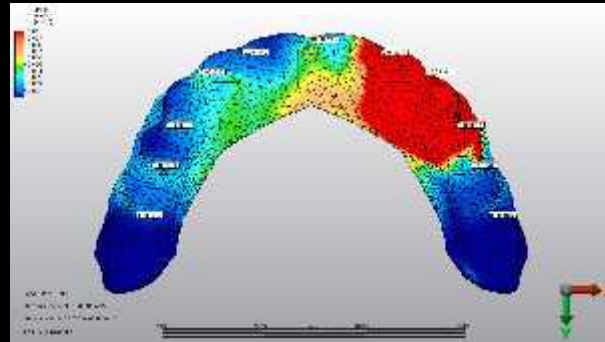
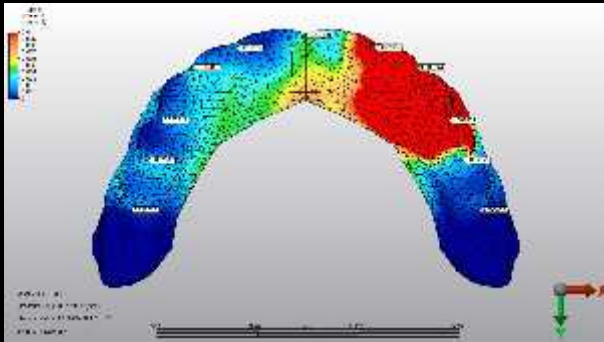
# PROTEZ (von Mises)

		Mpa	Molar-2. Premolar	2.Premolar- 1.Premolar	1.Premolar- Kanin	Kanin- Lateral	Lateral- Santral	Santral
<b>Model-1</b>	Grup Fonksiyon Oklüzyon	Dengeleyen Taraf	0.000750	0.002064	0.002901	0.005059	0.002766	0.004141
		Çalı an Taraf	1.228103	1.579735	1.063957	1.011522	0.008254	
	Kanin Koruyuculu Oklüzyon	Dengeleyen Taraf	0.000635	0.002142	0.000813	0.002459	0.001264	0.003481
		Çalı an Taraf	0.000436	0.002825	1.097974	0.980744	0.047784	
<b>Model-2</b>	Grup Fonksiyon Oklüzyon	Dengeleyen Taraf	0.000686	0.002157	0.003099	0.004959	0.003030	0.004506
		Çalı an Taraf	1.370947	1.699726	1.679838	0.012022	0.008576	
	Kanin Koruyuculu Oklüzyon	Dengeleyen Taraf	0.000595	0.002238	0.000916	0.002548	0.001442	0.003241
		Çalı an Taraf	0.000346	0.002781	1.010591	1.205461	0.040775	
<b>Model-3</b>	Grup Fonksiyon Oklüzyon	Dengeleyen Taraf	0.000671	0.002091	0.002751	0.003606	0.002398	0.004219
		Çalı an Taraf	1.204825	1.728867	1.201441	0.011985	0.008471	
	Kanin Koruyuculu Oklüzyon	Dengeleyen Taraf	0.000579	0.001898	0.000923	0.001846	0.001002	0.003333
		Çalı an Taraf	0.000298	0.002372	1.007075	1.102437	0.038564	





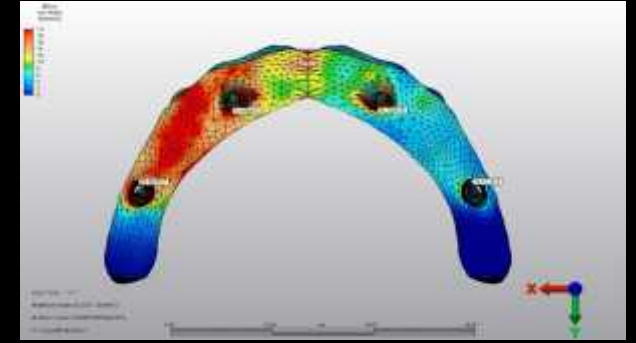
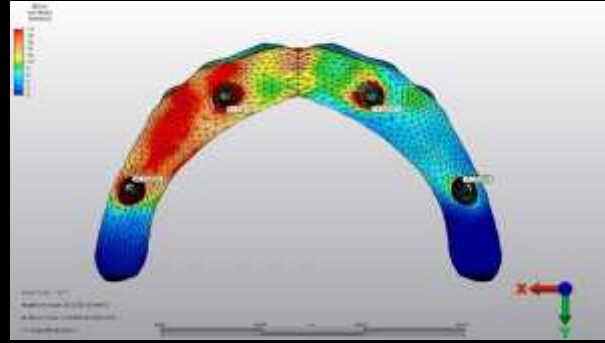
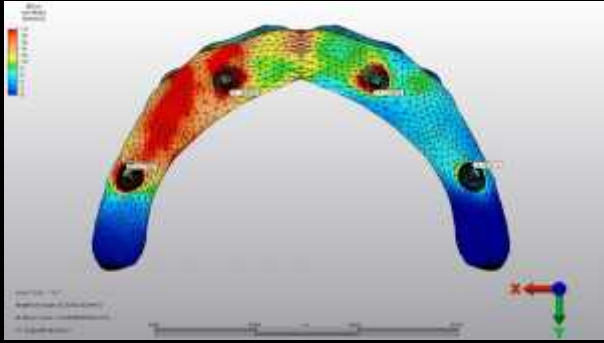
## Grup Fonksiyon Oklüzyon



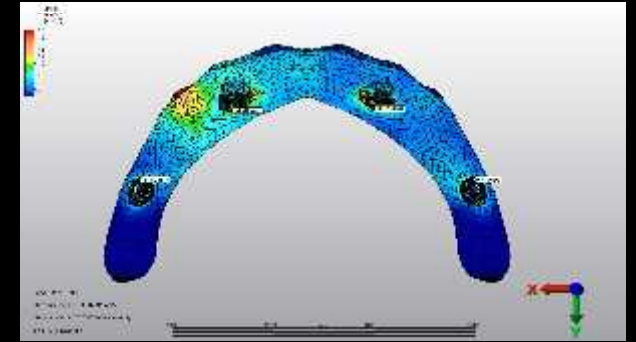
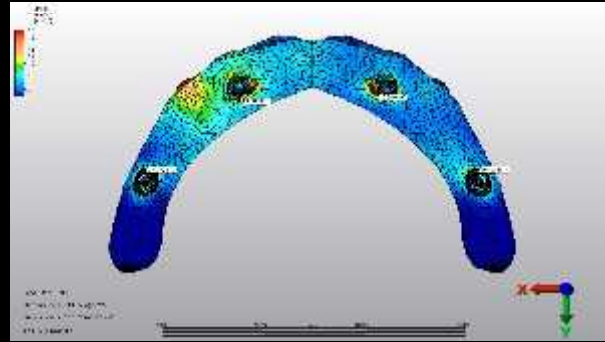
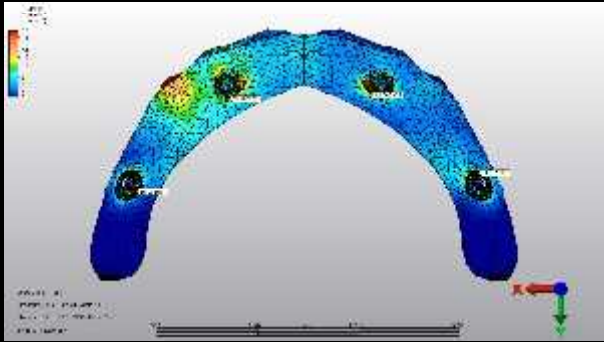
## Kanin Koruyuculu Oklüzyon

# ALTYAPI (von Misses)

	Mpa	Çalı an taraf- Anterior	Çalı an taraf- Posterior	Dengeleyen taraf- Posterior	Dengeleyen taraf-Anterior
<b>Model-1</b>	Grup Fonksiyon Oklüzyon	31.16	59.64	17.95	17.72
	Kanin Koruyucu Oklüzyon	13.28	16.25	11.61	12.68
<b>Model-2</b>	Grup Fonksiyon Oklüzyon	31.92	60.92	19.25	18.24
	Kanin Koruyucu Oklüzyon	13.66	27.27	12.02	12.94
<b>Model-3</b>	Grup Fonksiyon Oklüzyon	33.40	60.80	16.42	30.58
	Kanin Koruyucu Oklüzyon	14.48	25.56	9.71	18.15



## Grup Fonksiyon Oklüzyon



## Kanin Koruyuculu Oklüzyon

**TARTI MA**

Günümüzde tam diş vakalarının tedavisinde implant destekli sabit restorasyonlar sıklıkla tercih edilmektedir.



