Claims

1. An electrosurgical handpiece, comprising:

a housing for a temperature sensor, wherein the housing defines a first patient-contact surface, an inner surface positioned opposite the first patient-contact surface, and an outer wall extending transversely relative to the first patient-contact surface;

a temperature sensor thermally coupled with the inner surface of the housing;

an energizable electrode defining a second patient-contact surface extending outward of the outer wall of the housing;

an insulator positioned between the energizable electrode and the housing for the temperature sensor to inhibit thermal conduction between the energizable electrode and the housing for the temperature sensor; and

wherein (1) the ratio of the thermal mass of the energizable electrode to the thermal mass of the temperature sensor is greater than 100:1 and/or (2) an energizable layer of the energizable electrode comprises a material having a thermal mass lower than a thermal mass of a dermal layer of human skin.

2. The handpiece of claim 1 wherein the first patient-contact surface and the second patient-contact surface are co-centrically aligned with each other.

3. The handpiece of claim 1 wherein the housing for the temperature sensor comprises a material having a thermal conductivity equal to or greater than about 200 W/mK.

4. The handpiece of claim 1 wherein the electrode comprises a dielectric coating defining the second patient contact surface.

5. The handpiece of claim 4 wherein the dielectric material has a dielectric constant of between about 4 to about 12 at an operating frequency of the energizable electrode.

6. The handpiece of claim 1 wherein the energizable electrode is capacitively coupled.

7. The handpiece of claim 6 wherein the energizable electrode is capacitively coupled via a dielectric material coating having a substantially even thickness of about 0.004 to about 0.020 inches.

8. The handpiece of claim 1 wherein the ratio of the thermal mass of the energizable electrode to the thermal mass of the temperature sensor is greater than 100:1.

9. The handpiece of claim 1 wherein the energizable electrode is configured to heat an area of a treatment surface having a diameter of greater than 30 mm when heating to a temperature of 39-46C with an energy flux not exceeding 4000 w/cm^2.

10. The handpiece of claim 1 wherein the energizable electrode comprises a metal foil enclosing a volume and defining a patient contact surface; and the temperature sensor being disposed in the volume and thermally coupled to the patient contact surface.

11. The handpiece of claim 1 wherein the energizable electrode comprises a first layer and a second layer coating the first layer and defining the second patient contact surface, wherein a thermal mass of the energizable electrode is larger than a thermal mass of the temperature sensor, and the first layer comprises a material having a thermal mass lower than a thermal mass of a dermal layer of human skin.

12. The handpiece of claim 1 wherein an energizable layer of the energizable electrode comprises a material having a thermal mass lower than a thermal mass of a dermal layer of human skin.

13. A non-invasive method of aesthetic treatment, comprising:

placing an electrosurgical handpiece comprising an energizable electrode in contact with a treatment surface comprising a tissue layer of skin at an external side of a patient's body;

causing the energizable electrode to emit a radio-frequency (RF) signal for a selected duration, the energizable electrode being configured to deliver energy corresponding to the RF signal, wherein the treatment surface is heated in correspondence with the RF signal and the selected duration;

measuring with the electrosurgical handpiece a temperature of the treatment surface;

communicating the measured temperature to a control system;

receiving from the control system a control signal responsive to the measured temperature;

wherein the energizable electrode has an inner first layer comprising a material having a thermal mass lower than a thermal mass of a dermal layer of human skin, and a second layer comprising a conductive coating over the first layer that defines a patient contact surface; and

wherein the RF signal comprises a waveform that is non-ablative to tissue and applied by the energizable electrode on the dermal tissue layer of skin on the external side of a patient's body.

14. The non-invasive method of aesthetic treatment according to claim 13, further comprising: moving the energizable electrode of the electrosurgical handpiece over the treatment surface to contact different regions of the treatment surface.

15. The non-invasive method of aesthetic treatment according to claim 14, comprising moving the energizable electrode of the electrosurgical handpiece over the treatment surface continuously for the selected duration.

16. The non-invasive method of aesthetic treatment according to claim 13, further comprising: applying a topical solution to the treatment surface before placing the energizable electrode of the electrosurgical handpiece in contact with the treatment surface.

17. The non-invasive method of aesthetic treatment according to claim 16, wherein the topical solution is an ultrasound gel.

18. The non-invasive method of aesthetic treatment according to claim 13, wherein the treatment surface is human skin, and wherein two or more of the skin's dermal layer, an epidermal layer, and a deep tissue layer are heated.

19. The non-invasive method of aesthetic treatment according to claim 18, wherein the treatment surface is heated to a range of about 39C-46C.

20. The non-invasive method of aesthetic treatment according to claim 19, wherein the treatment time period is between about 5 minutes to about 50 minutes.

21. The non-invasive method of aesthetic treatment according to claim 13, wherein the control signal received from the control system causes a termination of the RF signal.

22. The non-invasive method of aesthetic treatment according to claim 13, wherein the control signal received from the control system causes a re-engagement of the RF signal.

