**Republic of Iraq**
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**College of Dentistry**

# Nugget Mechanical Properties of Combination (Rectangular and Round) Soldered and Welded Stainless steel Wires

A Thesis

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# Abstract

During retraction of canines a stoppers used mesial to the molars for preventing Protraction of posterior teeth, but this will subject the anterior teeth to forces via the arch wire from the molars. To prevent the proclination of the anterior teeth a fitness between the brackets and archwire required by using a heavy gauge rectangular archwire but this will produce a high friction during the canine retraction ,therefore, a round archwire is necessary instead. To solve this problem a combination archwire composed from anterior segment rectangular to prevent tipping and posterior segment round to allow anterio - posterior bodily movement & tipping in bucco-palatal dimension and facilitate the canine retraction. There are other benefits for those wires like torqueing of teeth and in v-bends ( making the bend in nugget area to produce differential force system).

A total of sixty stainless steel combination wires were prepared, thirty of them united by soldering group and the other thirty united by welding method group, in each group samples were equally divided into two sub-groups according to the sizes of wires used which were: (0.016×0.022+0.016) inches,(0.016×0.022+0.018) inches, the ultimate force, ultimate tensile strength of nugget area (joints) were tested by universal testing machine, elastic modulus and resiliency were calculated by special equations.

Samples were prepared according to specific parameters which were: length, weight and for (soldered samples) the distance from heat source and time of heat application. Results of ultimate force and ultimate tensile strength showed higher mean values for the soldered (0.016×0.022+0.018) inches combination wire, results for elastic modulus showed higher mean values for soldered (0.016×0.022+0.016) inches combination wire and results of resiliency showed higher mean values for welded (0.016×0.022+0.016) inches wires.

# Abstract

The mechanical properties of the combination stainless steel wires were compared according to the sizes of wires used, according to the methods used for joining them, and also a comparison were made between those wires and the original wires before soldering and welding.

All of the mechanical properties values were lower than the original wires, this is due to the fact that during fabrication of wires there was an exposure to heat which may subject them to recrystallization which lower their mechanical properties, another reason is the diffusion of the solder into the grain boundaries from the wire to the solder and from the solder to the wire. The composition of both the solder and the alloy has been changed with the result that mechanical properties of the joint are no longer under the control of the operator. Welded groups showed lower mechanical values than the original one, this may be because that welding process necessitate melting of the parts to be joined and this will subject the nugget area to further deformation and weakening (the strength of the welded joint decreases with an increase in the area of recrystallization of the adjacent wrought structure).