Implant tedavilerinde önemli faktörler



- Estetik
- Fonksiyon
- Oklüzal kuvvetlerin dağılımı

## Yanlı oklüzal tasarım

implantta stres yoğunlaşması

Kemik rezorpsiyonu



Oklüzyon  
Tipi

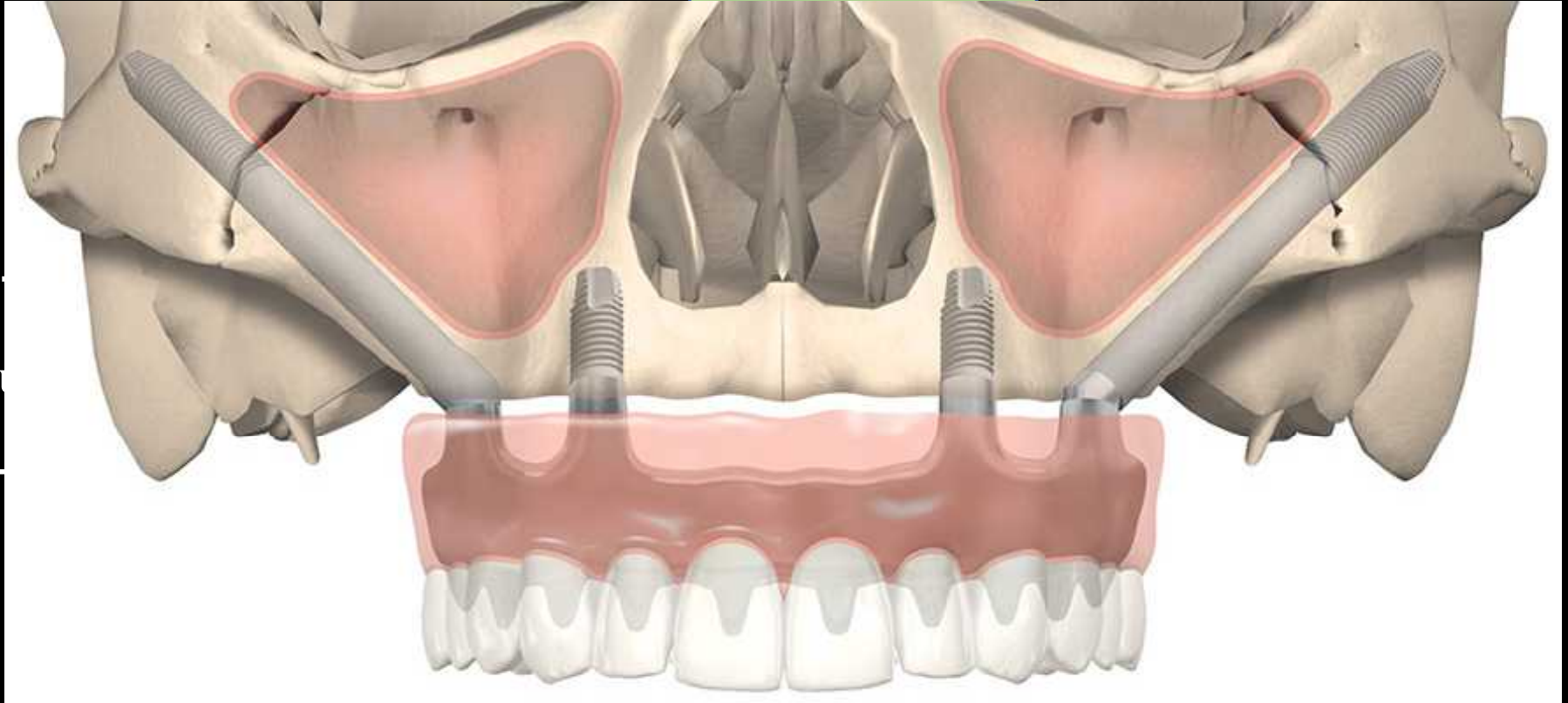
Oklüzyon  
Tasarımı

> Isırma kuvvetleri

- Lateral kuvvetlerin

Yıkıcı Lateral Kuvvetler

Komplikasyon

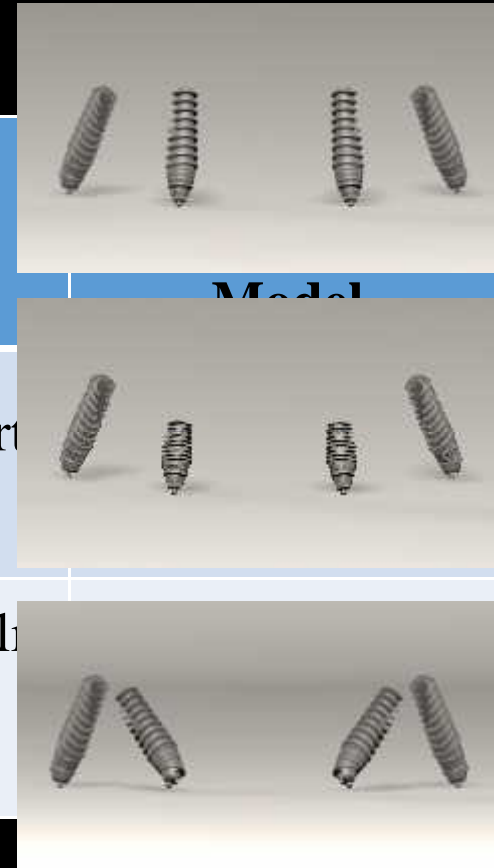


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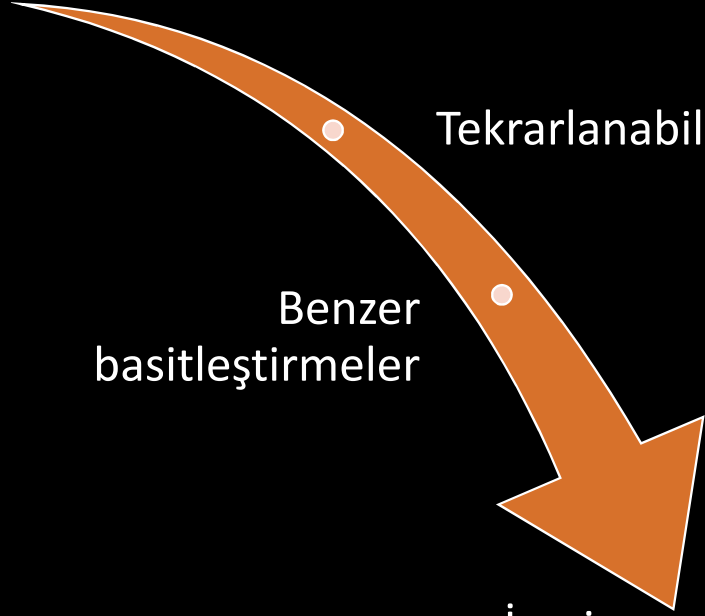
2 kısa implant + 2 zigomatik implant



	All-on-4	All-on-4	M-4
Anterior	2 Zigomatik mplant	2 Standart Açısız mplant	2 Açılı Standart mplant
Posterior	2 Standart Açılı mplant	2 Standart Açılı mplant	2 Standart Açılı mplant



Standardizasyon



Tekrarlanabilirlik

Benzer  
basitleştirmeler

İn-vivo çalışmalar



Gerinim  
Ölçer

Fotoelastik  
Kuvvet  
Analizi

Sonlu  
Elemanlar  
Analizi

- ✘ Çalışılacak bölgenin izolasyonu
- ✘ Mutlak sayısal değerler elde edilmesi
- ✘ Üç boyutlu inceleme imkanı

Ar Analizi

Karma ık ara tırmaları  
kolayla tırma

Çalı mada kullanılan analiz yöntemi

**SEA**

Sonlu F

Güvenilir yöntem

SEA alı maları d üm sayısı ve eleman sayısına ba lıdır.

En az  
30 000

200 000  
arasında

Eleman ve d üm sayısı  
arttıka

→ daha gçlü bilgisayar  
donanımı

→ uzun analiz süresi

	Eleman/D üm
<b>Model-1</b>	D üm sayısı = <del>239535</del> Eleman sayısı = 1287365
<b>Model-2</b>	D üm sayısı = 236975 Eleman sayısı = 1264149
<b>Model-3</b>	D üm sayısı = <u>235680</u>

Olu turulan modelin belirli d üm noktalarından sabitlenmesiyle yer de i tirme standardizasyonu da sa lanmı tır.

Üç boyutlu  
sonlu elemanlar  
analizi

ki boyutlu  
sonlu elemanlar  
analizi

Kemik dokusunda  
olu an stresler daha  
hassas ve detaylı  
incelenebildi inden bu  
çalı mada üç boyutlu  
SEA tercih edilmi tir.

Gerinim ve  
gerilim detaylı  
incelenemez

Sonuçlarda  
yanlılık olabilir

Başka gerilim  
analizine ihtiyaç  
duyulabilir

## RESEARCH

### THE ROLE OF THE FINITE ELEMENT MODEL IN DENTAL IMPLANTS

David J. Davies, DDS  
Sébastien Andriano, DDS  
Alexi Tsara, PhD  
Robert Hulse, DDS  
Brenda Casella, MS

#### Key Words

Finite element methods  
Dental implants  
Implant design

Computer-aided design and finite element methods (FEM) have interested dental researchers because of its use in the computer simulation and design of dental implants, a process greatly facilitated by the development of new computer technology and more accurate modeling techniques. FEM allows for a better understanding of stresses along the surfaces of an implant and its surrounding bone. This will aid in the optimization of implant design and placement of the implant into the bone; it will also help when designing the final prostheses to minimize stresses. The purpose of this review is to elucidate the role of FEM and the impact of this technology in clinical dentistry in the new millennium.

