CLAIMS

1. A microwave antenna apparatus comprising:

a radiating element configured to perform a treatment, the treatment comprising heating a volume of tissue using microwave radiation emitted from the radiating element;

a cooling structure arranged for flowing a coolant through at least one lumen of the cooling structure during the treatment; and

a controller configured to control the flow of coolant to provide a first flow rate of coolant through the at least one lumen during a first period of the treatment, wherein the first flow rate is selected to cause the radiating element to heat a first part of a selected treatment zone such that the first part of the selected treatment zone has a selected first shape, and to provide a second, different flow rate of coolant through the at least one lumen during a second, later period of the treatment, wherein the second flow rate is selected to cause the radiating element to heat a second part of the selected treatment zone such that the second part of the selected treatment zone has a selected second, different shape, wherein

the first and second flow rates, and thus the first and second shapes, are selected so that the treatment zone is a volume of tissue having a desired shape that is more spherical than the first shape and/or second shape.

2. An apparatus according to Claim 1, wherein the selected treatment zone comprises at least one of a) to d):

a) a spherical treatment zone;

b) a hybrid spherical lachrymiform treatment zone;

c) a partial lachrymiform treatment zone;

d) a partial spherical treatment zone.

3. An apparatus according to any preceding claim, wherein the controller is configured to control the flow of coolant such that the first flow rate during the first period is higher than the second flow rate during the second period.

4. An apparatus according to Claim 1 or Claim 2, wherein the controller is configured to control the flow of coolant such that the first flow rate during the first period is lower than the second flow rate during the second period.

5. An apparatus according to any preceding claim, wherein the first period is longer than the second period.

6. An apparatus according to any of Claims 1 to 4, wherein the second period is longer than the first period.

7. An apparatus according to any preceding claim, wherein the controller is configured to vary the flow rate continuously over time during the treatment.

8. An apparatus according to any preceding claim, wherein the controller is further configured to alter a power of the radiation emitted from the radiating element during the treatment.

9. An apparatus according to any preceding claim, wherein the cooling structure comprises at least one inner lumen positioned radially proximal to the radiating element and at least one outer lumen positioned radially distal to the radiating element, and where either a) or b):-

a) the controller is configured to control the flow of coolant such that the coolant flows into the at least one inner lumen and returns through the at least one outer lumen;

b) the controller is configured to control the flow of coolant such that the coolant flows into the at least one outer lumen and returns through the at least one inner lumen.

10. An apparatus according to any preceding claim, wherein the cooling structure comprises a plurality of lumens arranged circumferentially around the radiating element.

11. An apparatus according to any preceding claimwherein the selected treatment zone is selected to reduce or eliminate heating of an anatomical structure and/or the selected treatment zone is selected to reduce tissue shrinkage in the vicinity of the radiating element.

12. An apparatus according to any preceding claim, further comprising at least one temperature sensor configured to monitor temperature within the volume of tissue to be heated, wherein the controller is configured to control the flow of coolant in dependence on signals from the at least one temperature sensor, wherein the signals are representative of the monitored temperature, optionally wherein the controller is further configured to control in dependence on the signals from the at least one temperature sensor at least one of: a power supplied to the radiating element, a direction of coolant flow, a coolant flow path.

13. An apparatus according to any preceding claim, wherein the radiating element is formed from coaxial cable and/or the radiating element comprises at least one of a slot antenna, a monopole antenna, a dipole antenna, a triaxial antenna.

14. An apparatus according to any preceding claims, wherein at least one of a) to d):-

a) the coolant comprises at least one of a gas coolant, a liquid coolant, air, saline;

b) the apparatus is configured to perform microwave ablation of tissue and/or tissue hyperthermia;

c) the flowing of the coolant through at least one lumen of the cooling structure is to cool the radiating element and/or to cool a cable supplying power to the radiating element;

d) the radiating element and the cooling structure are housed within a common housing.

15. A microwave system comprising:

a microwave generator;

a microwave cable apparatus comprising a coaxial cable, wherein an exposed distal portion of an inner conductor of the coaxial cable is longer than an outer conductor of the coaxial cable, the exposed distal portion forming a radiating element, wherein the radiating element is configured to perform a treatment, the treatment comprising heating a volume of tissue using microwave radiation emitted from the radiating element;

a cooling structure arranged for flowing a coolant through at least one lumen of the cooling structure during the treatment; and

a controller configured to control the flow of coolant such as to provide a first flow rate of coolant through the at least one lumen during a first period of the treatment, wherein the first flow rate is selected to cause the radiating element to heat a first part of a selected treatment zone such that the first part of the selected treatment zone has a selected first shape, and to provide a second, different flow rate of coolant through the at least one lumen during a second, later period of the treatment, wherein the second flow rate is selected to cause the radiating element to heat a second part of the selected treatment zone such that the second part of the selected treatment zone has a selected second, different shape, wherein

the first and second flow rates, and thus the first and second shapes, are selected so that the treatment zone is a volume of tissue having a desired shape that is more spherical than the first shape and/or second shape.