Claims

The invention claimed is:

1. A device for delivering electromagnetic radiation to the iris of the human eye, comprising:

an electromagnetic radiation generator;

a computerized scanning system to apply the electromagnetic radiation to the iris; and

a delivery profile of the electromagnetic radiation pathway such that the energy density at the iris is greater than the energy density at the posterior portion of the eye.

2. The device of claim 1 wherein the electromagnetic radiation comprises light waves.

3. The device of claim 2 wherein the electromagnetic radiation generator is a laser.

4. The device of claim 1 wherein the electromagnetic radiation comprises sound waves.

5. The device of claim 4 wherein the electromagnetic radiation generator is a sound amplification by stimulated emission of radiation (SASER) device.

6. The device of claim 1 wherein the electromagnetic radiation is applied in one or more a spiral patterns.

7. The device of claim 6 wherein the spiral pattern comprises two zones, both concentric to the pupil, the first zone extending from approximately the outer periphery of the pupillary constrictor muscles to approximately the outer periphery of the pupil, and the second zone extending from approximately the limbus to approximately the outer periphery of the pupillary constrictor muscles.

8. The device of claim 7 wherein the electromagnetic radiation is applied to the first zone prior to its application to the second zone.

9. The device of claim 1 wherein the site of a second application of the electromagnetic radiation overlaps the site of a first application of electromagnetic radiation within a 24-hour period.

10. The device of claim 1 wherein the site of a subsequent application of the electromagnetic radiation does not overlap the site of any previous application of electromagnetic radiation within an approximately 24-hour period.

11. The device of claim 1 wherein the electromagnetic radiation is not applied inside the perimeter of the pupil.

12. The device of claim 1 wherein the electromagnetic radiation is applied to not less than 25 percent of the total anterior surface area of the iris.

13. The device of claim 2 wherein the delivery profile of the light beam diverges posterior to the iris.

14. The device of claim 13 wherein the divergence angle of the beam is not less than approximately 1.0 degree.

15. The device of claim 14 wherein the divergence angle of the beam is not less than approximately 2.5 degrees.

16. The device of claim 15 wherein the divergence angle of the beam is not less than approximately 5.0 degrees.

17. The device of claim 16 wherein the divergence angle of the beam is not less than approximately 7.5 degrees.

18. The device of claim 17 wherein the divergence angle of the beam is not less than approximately 10.0 degrees.

19. The device of claim 18 wherein the divergence angle of the beam is not less than approximately 12.5 degrees.

20. The device of claim 1 wherein a spot is produced on the anterior surface of the iris by the light waves, and the diameter of the spot is between approximately 10 microns and approximately 15 millimeters.

21. The device of claim 1 wherein the device also comprises an apparatus to restrict movement of the head.

22. The device of claim 21 wherein the apparatus comprises a bite bar.

23. The device of claim 22 wherein the apparatus also comprises an object that prevents the forehead from moving towards the device during treatment.

24. The device of claim 23 wherein the object comprises at least one of a rod, a bar, or a strap.

25. The device of claim 1 wherein the device also comprises an apparatus to restrict movement of the treated eye.

26. The device of claim 25 wherein the apparatus comprises a gaze fixation target.

27. The device of claim 26 wherein the target comprises a moving video image.

28. The device of claim 27 wherein the moving video image comprises live action.

29. The device of claim 27 wherein the moving video image comprises animation.

30. The device of claim 26 wherein the target comprises a light.

31. The device of claim 30 wherein the light changes color at least one time during treatment.

32. The device of claim 30 wherein the light changes intensity at least one time during treatment.

33. The device of claim 30 wherein the light is situated inside of a cylindrical tube.

34. The device of claim 26 wherein the target is situated in front of the treated eye during treatment.

35. The device of claim 26 wherein the target is situated in front of the fellow eye during treatment.

36. The device of claim 1 wherein the device also includes detecting movement of the eye during treatment.

37. The device of claim 36 wherein movement of the eye is detected by detecting movement of the pupil.

38. The device of claim 37 wherein infrared iris transillumination is used to locate the pupil.

39. The device of claim 36 wherein the application site of the electromagnetic radiation moves to correspond to the movement of the eye.