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Vol. 17 No. 1 February 2005

### EFFECTS OF DENTAL IMPLANT LENGTH AND BONE QUALITY ON BIOMECHANICAL RESPONSES IN BONE AROUND IMPLANTS: A 3-D NON-LINEAR FINITE ELEMENT ANALYSIS

CHUN-LEI LIU,<sup>1</sup> YUE-HSIAN KUI,<sup>2</sup> TING-SHENG LIAW<sup>3</sup>

<sup>1</sup>Department of Mechanical Engineering, Graduate Institute of Medical Mechatronic,  
Chang Gung University, Tao-yuan, Taiwan

<sup>2</sup>Graduate Institute of Medical Mechatronic, Chang Gung University, Tao-yuan, Taiwan

<sup>3</sup>Institute of Biomedical Engineering, National Cheng-Kung University, Tainan, Taiwan

ACP  
AMERICAN COLLEGE OF  
PROSTHODONTISTS

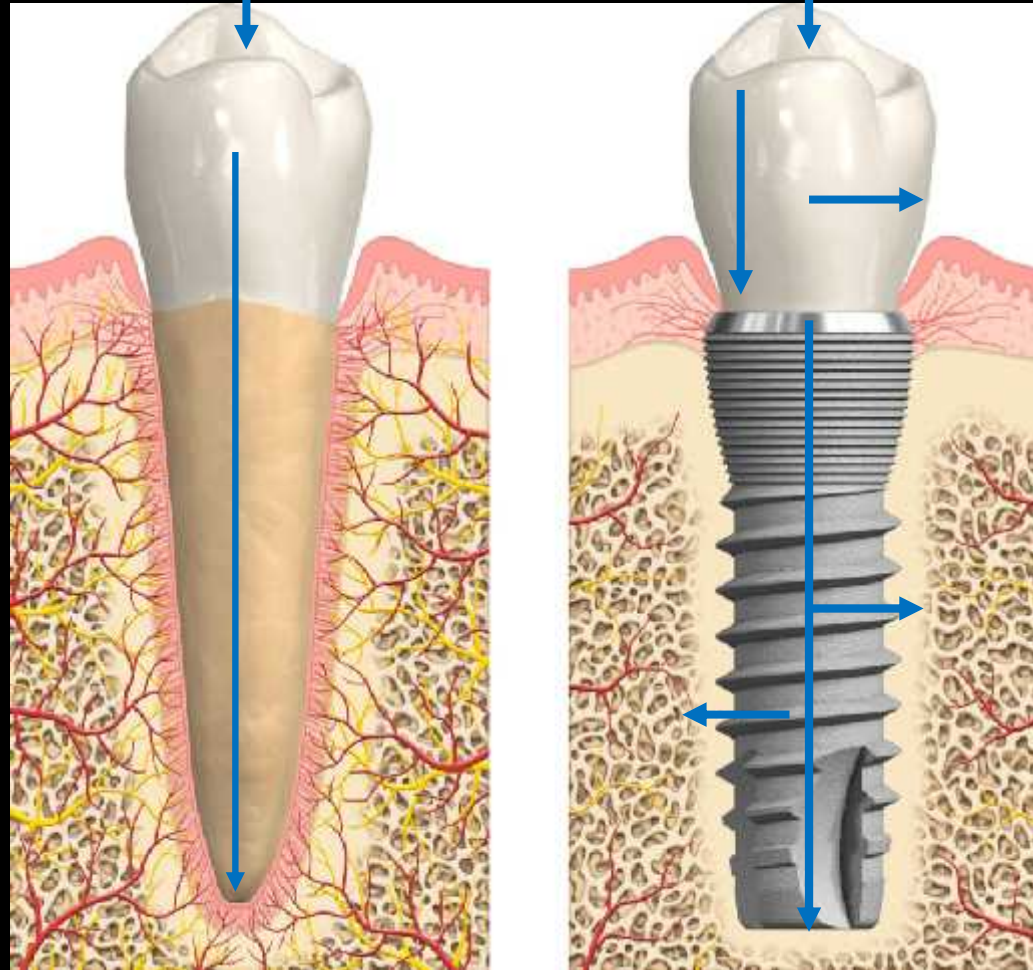
### Biomechanical Evaluation of Tooth- and Implant-Supported Fixed Dental Prosthesis with Various Nonrigid Connector Positions: A Finite Element Analysis

Tuncer Burak Özcelik, DDS, PhD,<sup>1</sup> Ersan Ersoy, DDS, PhD,<sup>2</sup> & Burak Yilmaz, DDS, PhD<sup>3</sup>

<sup>1</sup> Department of Prosthodontics, Söğüt University, Adana, Turkey

<sup>2</sup> Department of Prosthodontics, Ankara University Faculty of Dentistry, Ankara, Turkey

<sup>3</sup> Division of Restorative Dentistry and Prosthodontics, The Ohio State University College of Dentistry, Columbus, OH



## The Effect of Three Different Crown Heights and Two Different Bone Types on Implants Placed in the Posterior Maxilla: Three-Dimensional Finite Element Analysis

Duygu Cinar, DDS, PhD<sup>1</sup>/Pervin Imirzalioglu, DDS, PhD<sup>2</sup>

Çi neme ve lateral kuvvetler

implant ve kemikte stres

Stresin implantlardan çevre dokulara iletimi

implant tedavisinin başarısı

Lateral kuvvetlerde kemikte yo unla an hareket

Lateral, vertikal ve oblik kuvvetler nedeniyle yıkıcı etkiler

Original Article

## Influence of prosthesis type and material on the stress distribution in bone around implants: A 3-dimensional finite element analysis

Gökçe Meriç <sup>1\*</sup>, Erkan Erkmen <sup>2</sup>, Ahmet Kurt <sup>3</sup>, Yahya Tunç <sup>3</sup>, Atılım Eser <sup>4</sup>

## Çi neme Kuvvetleri

Ya

Cinsiyet

Tedavi yöntemi

Di sizlik

Parafonksiyonel hareket

Vertikal kuvvetlerden daha az

Horizontal Kuvvetler

implantlar için yüksek stres nedeni



Horizontal kuvvetler

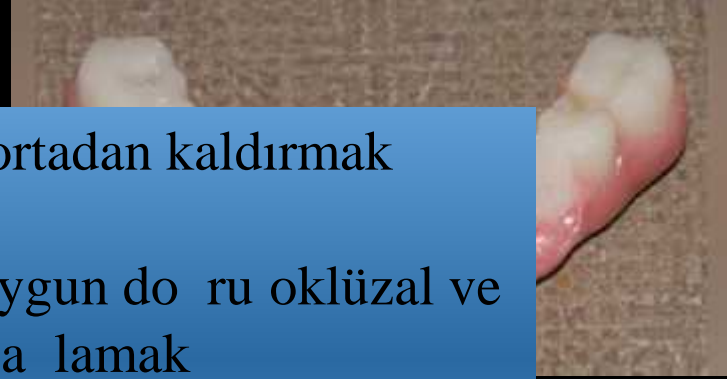
K

kuvvetlerin yıkıcı etkilerini ortadan kaldırmak  
çene ili kileri ve hareketlerine uygun do ru oklüzal ve  
tedavi ko ullarını sa lamak

**HOR ZONTAL KUVVETLER**

momenti

Kemikte ve implantta  
komplikasyonlar



Meijer ve ark.; 1993;  
Alkan ve ark., 2004

implant vidasına  
uygulanan tork kuvveti  
bilinmedi

Horizontal kuvvet değeri  
10 N

Tada ve ark., 2003

Kemikte yıkıma neden  
olmayan değer seçildi

Horizontal kuvvet değeri  
50 N

Tada ve arkSannino,  
2015; Liu ve ark., 2019  
Darwich ve ark., 2021  
2003

Üstyapıda ve kemikte  
yorulma değerleri  
kullanıldı

Horizontal kuvvet değeri  
90 N, 100 N, 150 N

Oklüzyon tipleri incelenmemiştir!!

## Finite Element Stress Analysis of Applied Forces to Implants and Supporting Tissues Using the “All-on-Four” Concept with Different Occlusal Schemes

Nurullah Tümer, DDS, PhD,<sup>1</sup> Ulviyye S. Büyükkaplan, DDS, PhD,<sup>2</sup> Steven J. Sarlowesky, DDS, PhD,<sup>2</sup> & Mehmet M. Goralan, DDS, PhD<sup>1</sup>

<sup>1</sup>Department of Prosthodontics, Istanbul University Faculty of Dentistry, Istanbul, Turkey  
<sup>2</sup>Research and Research Department, University of the Pacific School of Dental School, San Francisco, CA

### Keywords

Finite element analysis; occlusal schemes; All-on-Four implant

### Correspondence

Dr. Nurullah Tümer, Faculty of Dentistry, Department of Prosthodontics, Istanbul University, 32110 Sarıyer, Turkey. Email: nurul@mahab@icloud.com

This study was funded by Istanbul University Scientific Research Projects Coordination Office (No. 10.10.10.10.10.10)

The authors declare no conflict of interest with respect to this study.

