



STATEMENT OF PROBLEM

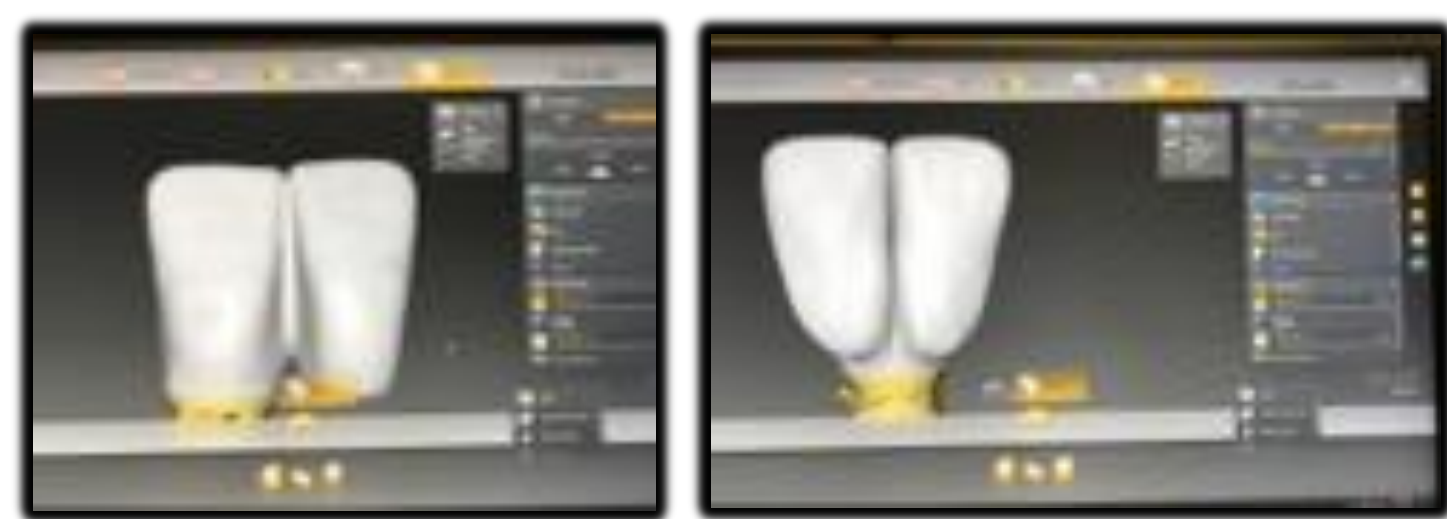
Loss of teeth leads to difficulty in mastication, poor esthetics, and altered speech, also affect the quality of life of individuals. Implant supported cantilever prosthesis in mandibular anterior region is a treatment option for edentulous sites with inadequate mesial-distal space.

OBJECTIVES

To evaluate the magnitude and distribution of stress on peri-implant bone influenced by the elastic properties of indirect restorative materials, dental implants materials, design of the implant fixed prosthesis, and loading conditions.

