AAO Foundation Award Final Report
(a/o 2/12/08)

Principal Investigator	Anil Ardeshna, DMD, MDS
Co-Investigator	
Secondary Investigators	
Award Type	AAOF Orthodontic Faculty development Fellowship Award
Project Title	Research in shape memory alloys and smart polymers for orthodontic and biomedical applications
Project Year	2007-2008
Institution	New Jersey Dental School, University of Medicine & Dentistry of New Jersey
Summary/Abstract (250 word maximum)	**Objective:** Three different laboratory analyses were used to evaluate the thermo-mechanical properties of nickel-titanium alloy orthodontic archwires. A better understanding of the properties and parameters would aid selection of orthodontic archwire based on specific force delivery. **Methods:** Storage modulus (mechanical stiffness) of six orthodontic archwire alloys: were investigated at different temperatures in tension mode with dynamic mechanical analysis. Martensitic to Austenitic phase transitional temperatures, and the superelastic profiles were also investigated with direct scanning calorimetry and mechanical deformation testing. **Results:** Changes in Storage Modulus values (stiffness) with temperature were observed for the different groups of alloys. The nickel titanium alloys showed a martensitic-austenic transition on heating, and a reverse transformation on cooling . Steel and TMA did not. Austenic finish temperatures of the NiTi alloys ranged from 30°C to 50°C. Mechanical deformation testing at 25°C in tension mode showed superelastic behavior of Ormco CuNiTi only, and incomplete superelastic behavior during unloading of the GAC Neo Sentalloy alloy. **Conclusion:** The nickel-titanium and TMA alloys exhibited complicated and unexpected properties under DMA and mechanical deformation testing. They had similar stiffness values at 37°C. Only one of the four NiTi alloys (ORMCO CuNiTi) showed superelastic behavior at 25°C. It is possible that the other NiTi alloys also have superelastic behavior, at higher temperatures or higher mechanical load. Further testing is needed to clarify mechanical properties of nickel-titanium alloys.

	An additional project done was, developing an interactive CD-ROM on Orthodontic diagnosis and treatment planning for the dental student.
Were the original, specific aims of the proposal realized?	Yes. We plan to continue research with shape memory metals and polymers, and apply for a future grant. A mini university educational grant to develop an educational multimedia interactive CD-ROM on biomechanics has been submitted.
Were the results published? If not, are there plans to publish? If not, why not?	Abstract will be published in the Autumn Issue of Middle Atlantic Society of Orthodontists Journal. Full publication manuscript is in preparation for submission to American Journal of Orthodontics & Dentofacial Orthopedics
Have the results of this proposal been presented? If so, when and where? If not, are there plans to do so? If not, why not?	A lecture titled "Dynamic thermo-mechanical behavior of current nickel titanium orthodontic arch wires" which presents the results of this research is planned to be presented at the AAO Annual meeting 2009 Boston, MA in the session "Rising Stars and Advances in Orthodontics".