Accepted November 23, 2018

doi:10.1111/jcpp.12398

### Abstract

**Purpose:** The aim of this study was to evaluate stress distributions on implants and abutments using finite element analysis (FEA) based on the loading chewing by prosthesis prepared according to the All-on-Four concept with different occlusal schemes using a finite element analysis method.

**Materials and Methods:** On simulated jaw models, teeth were set in accordance with the occlusal conditions of canine guided occlusion, group function occlusion, bilateral balanced occlusion (BBO), group function occlusion, and monoplane occlusion schemes. Three-dimensional (3D) images of these models were obtained using a surface scanner. Implants, superstructures, the maxilla, and mandible were modeled in the All-on-Four concept with 3D modeling software. Forces were defined on centers formed in maximum intercuspitation, lateral, and protrusive movement positions on occlusal occlusion types. Stress outputs were recorded as maximum and minimum principal stresses ( $P_{max}$ ,  $P_{min}$ ) and von Mises stress values for the implants.

**Results:** The highest  $P_{max}$  value for the maxilla was observed in occlusal bone on the group function occlusion during lateral movement (15.95 MPa). For the mandible, the highest  $P_{max}$  value was observed on the occlusal bone in maximum intercuspitation of horizontal occlusion (72.75 MPa). The highest  $P_{min}$  values for the maxilla was observed during the lateral movement in group function and for the mandible in BBO (-29.22 and -30.31 MPa, respectively). The lowest stress values were observed with occlusal guided occlusion in all occlusal conditions and occlusal schemes.

**Conclusions:** With the limitations of this simulation study, considering stress on an occlusal bone and implants in All-on-Four appliances, the use of occlusal guided occlusion may be suggested.

Immediately loaded implant prosthesis such as the All-on-Four concept have been presented in the literature, either because of the overall reduction of treatment time, morbidity, and risks, especially when advanced surgical techniques are used to overcome bone deficiencies.<sup>1–5</sup> Makin et al<sup>6</sup> developed a concept that allows implant placement in some resorbed ridges. In this application, which is performed with 4 implants placed in the maxilla or mandible and called the All-on-Four concept, the implants placed in the posterior region of the jaw are angled up to 45°. The angulation of implants in the posterior region circumvents violation of the stresses in the maxilla and the mandible areas in the maxilla and thus involves the more simulated placement of molars. In this concept, high survival rates have been observed in the implants.<sup>7,8</sup> However, some mechanical and biological complications associ-

ated with this concept have been reported.<sup>9,10</sup> Occlusal method has been shown to be linked to mechanical, structure burden, and when the occlusal scheme is not optimized, success is challenged.<sup>11,12</sup> Kim et al<sup>13</sup> conducted a literature review to determine the preferable types of occlusion in implant dentures. Accordingly, bilateral balanced occlusion (BBO), group function occlusion, or occlusal guided occlusion can be preferred in fixed implant dentures depending on the occlusion of the denture; however, Kim et al<sup>13</sup> reported that the intervention was not supported by adequate evidence. There is no scientific evidence-based information on the type of occlusion to be preferred in the All-on-Four concept, which is a relatively new treatment concept and includes fixed implant dentures. The scientific evidence on the preferred occlusal scheme in the All-on-Four concept, however, is insufficient,<sup>14</sup> and although

Kanin koruyuculu oklüzyon

Kanin dişlere 93 N

Grup fonksiyon oklüzyon

Kanin-Molar arası dişler 50'er N

Grup Fonksiyon Oklüzyon

Kanin Koruyuculu Oklüzyon

- ✓ Uygulaması kolaydır.
- ✓ Biyomekanik avantaj sa lar.

Oklüzyon çalı malarında kuvvet de erleri farklıdır

Kas aktiviteleri

Çi neme ve lateral kuvvetleri kesin nicel de erlere sahip de ildir.

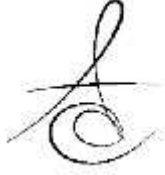
Limitasyon!

Rezorpsiyon ba langıcı

Maksimum  
gerilme de erleri

Proliferasyon de erleri  
Kemik e  
uygulanan yük

Kemikte ekil  
de i tirmeye  
neden olan yük



DÖRT FARKLI TIP ALV  
ZİGOMATİK İMPLANT

EVALUATION OF THE BIOMECHANICAL EFFECTS OF QUAD ZYGOMATIC  
IMPLANT APPLICATION IN FOUR DIFFERENT MAXILLARY DEFECT TYPES

Dr. Öğr. Üyesi Zeynep GÜMRÜKÇÜ

Makale Kodu/Article code: 4048  
Makale Gönderilme tarihi: 24.04.2019  
Kabul Tarihi: 25.07.2019

Mevcut çalı mada görülen çekme ve sıkı ma  
kuvvetleri 0-30 N

tion, prosthetic materials,  
stress distribution of short  
implants: a finite element analysis

Pinar Ercal<sup>1</sup> • Aysegul Erten Taysi<sup>1</sup> • Demet Cagil Ayvalioglu<sup>2</sup> • Meltem Mert Eren<sup>3</sup> • Soner Sismanoglu<sup>3</sup>

Oklüzyon ve modellemelerin stresi  
implanttan kemi e aktarımı

Kortikal kemikte

150 N çekme  
kuvveti  
250 N sıkı tırma  
kuvveti

Kortikal kemikte

121-135 N çekme  
kuvveti 167-205  
N sıkı tırma  
kuvveti

Kortikal Kemik Pmax ve Pmin de erleri > Süngerimsi kemik Pmax ve Pmin de erleri

Kortikal kemi in  
yüksek elastisitesi

Kanın koruyuculu oklüzyon kortikal kemik için daha koruyucudur.

Primer  
stabilite

Kemi in mekanik  
mukavementi

Stresleri kar ılamada kortikal kemik süngerimsi kemikten daha ba arılıdır.



EFFECT OF OCCLUSION ON THE ALVEOLAR BONE RESORPTION IN IMPLANT-SUPPORTED PROSTHESIS

İMLANT ÜSTÜ PROTEZLERDE OKLÜZYONUN ALVEOLAR KEMİK REZORPSİYONU ÜZERİNE ETKİSİ

Biçe ERGÖNBAŞ<sup>1</sup>, Mustafa ZORTUK<sup>2</sup>

The influence of altered working-side occlusal guidance on masticatory muscles and related jaw movement

U. C. Belser, Dr.Med.Dent,<sup>†</sup> and A. G. Hannam, B.D.S., Ph.D., F.D.S., R.C.S.\*\*

University of British Columbia, Faculty of Dentistry, Vancouver, B.C., Canada



The Journal of Prosthetic Dentistry

Volume 114, Issue 2, August 2015, Pages 193-201

Systematic Review

Impact of lateral occlusion schemes: A systematic review

Jaafar Abdulo BDS, DClinDent, MRACDS (Pros)<sup>1</sup>, Marc Tennant DDSc, PhD, AFCHSE<sup>2</sup>

Uygun oklüzal tasarım ve yükleme, kortikal kemi i olumlu yönde etkileyen stresleri uyarır.

Bu nedenlerle kanin koruyuculu oklüzyona sahip modellerde alveoler kemikte stresler daha az not edilmi tir.

Kanin koruyuculu oklüzyonda lateral kuvvetlerin olu turdu u stresler kanin di lerde yo unla masıyla kas kasılmaları azalır.





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Seçilen oklüzyonla implanttan kemiğe iletilen kuvvetin implant biyomekaniğine etkisi deşmektedir, bu sonuç da implant üstü tam-ark protezlerde oklüzyon seçiminin doğru yapılmasının gerekliliğini doğrulamaktadır.

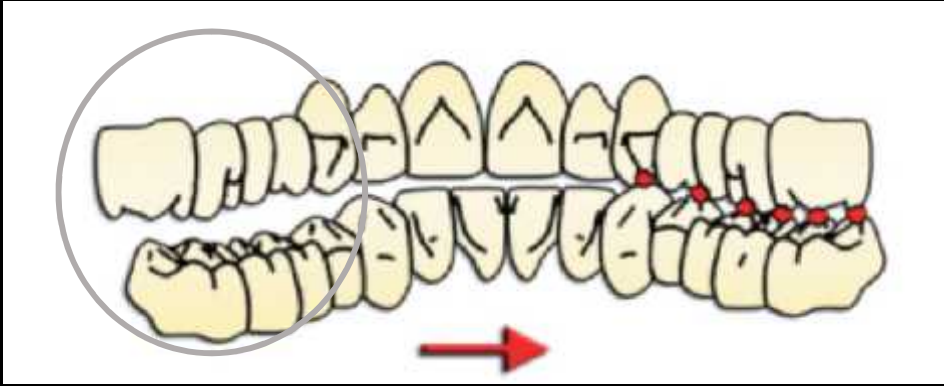
### **A systematic review**

Ke Zhao<sup>a,\*</sup>, Qing-Qing Mai<sup>b</sup>, Xiao-Dong Wang<sup>a</sup>, Wen Yang<sup>a</sup>, Li Zhao<sup>a</sup>

All-on-4 konfigürasyonlarında grup fonksiyon oklüzyon ve kanin koruyuculu oklüzyon biyomekaniğine katkı sağlamaktadır.