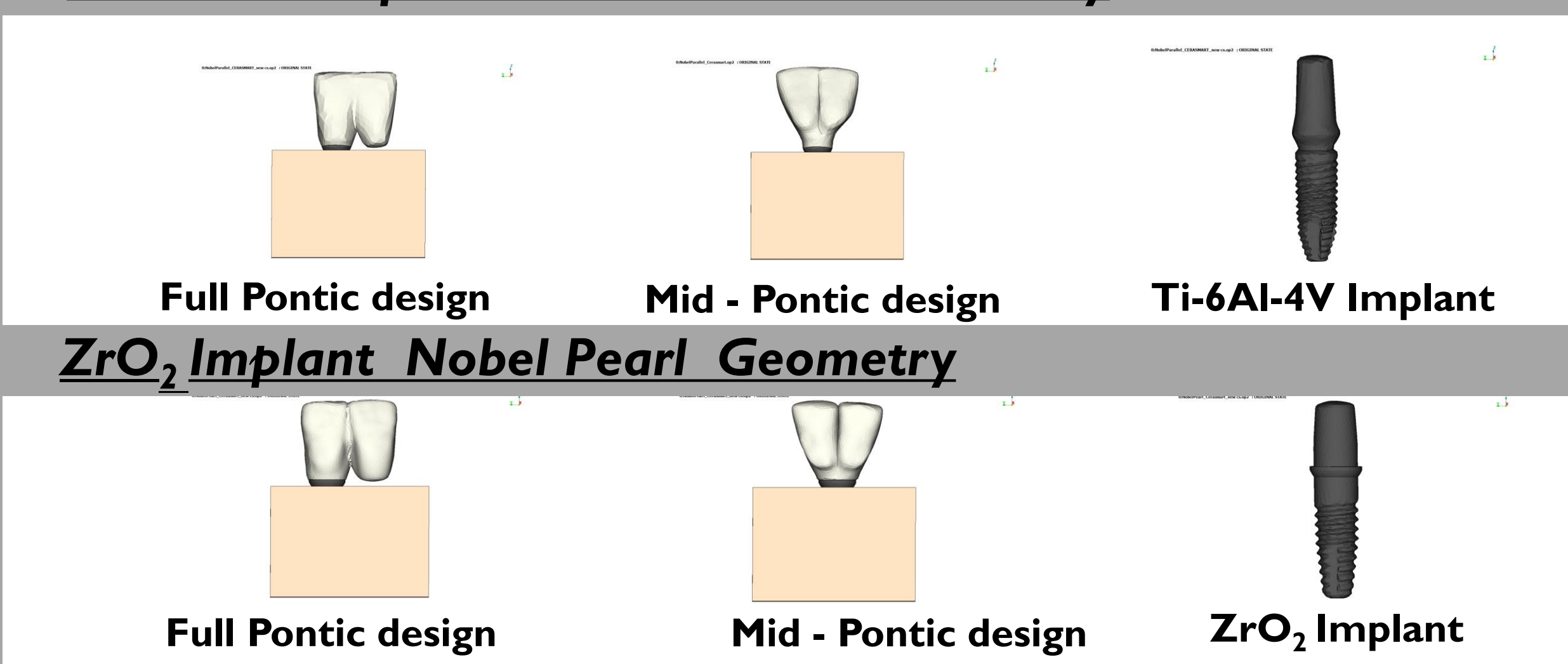
MATERIALS & METHODS

The restoration models used were STL designed files imported from the Dentsply-Sirona Inlab software SW 20 and a section of mandibular bone with a single implant containing a cemented retained implant-supported fixed dental prosthesis #24,25. A three-dimensional (3D) finite element analysis was performed using ANSA static analysis method to obtain the maximum stress on interested regions, crown, bone, implant. Different crown materials (Cerasmart, Enamic, E-max, 4Y-ZrO₂ and 3Y-ZrO₂) were modeled on two implant materials. 3.75x10mm Ti -6Al-4V Nobel Parallel and 4.2x10mm ATZ. A 150-N static load was applied on the incisal edges to the axial axis of the implant with different loading scenarios: Central, Distal Cantilevered, Mid Cantilevered, and Multiple. The data was analysed by multi-way ANOVA regression model using JMP Pro 17.

