CLAIMS

1. An oral hygiene system for monitoring compliance with an oral hygiene regimen, the system comprising:

an oral hygiene device comprising a handle, a head, and one or more patterns;

an optical sensor for detecting visual data related to the one or more patterns; and

a control system configured to determine a position of the oral hygiene device based on at least a statistical analysis comparing previously recorded calibration data and the visual data output by the optical sensor, the statistical analysis including periodically correcting a drift associated with determining the position.

2. The oral hygiene system according to claim 1, wherein the control system is further configured to determine an orientation of the oral hygiene device based on at least an analysis of the one or more patterns in the visual data output by the optical sensor.

3. The oral hygiene system according to claim 1, wherein the one or more patterns is on an add-on attachment to the oral hygiene device.

4. The oral hygiene system according to claim 1, wherein a first pattern of the one or more patterns is on the head.

5. The oral hygiene system according to claim 1, wherein a second pattern of the one or more patterns is on the handle.

6. The oral hygiene system according to claim 1, wherein the oral hygiene device is a toothbrush.

7. The oral hygiene system according to claim 1, wherein the position of the oral hygiene device is determined with respect to a mouth of a user of the oral hygiene device.

8. The oral hygiene system according to claim 1, configured for the position of the oral hygiene device to be determined by determining a position of the head, a position of the handle, or a position of the one or more patterns on the oral hygiene device.

9. The oral hygiene system according to claim 1, configured for an orientation of the oral hygiene device to be determined by the control system based on at least the visual data output by the optical sensor.

10. The oral hygiene system according to claim 9, wherein the oral hygiene device further includes a motion sensor that is configured to output motion data relating to an orientation of the oral hygiene device and wherein the control system is further configured to determine the orientation of the oral hygiene device in space additionally based on the motion data output from the motion sensor.

11. The oral hygiene system according to claim 0, wherein the control system is further configured to determine relative positional changes of the oral hygiene device using the visual data output from the optical sensor.

12. The oral hygiene system according to claim 0 wherein the control system is further configured to utilize the visual data output from the optical sensor to determine an estimated distance window within which the oral hygiene device has changed position.

13. The oral hygiene system according to claim 0, wherein the control system is further configured to utilize the statistical analysis to determine an orientation of the oral hygiene device.

14. The oral hygiene system according to claim 0, wherein the control system is further configured to utilize the statistical analysis to determine positional changes of the oral hygiene device.

15. The oral hygiene system according to claim 14, configured for the statistical analysis to be performed using relative positional changes based on a reference coordinated system determined during each session of brushing with the oral hygiene device.

16. The oral hygiene system according to claim 15, configured for the statistical analysis to be performed by fitting the visual data from the optical sensor to the previously recorded calibration data after the control system determines a completed brushing session.

17. The oral hygiene system according to claim 0, wherein the control system is further configured to determine an orientation of the oral hygiene device by analyzing motion data from a motion sensor representing the strength and direction of the earth's magnetic field.

18. The oral hygiene system according to claim 10, wherein the motion sensor is a gyroscope or accelerometer.

19. An electronic oral hygiene device system for monitoring brushing and compliance with a tooth brush regime, the system comprising:

a toothbrush including a handle and a head;

an attachment that is configured to be attachable to the handle of the toothbrush, the attachment including a first visual pattern;

a camera for detecting visual data related to the first visual pattern;

a memory for storing the visual data output by the camera and in data communication with the camera; and

a control system configured to determine a relative distance and direction of positional movement of the toothbrush based on at least a statistical analysis of previously recorded calibration data and the visual data output by the camera, the statistical analysis including periodically correcting a drift associated with determining position of the toothbrush.

20. The tooth brushing system according to claim 0, wherein the head includes a second visual pattern different from the first visual pattern.

21. The tooth brushing system according to claim 19, configured for the control system to utilize the visual data output from the camera to determine an estimated distance window within which the toothbrush has changed position.

22. The tooth brushing system according to claim 19, wherein the toothbrush further includes a motion sensor that is configured to output motion data relating to orientation of the toothbrush and wherein the control system is further configured to calculate an orientation of the toothbrush in space based on the visual data output from the camera.

23. A method for determining an orientation of an oral hygiene device, the method comprising:

recording, during a calibration session, calibration data from an optical sensor that represents an image of the oral hygiene device in a fixed orientation;

storing the calibration data in a memory;

recording, during a use session, usage data from the optical sensor; and

performing a statistical analysis on the usage data and the calibration data to determine at least one orientation of the oral hygiene device, the statistical analysis including periodically correcting a drift associated with determining position of the oral hygiene device.

24. The method of claim 23, wherein the statistical analysis is performed using a regression analysis.

25. The method of claim 23, wherein the statistical analysis is performed using a reference starting position in the user's mouth recorded during the use session.

26. The method of claim 23, wherein the performing the statistical analysis on the usage data and the calibration data also includes determining a relative positional movement of the oral hygiene device.

27. The method of claim 0, wherein the calibration session records data representing a user's face.

28. The method of claim 27, wherein the calibration session compares the size of a visual pattern on the oral hygiene device to the size of the user's face.