Dengeleyen taraf

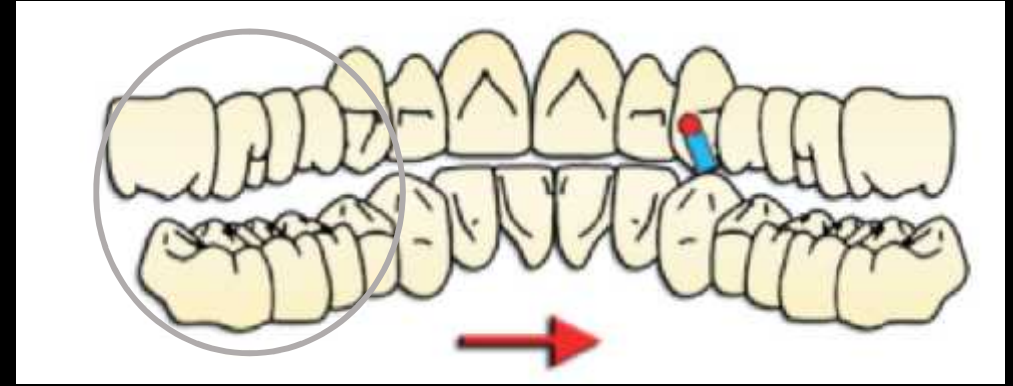
Çalı an taraf



Grup Fonksiyon Oklüzyon

Dengeleyen taraf

Çalı an taraf



Kanin Koruyuculu Oklüzyon

Kanin koruyucu oklüzyon  
Grup fonksiyon oklüzyon

Lateral hareket

Dengeleyen tarafta  
minimum temas

Gelen stres tek tarafta yo unla madan tüm çene boyunca yayılır.

Kuvvetler sonucu olu an  
stresler:

- Implant gövdesinde kırık,
- Abutmentta kırık,
- Vida kırıkları,
- Kron kaybı.

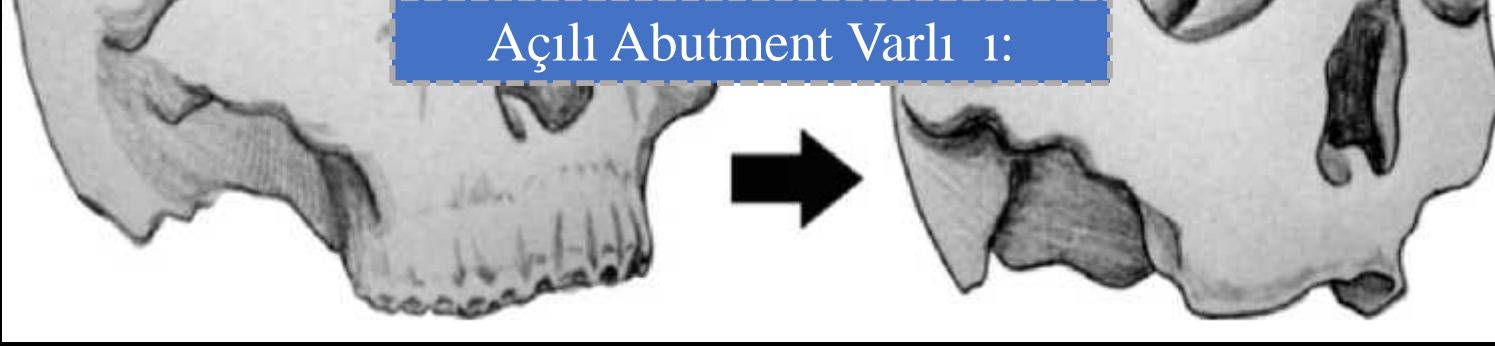
Titanyumun  
germe/akma  
dayanımı:  
550-860 MPa



**Çalı mamızda e ik  
de erlerini a an stresler  
bulgulanmamı tır!**

- ✓ Uygun ekil,
- ✓ Geni boyun seçene i.

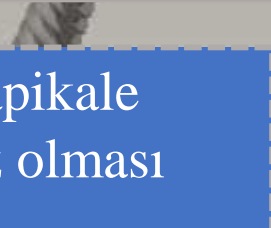
## Açılı Abutment Varlığı:



Premaksillada di çekimi

- Kemik kaybı
- Anatomik yapılarla yakla ma
- mpant tedavisinde zorluk

- Streslerin apikale iletiminin az olması
- Stresin implant çevre dokularında ve implantın koronal bölgesinde yo unlaşması



Lateral kuvvetlerin yarattığı stresi azaltmak için:

Palatinal tüberküllerin temaslarının kaldırılması

Tüberküle iminin azaltılması

10°'lik  
tüberküle  
e imi artırır



E ilme  
momentini  
%30 artırır

G.Ü. D  
Cilt X,

Grup fonksiyon oklüzyon ve kanin koruyucu oklüzyonun anatomik özelli i olan tüberkül-fossa temasının varlı ı, posteriorda oklüzal tablaların modifiye edilmesine olanak tanımaktadır.

ARI

Açılı abutmenta sahip Model-3' te yıkıcı etkileri engellemeyi sa lamaktadır.

Grup Fonksiyon Oklüzyon



Palatinal tüberkül temasını ortadan kaldırmak

Kanin Koruyuculu Oklüzyon



Tüberkül e imini azaltmak

## CLINICAL ORAL IMPLANTS RESEARCH

*Sung-Hee Oh  
Younhee Kim  
Joo-Yeon Park  
Yea Ji Jung  
Seong-Kyun Kim  
Sun-Young Park*

Comparison of fixed implant-supported prostheses, removable implant-supported prostheses, and complete dentures: patient satisfaction and oral

Görülen stresler çineme ve lateral kuvvetlerin meydana getirdi i streslerin nispeten posterior bölgede birikmesinden kaynaklanmaktadır.

### Connection Systems in the All-on-four Procedure

Özge Özdal Zincir (✉ [ozgeozdalzincir@gmail.com](mailto:ozgeozdalzincir@gmail.com))

Private Meltem Oral and Dental Health Polyclinics <https://orcid.org/0000-0002-6086-5490>

Ateş Parlar

Private Practise

Research article

**Keywords:** All-on-four, Finite element analysis, Fixed prosthesis, Monoblock implant, Tilted implant

**DOI:** <https://doi.org/10.21203/rs.3.rs-92688/v1>



## **“All-on-Four” Immediate Function Concept and Clinical Report of Treatment of an Edentulous Mandible with a Fixed Complete Denture and Milled Titanium Framework**

Amir H. Khatami, DDS<sup>1</sup> & Christopher R. Smith, DDS, FACP<sup>2</sup>

<sup>1</sup> Assistant Professor, Department of Restorative Dentistry and Prosthodontics, The Ohio State University, Columbus, OH

<sup>2</sup> Associate Professor, Department of Surgery, Section of Dentistry, The University of Chicago Hospitals, Chicago, IL



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Journal of Dentistry 30 (2002) 41–46

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## **Comparative evaluation of the effect of diameter, length and number of implants supporting three-unit fixed partial prostheses on stress distribution in the bone**

Haldun İplikçioğlu, Kıvanç Akça\*

*Department of Prosthodontics, Faculty of Dentistry, Hacettepe University, 05100 Ankara, Turkey*