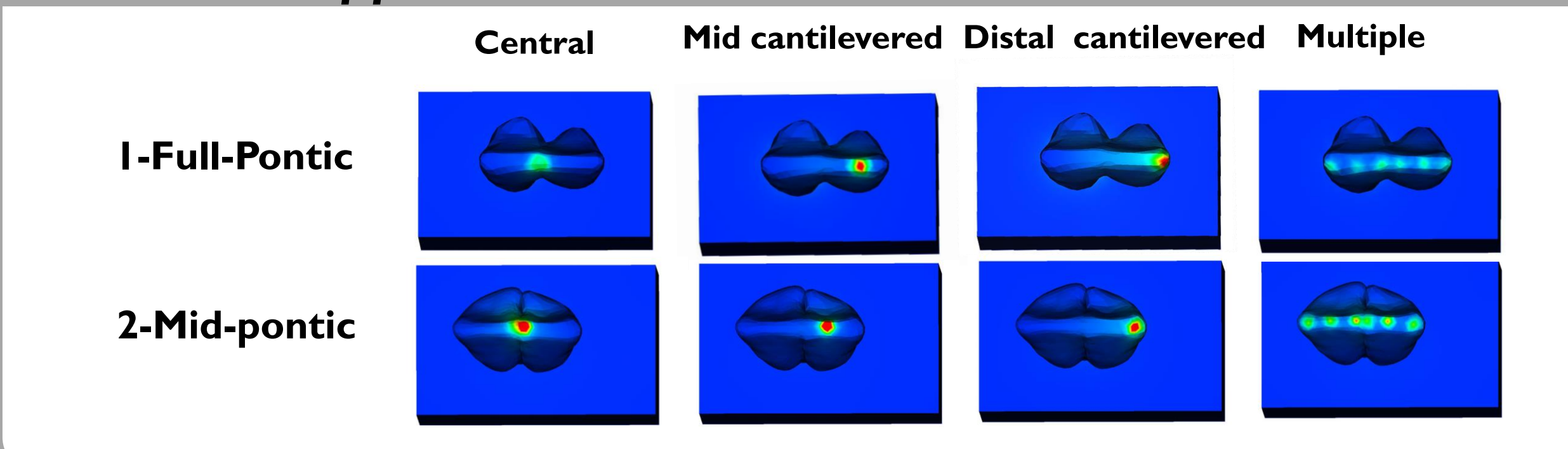


Materials	Modulus of elasticity GPa	Density g/cm ³	Poisson's ratio
ZrO ₂ implant (Nobel Pearl)	250	5.50	0.23
Ti Implant(Nobel Parallel)	114	4.40	0.36
Cerasmart	9,6	1.84	0.38
E- max	95	2.50	0.26
Enamic	30	2.10	0.21
3Y- ZrO ₂ (Zirconia YZ)	210	6.50	0.31
4Y- ZrO ₂	204	3.00	0.31
Bone	17	2.09	0.3

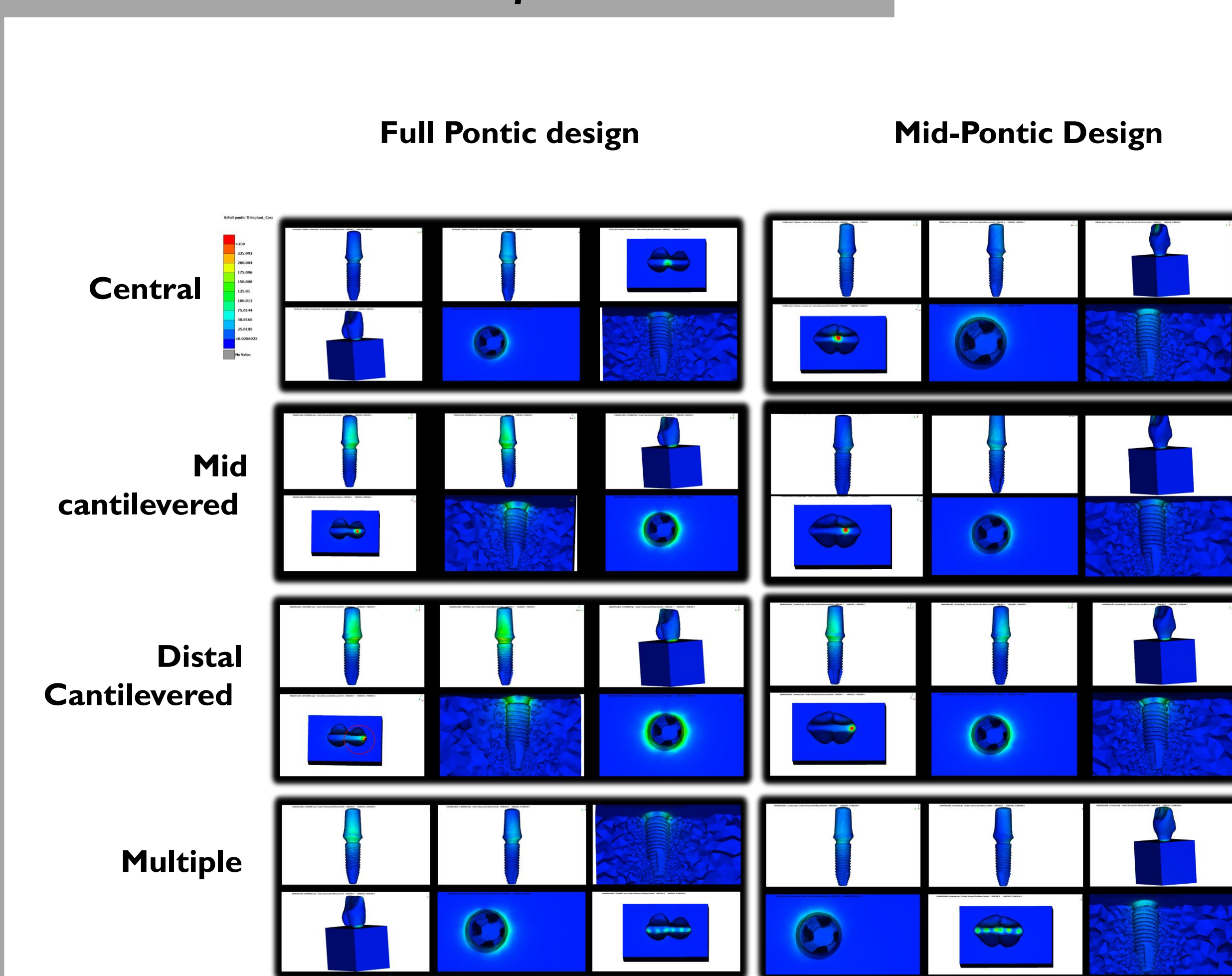
Ti-6Al-4V Implant Nobel Parallel Geometry