29. An electronic oral hygiene device system for monitoring brushing and compliance with a tooth brush regime, the system comprising:

an oral hygiene device including a handle and a head, wherein the oral hygiene device contains a visual pattern;

a base station including an optical sensor;

a motion sensor configured to output motion data related to motion of the oral hygiene device;

a memory for storing the motion data output by the motion sensor, the memory being in data communication with the motion sensor; and

a control system configured to determine a position of the head of the oral hygiene device in a user's mouth by comparing the motion data to previously recorded calibration data using a statistical analysis and by periodically correcting a drift of the position determination using visual data output from the optical sensor.

30. An oral hygiene system for monitoring brushing and compliance with a tooth brush regime, the system comprising:

a toothbrush including a handle, a head, and one or more patterns;

an optical sensor for detecting visual data, the visual data including a representation of the toothbrush;

a memory containing machine readable medium comprising machine executable code having stored thereon instructions for performing a method of determining a position and an orientation of the toothbrush;

a control system including a processor coupled to the memory, the processor being configured to execute the machine executable code to cause the control system to determine the orientation and the position of the toothbrush based on at least a statistical analysis of previously

recorded calibration data and the visual data output by the optical sensor, the statistical analysis including periodically correcting a drift associated with determining the position of the toothbrush.

31. The oral hygiene system according to claim 0, wherein the toothbrush further includes a gyroscope that is configured to output motion data relating to orientation changes of the toothbrush and wherein the control system is configured to determine the orientation of the oral hygiene device additionally based on the motion data output from the gyroscope.

32. The oral hygiene system according to claim 0, wherein the control system is also configured to determine relative positional changes of the toothbrush using visual data output from the optical sensor.

33. The oral hygiene system according to claim 0 wherein the control system is configured to utilize the visual data output from the optical sensor to determine an estimated distance window within which the toothbrush has changed position.

34. The oral hygiene system according to claim 0, wherein the control system is configured to utilize a statistical analysis to determine the orientation of the toothbrush.

35. The oral hygiene system according to claim 0, wherein the control system is configured to utilize a statistical analysis to determine positional changes of the toothbrush.

36. The oral hygiene system according to claim 0, configured for the statistical analysis to be performed using relative positional changes based on a reference coordinated system determined during each session of brushing.

37. The oral hygiene system according to claim 0, configured for the statistical analysis to be performed by fitting the data from the optical sensor to calibration data after the control system determines a completed brushing session.

38. The oral hygiene system according to claim 0, configured for the control system additionally to determine the orientation of the toothbrush by analyzing motion data from a magnetometer representing the strength and direction of the earth's magnetic field.

39. The oral hygiene system according to claim 0, configured for the control system additionally to determine the orientation of the toothbrush by analyzing motion data from a motion sensor connected to the toothbrush.

40. The oral hygiene system according to claim 0, wherein a first pattern of the one or more patterns is located on the handle of the toothbrush.

41. The oral hygiene device system according to claim 0, configured for the control system to determine the position of the toothbrush by identifying an orientation of a longitudinal axis of the toothbrush relative to a mouth of the user based on the representation the toothbrush included in the visual data.

42. The oral hygiene device system according to claim 0, wherein the visual data further includes a representation of the mouth of the user, and wherein the control system is configured:

to determine the position of the toothbrush with respect to the mouth of the user based on the representation of the toothbrush included in the visual data and the representation of the mouth of the user included in the visual data, and

to combine the determined position of the toothbrush with the orientation information determined from motion data output by a gyrometer to identify which of the user's teeth are being brushed.

43. The oral hygiene system according to claim 0, wherein the motion data from the motion sensor is at least one of acceleration data or orientation data.

44. A non-transitory, computer-readable storage medium having stored thereon instructions for performing a method comprising machine executable code which when executed by at least one machine, causes the machine to:

determine a spatial position of an oral hygiene device based on at least visual data output by an optical sensor, the visual data including a representation of the oral hygiene device;

determine an angular orientation of the oral hygiene device based on at least motion data output by a motion sensor; and

determine a section of a user's teeth being brushed by the oral hygiene device using a statistical analysis of previously recorded data, the determined spatial position and the determined angular orientation, the statistical analysis including periodically correcting a drift associated with determining the spatial position of the oral hygiene device.

45. The non-transitory, computer-readable storage medium of claim 0, wherein the section of the user's teeth comprises an outside face of upper molars, or an inside face of lower molars.

46. The non-transitory, computer-readable storage medium of claim 0, wherein the section of the user's teeth comprises an outside face of upper incisors or an outside face of lower incisors.

47. The non-transitory, computer-readable storage medium of claim 0, wherein the representation of the oral hygiene device comprises optical data representing a pattern on the optical hygiene device.

48. The non-transitory, computer-readable storage medium of claim 0, wherein the motion data output by the motion sensor is orientation data.

49. The non-transitory, computer-readable storage medium of claim 0, wherein the motion data output by the motion sensor is acceleration data.

50. An oral hygiene system for monitoring compliance with an oral hygiene regimen, the system comprising:

an optical sensor for detecting visual data related to one or more patterns on an oral hygiene device, the oral hygiene device also comprising a handle and a head; and

a control system configured to determine a position of the oral hygiene device based on at least a statistical analysis comparing previously recorded calibration data and the

visual data output by the optical sensor, the statistical analysis including periodically correcting a drift associated with determining the position.