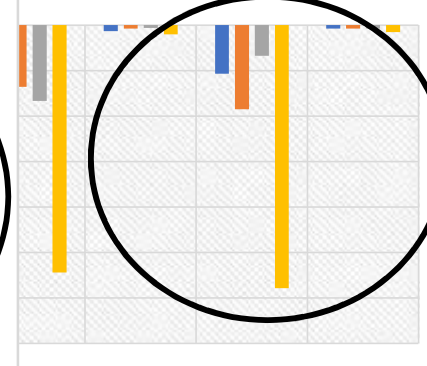
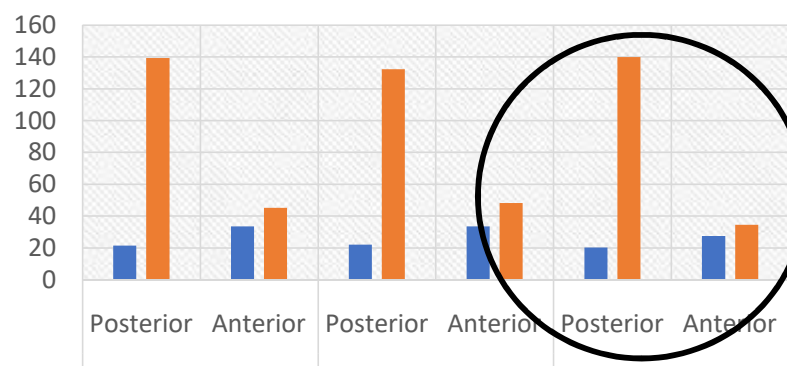
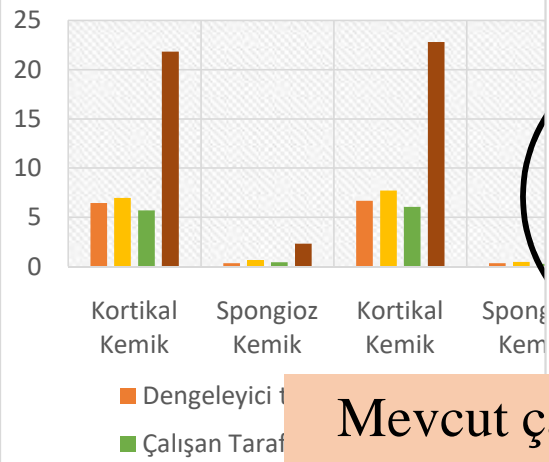
Received 9 October 2000; revised 8 August 2001; accepted 2 October 2001

## **Influence of Implant Abutment Type on Stress Distribution in Bone Under Various Loading Conditions Using Finite Element Analysis**

Heoung-Jae Chun, PhD<sup>1</sup>/Ha-Shik Shin, MS<sup>2</sup>/Chong-Hyun Han, DDS<sup>3</sup>/Soo-Hong Lee, PhD<sup>4</sup>

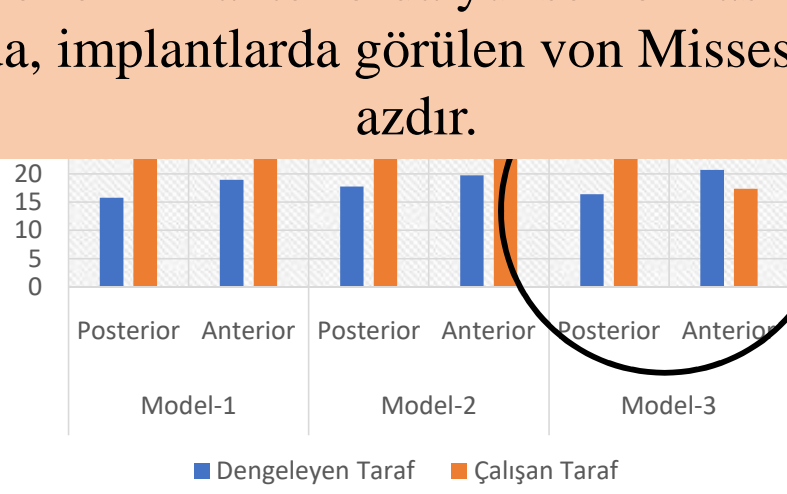
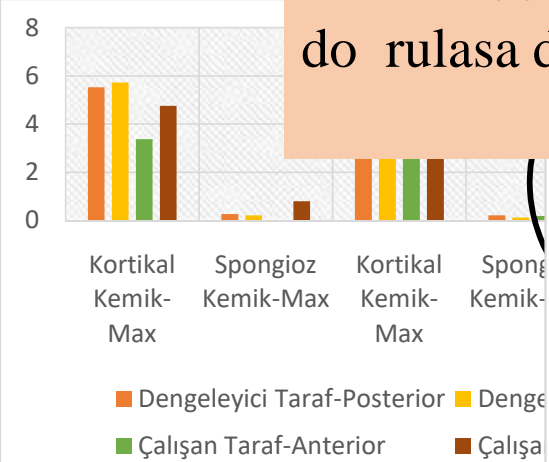
Mevcut çalı mada da atrofik premaksillada uzun implantın açılı yerle tirilmesiyle tasarlanan M-4 konseptiyle çevre kemik doku üzerinde stres daha az gözlemlenmi tir.





Grup  
Fonksiyon  
Oklüzyon

Mevcut çalışmada Model-3'te kemikte görülen Pmax ve Pmin değerlerinin anteriorda yüksek olması bu durumu doğrulasa da, implantlarda görülen von Mises stresler daha azdır.



Kanın  
Koruyuculuğu  
Oklüzyon

implantların yerleşim açısı ve implant boyunda artış, süngerimsi kemikte görülen Pmax ve Pmin stres değerlerinin azalmasına neden olmaktadır.

	implant açısında artış	Sonuç
<i>Misch CE, 2011, sf. 404.</i>	Makaslama kuvveti artışı	Kemik rezorpsiyonu ↑
<i>Saber ve ark., 2015</i>	Kemik stresinin distale aktarılması	Stres değeri ↓
<i>Gartner ve Hiatt, 2011</i>	Kuvvet süngerimsi kemikten önce kortikal kemikte yoğunlaşması	Süngerimsi kemikte stres ↓

Mevcut çalışmada Model-3' teki süngerimsi kemikte stres dağılımı homojendir.

## The influence of abutment angulation on strains and stresses along the implant/bone interface: Comparison between two experimental techniques

Tamar Brosh, PhD,<sup>a</sup> Raphael Pilo, DMD,<sup>a</sup> and David Sudai, DMD<sup>b</sup>  
Department of Oral Rehabilitation, The Maurice and Gabriela Goldschleger  
School of Dental Medicine, Tel Aviv University, Tel Aviv, Israel

Kemik

## Placement of Posterior Mandibular and Maxillary Implants In Patients with Severe Bone Deficiency: A Clinical Report of Procedure

Leonard Krekmanov, DDS, PhD<sup>1</sup>

## Influence of Implant Length and Bicortical Anchorage on Implant Stress Distribution

Laurent Pierrisnard, DDS,<sup>a</sup> Franck Renouard, DDS,<sup>†</sup> Patrick Renault, DDS,<sup>a</sup> Michel Barquins<sup>‡</sup>

*Istanbul Üniversitesi Diş Hekimliği Fakültesi Dergisi*  
Cilt: 46, Sayı 3 Sayfa: 15-28, 2012

15  
ARAŞTIRMA

## İMLANT KONUMLARININ ANTERİÖR MAKSİLLADA OLUŞTURACAKLARI ETKİLERİN BİYOMEKANİK OLARAK ARAŞTIRILMASI

*Evaluation of the Effect of Implant Localization on the Anterior Maxilla*

Nilüfer Bölükbaşı<sup>1</sup>, Ali Koçak<sup>2</sup>, Tayfun Özdemir<sup>1</sup>

*Türkiye Klinikleri Diş Hekimliği Bilimleri Dergisi*  
Türkiye Klinikleri Journal of Dental Sciences