23. The non-invasive method of aesthetic treatment according to claim 13, further comprising: causing the energizable electrode of the electrosurgical handpiece to emit a sinusoidal RF energy.

24. A non-invasive method of aesthetic treatment, comprising:

causing an electrosurgical handpiece to emit a radio-frequency (RF) signal for a selected duration, the electrosurgical handpiece comprising an energizable electrode and a temperature sensor thermally coupled thereto, and an insulator positioned between the energizable electrode and a housing for the temperature sensor to inhibit thermal conduction between the energizable electrode and the housing for the temperature sensor and wherein an energizable layer of the energizable electrode has a higher thermal mass than the temperature sensor;

receiving from the temperature sensor of the electrosurgical handpiece a temperature of a treatment surface in contact with the energizable electrode of the electrosurgical handpiece, wherein the treatment surface comprises a dermal tissue layer of skin on an external side of a patient's body;

comparing the received temperature to a threshold temperature;

terminating the RF signal when the received temperature is equal to or higher than the threshold temperature;

re-engaging or continuing the RF signal emission when the received temperature is lower than the threshold temperature; and

wherein the RF signal comprises a waveform that is non-ablative to tissue and applied by the energizable electrode on the dermal tissue layer of skin on the external side of a patient's body.

25. A non-invasive method of aesthetic treatment, comprising:

causing an energizable electrode of the electrosurgical handpiece to emit a radio-frequency (RF) signal for a selected duration, the electrosurgical handpiece comprising

a housing for a temperature sensor, wherein the housing defines a first patient-contact surface, an inner surface positioned opposite the first patient-contact surface, and an outer wall extending transversely relative to the first patient-contact surface;

a temperature sensor thermally coupled with the inner surface of the housing;

an energizable electrode defining a second patient-contact surface extending outward of the outer wall of the housing;

an insulator positioned between the energizable electrode and the housing for the temperature sensor to inhibit thermal conduction between the energizable electrode and the housing for the temperature sensor;

receiving from the temperature sensor of the electrosurgical handpiece while in a non-invasive use a temperature of a skin treatment surface in contact with the electrosurgical handpiece;

comparing the received temperature to a threshold temperature;

terminating the RF signal when the received temperature is equal to or higher than the threshold temperature;

re-engaging or continuing the RF signal emission when the received temperature is lower than the threshold temperature; and further comprising:

receiving a user selection of a value for one or more of a first frequency, a first amplitude, a first pulse-width, a second frequency, a second amplitude, and a second pulse-width; and

causing the electrosurgical handpiece to emit a RF signal comprising a waveform blended from a first current waveform having the first frequency, the first amplitude, and the first pulse-width and a second current waveform having the second frequency, the second amplitude, and the second pulse-width; and

wherein the waveform is non-ablative to tissue and applied by the energizable electrode on a dermal tissue layer of skin on an external side of a patient's body.

26. The non-invasive method of aesthetic treatment of claim 24 or 25 wherein the energizable electrode has an inner first layer comprising a material having a thermal mass lower than a thermal mass of a dermal layer of human skin, and a second layer comprising a conductive coating over the first layer that defines a patient contact surface.

27. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the first patient-contact surface and the second patient-contact surface are co-centrically aligned with each other.

28. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the housing for the temperature sensor comprises a material having a thermal conductivity equal to or greater than about 200 W/mK.

29. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the electrode comprises a dielectric coating defining the second patient contact surface.

30. The non-invasive method of aesthetic treatment of claim 29 wherein the dielectric material has a dielectric constant of between about 4 to about 12 at an operating frequency of the energizable electrode.

31. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the energizable electrode is capacitively coupled.

32. The non-invasive method of aesthetic treatment of claim 31 wherein the energizable electrode is capacitively coupled via a dielectric material coating having a substantially even thickness of about 0.004 to about 0.020 inches.

33. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the ratio of the thermal mass of the energizable electrode to the thermal mass of the temperature sensor is greater than 100:1.

34. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the energizable electrode is configured to heat an area of a treatment surface having a diameter of greater than 30 mm when heating to a temperature of 39-46C with an energy flux not exceeding 4000 w/cm^2.

35. The non-invasive method of aesthetic treatment of claim 13, 24, 25 wherein the energizable electrode comprises a metal foil enclosing a volume and defining a patient contact surface; and the temperature sensor being disposed in the volume and thermally coupled to the patient contact surface.

36. The non-invasive method of aesthetic treatment of claim 13, 24 or 25 wherein the energizable electrode comprises a first layer and a second layer coating the first layer and defining the second patient contact surface, wherein a thermal mass of the energizable electrode is larger than a thermal mass of the temperature sensor, and the first layer comprises a material having a thermal mass lower than a thermal mass of a dermal layer of human skin.

37. The electrosurgical system of claim 24 or 25 wherein an energizable layer of the energizable electrode comprises a material having a thermal mass lower than a thermal mass of a dermal layer of human skin.