40. The device of claim 36 wherein application of the electromagnetic radiation is suspended if the eye moves from a first position to a second position.

41. The device of claim 40 wherein application of the electromagnetic radiation resumes if the eye returns to the first position.

42. The device of claim 2 wherein the device also measures the depth of the anterior chamber of the eye and adjusts the application of the light to take into account the refraction of the light during treatment.

43. The device of claim 2 wherein the device also measures the shape of the cornea and adjusts the application of the light to take into account the refraction of the light during treatment.

Claims

1. An apparatus for delivering electromagnetic radiation to an iris of a human eye, comprising:

an electromagnetic radiation generator, configured to generate an electromagnetic radiation pathway, and

a computerized scanning system, configured to direct the pathway to at least one predetermined area of the anterior surface of the iris.

2. An apparatus for delivering electromagnetic radiation to an iris of a human eye, comprising:

an electromagnetic radiation generator, configured to generate an electromagnetic radiation pathway,

wherein the pathway produces at least a first spot and a second spot on the anterior surface of the iris,

the first spot and the second spot overlap, and

the area of overlap between the first spot and the second spot is between approximately 25% and approximately 75% of the average area of the first spot and the second spot.

3. An apparatus for delivering electromagnetic radiation to an iris of a human eye, comprising:

an electromagnetic radiation generator, configured to generate an electromagnetic radiation pathway,

wherein the pathway is directed to at least one predetermined area of the anterior surface of the iris, and

the predetermined areas comprise, in the aggregate, at least approximately 50% of the anterior surface of the iris.

4. The apparatus according to any of the previous claims, wherein the electromagnetic radiation generator comprises a laser device.

5. The apparatus according to any of the previous claims, wherein the electromagnetic radiation generator comprises radio frequency.

6. The apparatus according to any of the previous claims, wherein the electromagnetic radiation generator comprises a frequency configured to produce ultrasound energy.

7. The apparatus according to any of the previous claims, wherein the pathway profile is such that the energy density at the iris is greater than the energy density at the posterior portion of the eye.

8. The apparatus according to any of the previous claims, wherein at least a portion of the pathway profile diverges at a predetermined angle.

9. The apparatus according to claim 8, wherein at least a portion of the pathway profile diverges at a predetermined angle, and the divergence is approximately collimated.

10. The apparatus according to claim 8, wherein at least a portion of the pathway profile diverges at a predetermined angle, and the divergence is greater than approximately 10 degrees.

11. The apparatus according to claim 8, wherein at least a portion of the pathway profile diverges at a predetermined angle, and the divergence is greater than approximately 20 degrees.

12. The apparatus according to any of claims 1 or 3 to 11, wherein the predetermined areas of the anterior surface of the iris comprise, in the aggregate, at least approximately 50% of the total anterior surface of the iris.

13. The apparatus according to any of claims 1 or 3 to 11, wherein the predetermined areas of the anterior surface of the iris comprise, in the aggregate, at least approximately 75% of the total anterior surface of the iris.

14. The apparatus according to any of claims 1 or 3 to 11, wherein the predetermined areas of the anterior surface of the iris comprise, in the aggregate, no more than approximately 75% of the total anterior surface of the iris.

15. The apparatus according to claims 1, 3 to 14, wherein the pathway produces a first spot and a second spot on the predetermined areas of the anterior surface of the iris,

the first spot and the second spot overlap, and

the area of overlap between the first spot and the second spot is between approximately 25% and approximately 75% of the average area of the first spot and the second spot.

16. The apparatus according to any of the previous claims, wherein at least a portion of the electromagnetic radiation is delivered to the iris in a spiral pattern.

17. The apparatus according to any of the previous claims, wherein at least a portion of the electromagnetic radiation is delivered to the iris in a raster pattern.

18. The apparatus according to any of the previous claims, wherein the apparatus further comprises a bite bar.

19. The apparatus according to any of previous claims, wherein the apparatus further comprises a gaze fixation target.

20. The apparatus according to any of previous claims, wherein the apparatus is further configured to detect movement of the eye.

21. The apparatus according to claim 20, wherein the apparatus is further configured to shift the direction of the pathway to correspond to the movement of the eye.