Türkiye Klinikleri J Dental Sci 2020;26(1):47-50

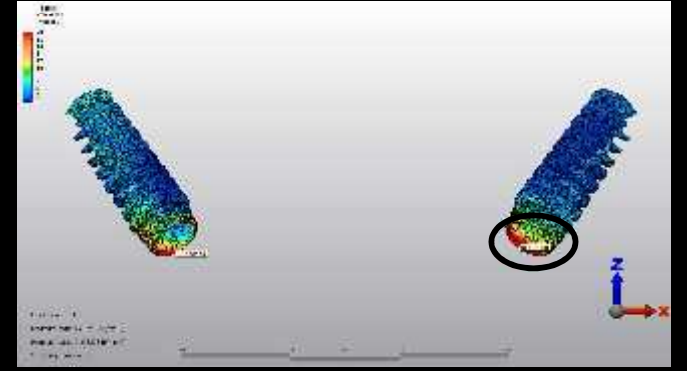
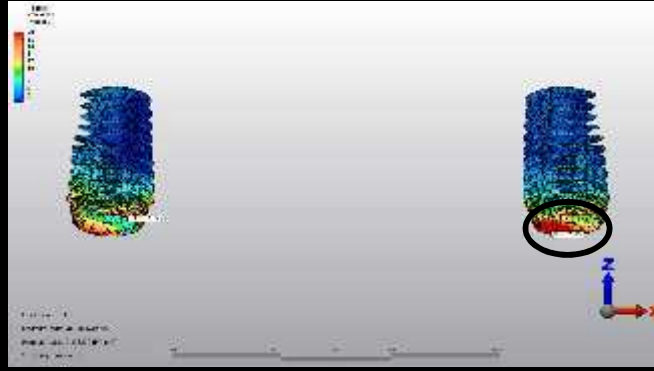
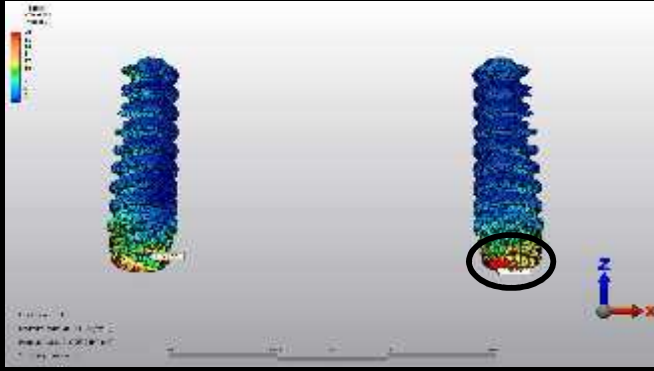
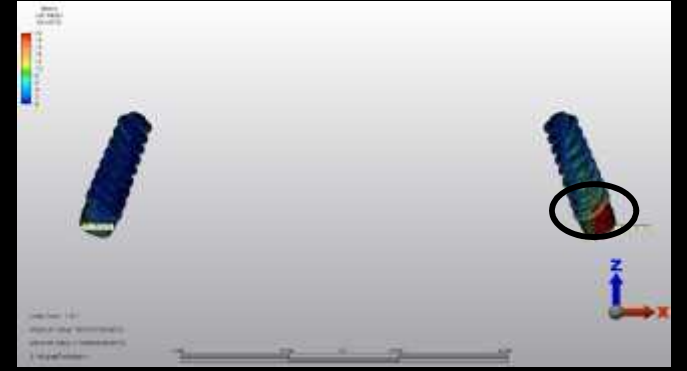
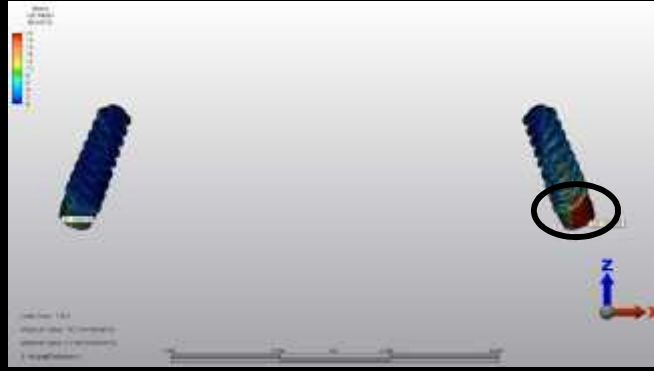
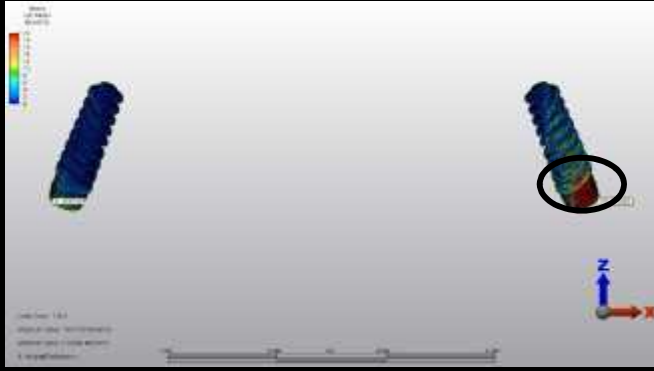
ORJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.5336/dentalsci.2019-65186

## Hibrid Abutment Kron Restorasyonlarda İmplant-Abutment Bağlantısının İmplant, Abutment ve Bazal Vidadaki Stres Dağılımı Üzerindeki Etkisinin İncelenmesi

*Evaluation of the Effect of Implant-Abutment Connection in Hybrid Abutment Crown Restorations on Stress Distribution in the Implant, Abutment, and Basal Screw*

Necati KALELİ<sup>1</sup>, Çağrı URAL<sup>2</sup>



Koronal bölgede en yüksek stres değerleri

## Influence of Implant Length and Bicortical Anchorage on Implant Stress Distribution

Laurent Pierrisnard, DDS,\* Franck Renouard, DDS,<sup>†</sup> Patrick Renault, DDS,<sup>‡</sup> Michel Barquins<sup>§</sup>

### ABSTRACT

**Background:** Short implants present superior failure rates for everybody.

**Purpose:** The aim of this theoretic study was to assess to what extent implant length and bicortical anchorage affect the way stress is transferred to implant components, the implant proper, and the surrounding bone.

**Materials and Methods:** Stress analysis was performed using a finite element method. A 3D model was generated. All implants modeled were of the standard length (6, 7, or 8.5 mm), and 11, and 12 mm (Bénelmark System<sup>®</sup>, Nobel Biocare AB, Göteborg, Sweden). The model consisted of a titanium abutment screw and abutment, a gold cylinder and abutment, and a supporting bone structure consisting of cortical and cancellous bone. The implant was seated in a supporting bone structure consisting of cortical and cancellous bone, and was tilted at a 30° angle to the buccolingual plane.

**Results:** With the selected model and bone properties, the coronal cortical anchorage was identified as the area where the highest stresses were concentrated to that area.

**Conclusions:** The maximum bone stress was virtually constant, independent of implant length and bicortical anchorage. The maximum implant stress, however, increased somewhat with implant length and bicortical anchorage.

**KEY WORDS:** bicortical anchorage, bone stress, finite element analysis, implant length, implant stress.

It has often been argued that the use of long implants (length  $\geq 10$  mm) is a positive factor in osseointegration, and many authors have reported on failures with short implants.<sup>1-3</sup> However, few studies that analyze the long-term performance of short implants have been conducted.<sup>4,5</sup> A retrospective clinical analysis on different implant dimensions<sup>6</sup> has strengthened the authors' belief that using long implants probably does not always present a biomechanical advantage and that, in fact, shorter (6, 7, or 8.5 mm) implants may offer enhanced long-term performance in some situations.

Lack of initial stability has often been assumed to be the causative factor for early implant failures.<sup>5-7</sup> When an implant has become integrated, however, the loss of integration is most often attributed to overload. In some

overload situations the implant components may fail, but this does not occur until after several years.<sup>8</sup> Therefore, bone stress may have both short- and long-term influence on implant survival. If the implant anchorage has a good prognosis, the mechanical stress in the components might be the next criterion to consider.

The purpose of this theoretic study using the finite element method is to assess to what extent implant length and bicortical anchorage affect the way stress is transferred to implant components, the implant proper, and the surrounding bone. With better knowledge in this area, it would be possible to improve both short- and

to calculate and visually represent stresses and strains in complex structures subjected to simulated loads. The software package used in this study was CADSAI<sup>®</sup> (CAD.I.M., Gif-sur-Yvette, France), a French version of

implant tedavilerinde kritik ve sahiptir.

Lateral kuvvetler kar ısında yüksek stresler koronal bölge

implant boylarının koronal kısımda etkisi yoktur.

imp kar 11, 12 mm sevi görür.

Çalı mamızda koronal bölgede yüksek stres görülmü tür.

\*Senior lecturer, Faculty of Dental Surgery Montreuil, University of Paris VI, Department of Prosthodontics, Paris, France; †private practice Paris, France; ‡research director, Centre National de la Recherche Scientifique (CNRS), Ecole Supérieure de Physique Chimie Industrielle (ESPCI), Paris, France

Reprint requests: Laurent Pierrisnard, 133 rue Lamarck, 75018 Paris; e-mail: laurent.pierrisnard@wanadoo.fr

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## Uzun implantlar

Yüksek ankraj

Lateral kuvvetlerde  
yüksek stres

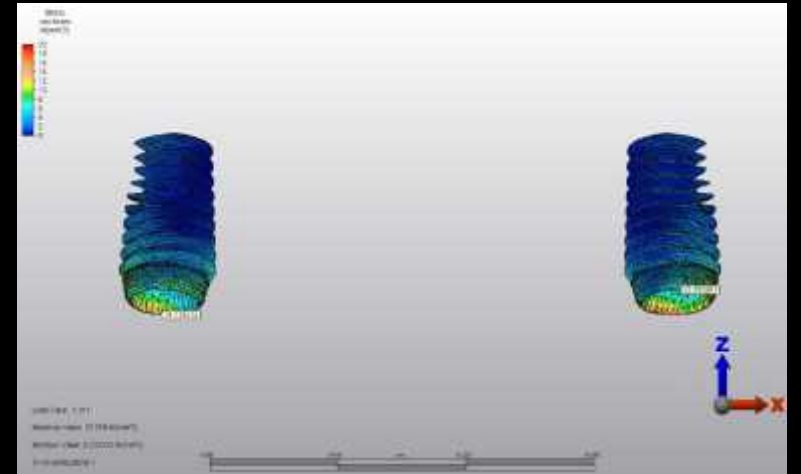
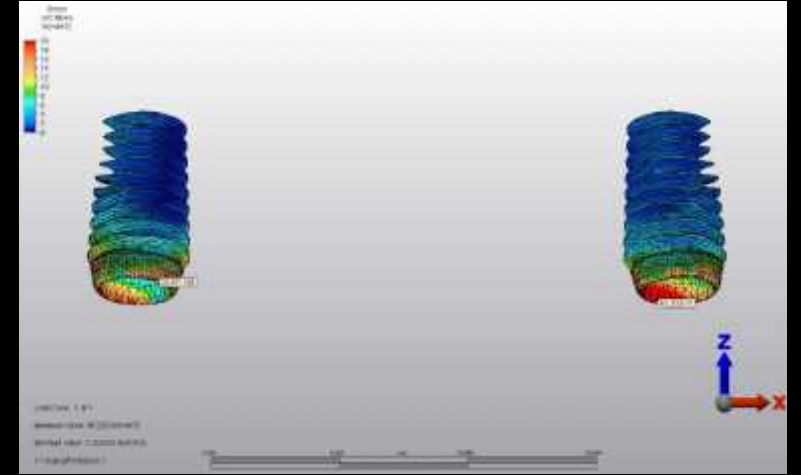
Mevcut çalı mada kısa implant ve uzun  
implant kullanımında yıkıcı de erler  
görülmemi tir.

kullanılmalıdır.