Force applications



Nobel Parallel Ti-6Al-4V Implant Cerasmart



Nobel Pearl ZrO₂ Implant Cerasmart

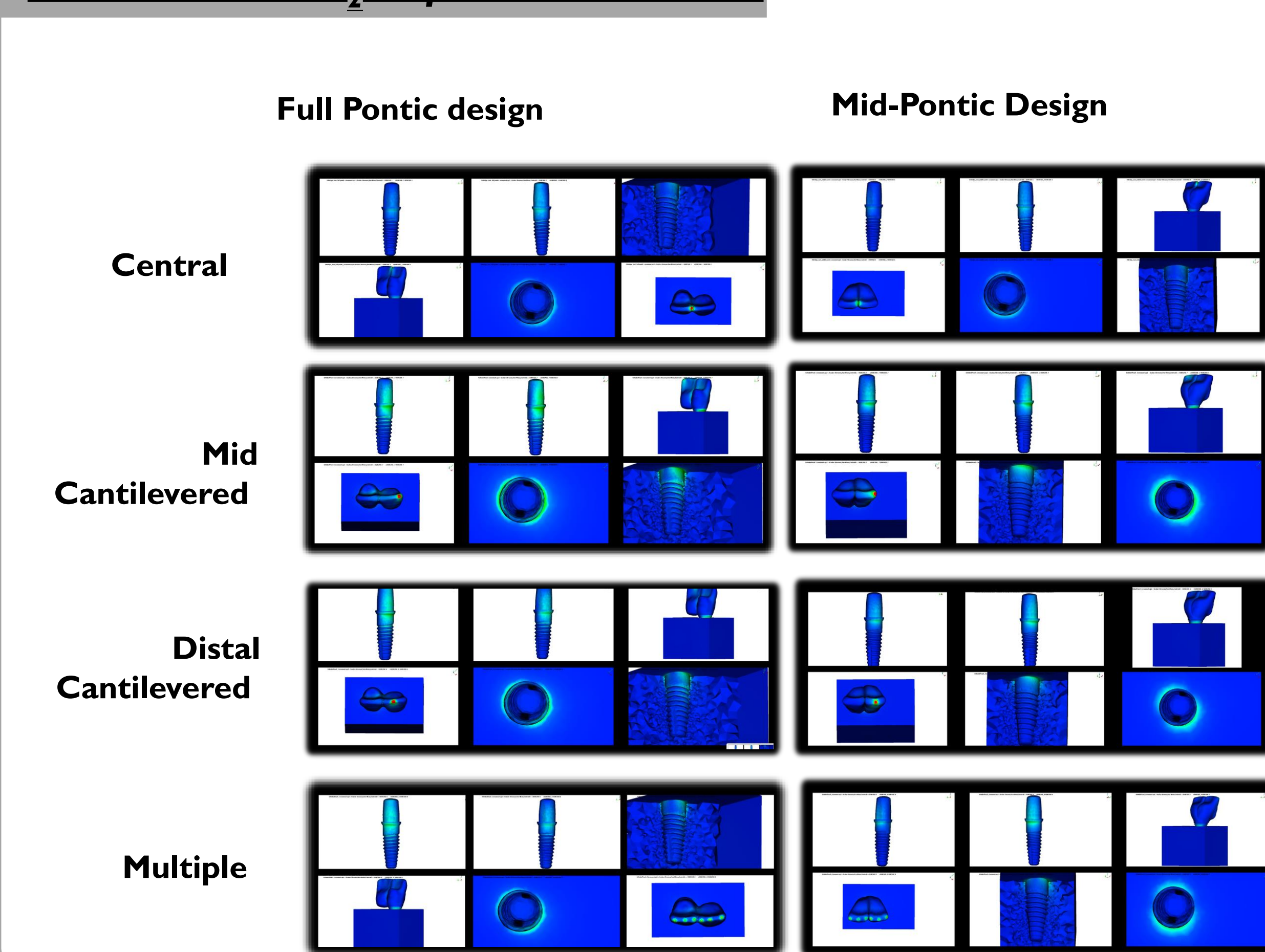


Fig:1 Max stress (MPa)Vs implant, crown Materials and Design

NobelPearl ZrO₂ Implant

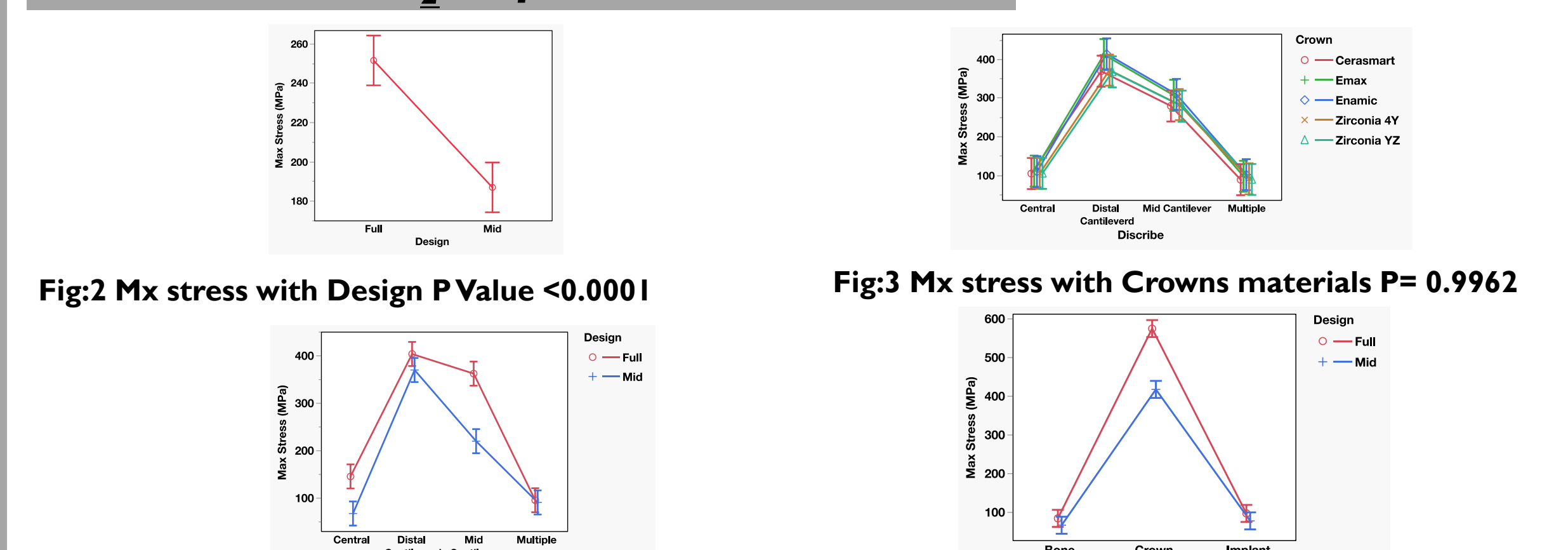


Fig:2 Mx stress with Design P Value <0.0001

Fig:4 Mx stress with (Distal cantilever) P<.0001

Fig:5 Mx stress with Prosthesis parts (crowns) P<.0001

Nobel Parallel Ti-6Al-4V Implant

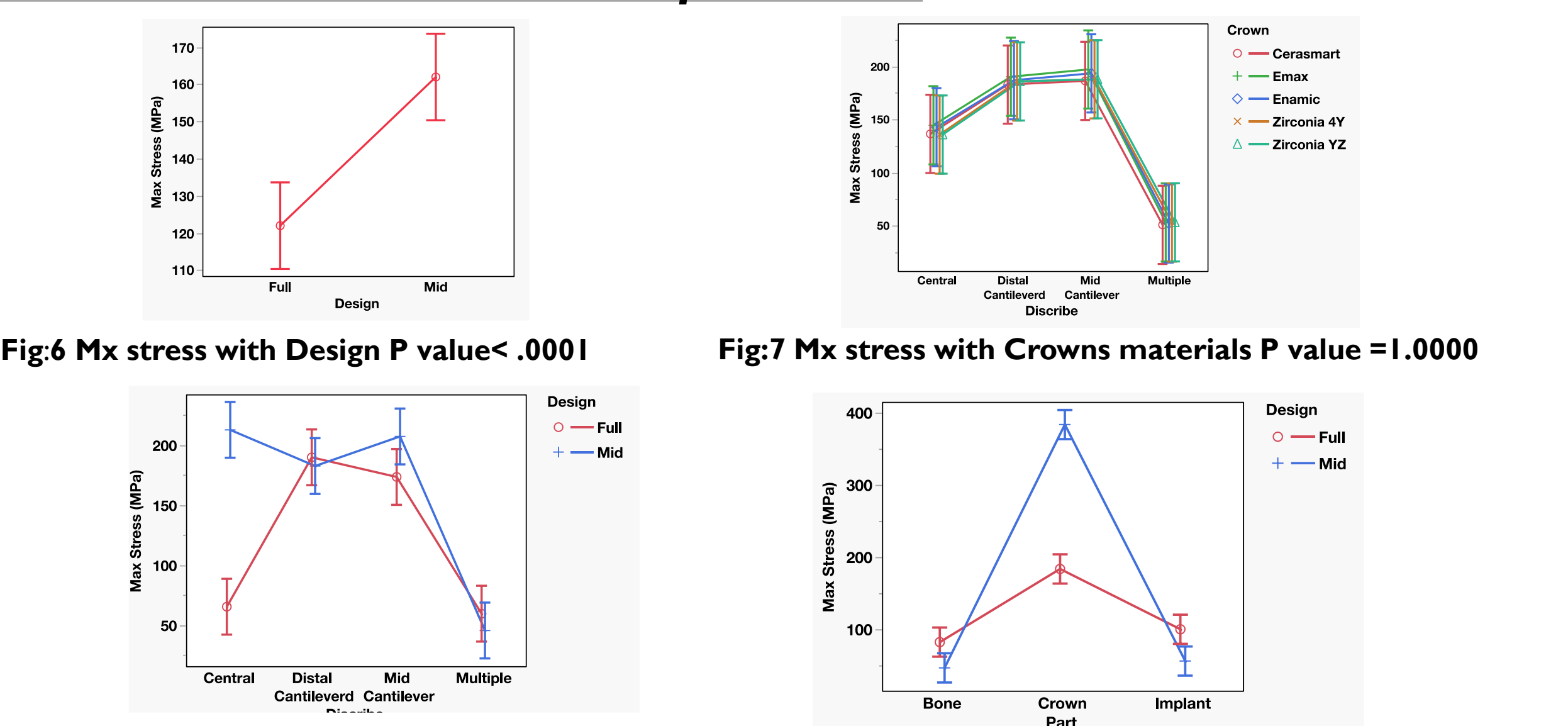


Fig:6 Mx stress with Design P value< .0001

Fig:8 Mx stress w Force applications P value <.0001

Fig:9 Mx stress with Prosthesis parts (crowns) P value<.0001

RESULTS

In general ATZ implant group showed higher magnitude of stress than Ti-6Al-4V group (Fig.1). On ATZ implant group there was a higher magnitude of stress on the full-pontic design compared to the mid-pontic design (Fig. 2, 5), while Ti-6Al-4V implant showed lower magnitude (highest in the crown region) (Fig.9). Compared to the full-pontic design, the Ti-6Al-4V implant group showed a higher stress in the crown region for mid-pontic, while lower stress in the implant-region and no significant difference in supporting bone (Fig.6,9). No significant difference in stress magnitude was observed with different crown materials (Fig.3,7). The highest stress was with the distal cantilever in ATZ Nobel Pearl implant (Fig.4)

CONCLUSIONS

The implant material with lower elastic modulus, mid-pontic cantilevered design, and central or multiple loading showed lower stress magnitude.

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