## Kısa implantlar

Kemikte fleksiyon

Lateral kuvvetlerde  
dü ük stres





implantların uzun akslarına denk gelen bölgede en yüksek streslerin görülmesi  
↓  
rijit materyal implantla akrilik rezinin elastik modüllerinin farklı olması



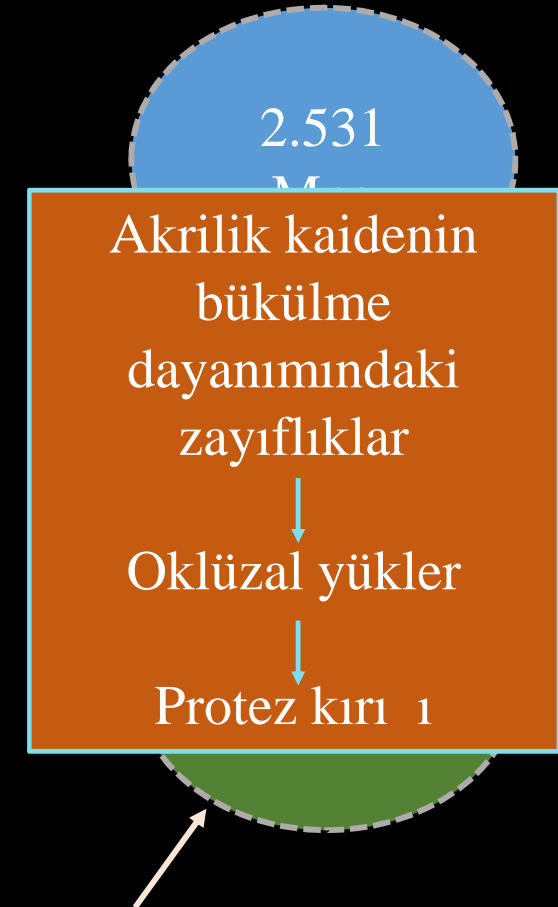
## INVESTIGATION OF MECHANICAL PROPERTIES OF PMMA COMPOSITE REINFORCED WITH DIFFERENT TYPES OF NATURAL POWDERS

Sihama Issa Salih<sup>1</sup>, Jawad Kadhim Oleiwi<sup>1</sup> and Arkan Saad Mohamed<sup>2</sup>

<sup>1</sup>Material Engineering Department, University of Technology, Baghdad, Iraq

<sup>2</sup>Dijlah University College, Baghdad, Iraq

E-Mail: [Sihama\\_Salih@yahoo.com](mailto:Sihama_Salih@yahoo.com)<sup>1</sup>





Akrilik + Seramik → All-on-4

Polimetilmetakrilat Kaidesi

Lityum Disilikat Kronlar

Grup fonksiyon oklüzyon → Seramik chipping

Protezlerin dikkatli tasarlanması ve üretilmesi  
implant sayısı ve altyapı desteğinin sağlanması

↓  
Başarılı sonuçlar

## Uygun Altyapı

Retansiyon

Stabilizasyon

Splint etkisi

E it stres dağılımı

## Titanyum

Korozyona direnç

Uygun fiziksel özellik

Uygun mekanik özellik

Grup fonksiyon oklüzyon

Atrofik çene

Titanyum Altyapı

CAD/CAM ile frezelenerek hazırlanan titanyum

Stres kaynaklı altyapı kırıklarının önlenmesi

## Alt Yapı von Mises Stres Değerleri

	Mpa	Çalışan taraf- Anterior	Çalışan taraf- Posterior	Dengeleyen taraf- Posterior	Dengeleyen taraf-Anterior
Model-1	Grup Fonksiyon Oklüzyon	31.16	59.64	17.95	17.72
	Kanin Koruyucu Oklüzyon	13.28	16.25	11.61	12.68
Model-2	Grup Fonksiyon Oklüzyon	31.92	60.92	19.25	18.24
	Kanin Koruyucu Oklüzyon	13.66	27.27	12.02	12.94
Model-3	Grup Fonksiyon Oklüzyon	33.40	60.80	16.42	30.58
	Kanin Koruyucu Oklüzyon	14.48	25.56	9.71	18.15

### Stresin implant-altyapı arasında aktarımı

Aksiyal implant

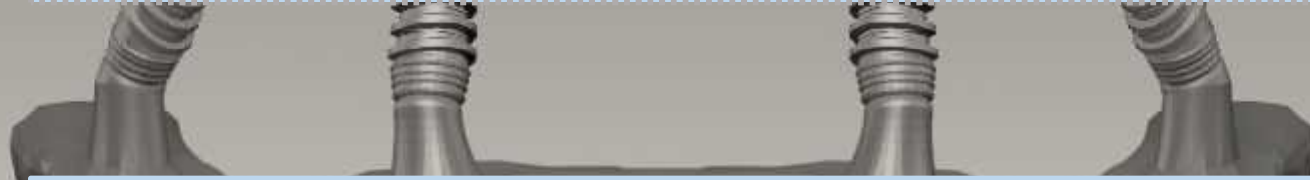
Uniform

Açılı implant

Uniform olmayan

Abutment ve implant materyallerinin titanyum olması sayesinde stres uniform aktarılır.

Stres tek bir parçada toplanmayıp uniform dağılım gösterir.



Titanyum



pasif uyum sağlaması



IMME  
IMPLA  
MANC  
DENT  
PROSI

Antonio Achilli, M  
Egon Euwe, DDS<sup>c</sup>  
University of Milan

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Journal section: Oral Surgery  
Publication Type: Review

All-On-4 standard treatment concept

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http://dx.doi.org/10.4317/jced.53759

**Consensus statements and clinical recommendations on treatment indications, surgical procedures, prosthetic protocols and complications following All-On-4 standard treatment. 9th Mozo-Grau Ticare Conference in Quintanilla, Spain**

Miguel Peñarrocha-Diago <sup>1</sup>, María Peñarrocha-Diago <sup>2</sup>, Regino Zaragoza-Alonso <sup>3</sup>, David Soto-Peñaloza <sup>4</sup>, on behalf of the Ticare Consensus Meeting <sup>5</sup>

Mev  
e

arda  
n

**koruyuculu oklüzyonda bulgulanmı tır.**

Kanin koruyuculu oklüzyonda, her ne kadar daha az stres bulgulanmı olsa da a ız içinde hep aynı noktanın strese maruz kalması, protetik açıdan yıkıcı etki yaratabilmektedir



(Penarrocha-Diago ve ark., 2017)



## Immediate loading short implants inserted on low bone quantity for the rehabilitation of the edentulous maxilla using an All-on-4 design

P. MALÓ\*, M. A. DE ARAÚJO NOBRE<sup>†</sup>, A. V. LOPES<sup>†</sup> & R. RODRIGUES<sup>‡</sup> \*Oral Surgery Department, Maló Clinic, Lisbon, <sup>†</sup>Research and Development Department, Maló Clinic, Lisbon, and <sup>‡</sup>Prosthodontics Department, Maló Clinic, Lisbon, Portugal



# Sonlu Elemanlar Analizi

Sadele tirmeler

Limitasyonlar

% 100 Temas

Mükemmel  
uyum

Bo luk ve  
sürtünme  
katsayısı yok

- ✓ En yüksek stres de erleri → posteriorda grup fonksiyon oklüzyonuna sahip modeller
  - ✓ Atrofik premaksilla → kısa veya açılı iki implant yerle tirilmesi
  - ✓ Kortikalde → süngerimsi kemikten fazla stres mevcudiyeti



Bu alı mada uygulanan limitasyonlar göz önüne alındı ında, All-on-4 tekni i ile maksiller di siz alanda kısa ve açılı implantların kullanılmasının, restorasyonun ideal bir oklüzyon tasarımı ile gerekle tirilmesi durumunda ba arılı olabilece ini göstermektedir.

# YAŞAMI YENİDEN YEŞERTECEĞİZ

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**Beni dinlediğiniz için teşekkür ederim..**