intensity to about 37% has occurred, is typically one to five millimeters in biological tissues. A comparably high penetration depth can be achieved when irradiating in the yellow spectral range, i.e., in the wavelength range from 560 to 590 nm. In contrast, the penetration depth greater than 2 µm of ultraviolet, violet and infrared radiation in biological tissues is typically only in the micrometer range.

In an aspect, the present disclosure provides a hand-held device for excitation a hand-held device for excitation and irradiation of pathogenic microorganisms in the mouth and throat, comprising at least one excitation light source in the short-wave visible spectral range, at least one primary irradiation light source in the red spectral range for primary irradiation of the pathogenic microorganisms and for transillumination, and optionally at least one secondary irradiation light source in the visible spectral range from 450 nm to 600 nm, wherein the emitted radiation of the irradiation light sources each have spectral components which can be absorbed by endogenous porphyrins produced by the pathogenic microorganisms, whereby fluorescence formation and inactivation of the pathogenic microorganisms occurs on the basis of subsequent processes, and the hand-held device further comprises a pressure sensor which, upon detection of a pressure of the hand-held device onto an affected surface area, increases an irradiation light intensity to values in a range of 10 mW/cm^2 to 100 mW/cm^2 to achieve inactivation of the pathogenic microorganisms.

According to the disclosure, a hand-held device for the excitation and irradiation of pathogenic microorganisms in the mouth and throat is provided, which comprises at least one excitation light source in the short-wave visible spectral range for auto-fluorescence excitation and irradiation of the pathogenic microorganisms at the surface of the region to be irradiated. The short-wave visible spectral range mentioned herein preferably comprises violet light in a range from 400 nm to 410 nm. Typical light penetration depths in this spectral range are a few hundred micrometers in the tooth, i.e. < 1 mm. Furthermore, the handheld device according to the disclosure comprises at least one primary irradiation light source in the red spectral range, i.e. having a wavelength around 630 nm, both for primary irradiation of the pathogenic microorganisms and for transillumination, i.e. having dual applicability. Furthermore, the handheld device according to the disclosure optionally comprises at least one

secondary irradiation light source in the visible spectral range, preferably green or yellow, for irradiating the pathogenic microorganisms. The excitation light source, as well as the primary and the optional secondary irradiation light source emit appropriate visible radiation, wherein all irradiation light sources have different wavelengths, and the respective emitted radiation is comprised of spectral components which can be absorbed by endogenous porphyrins produced by the pathogenic microorganisms. Thus, fluorescence formation and inactivation of the pathogenic microorganisms can be achieved on the basis of subsequent processes. Besides direct irradiation of the microorganisms for inactivation thereof, radiation of the primary irradiation light source in the red spectral range around 630 nm is additionally also suitable for detecting inflammatory processes in the throat (sinusitis) by transillumination. In other words, the handheld device according to the disclosure comprises at least one violet radiation source (405 nm) and one red radiation source (633nm). Herein, the violet radiation is used for fluorescence excitation and inactivation of bacteria on the surface of the dental hard tissue and soft tissue. On the one hand, the red radiation of the primary irradiation light source is for the already mentioned dual use applicability, for detection of sinusitis

CLAIMS

1. A hand-held device (1; 1') for excitation and irradiation of pathogenic microorganisms in the mouth and throat, comprising
at least one excitation light source (31; 31') in the short-wave visible spectral range,
at least one primary irradiation light source (32; 32') in the red spectral range for primary irradiation of the pathogenic microorganisms and for transillumination, and
optionally at least one secondary irradiation light source (33; 33') in the visible spectral range from 450 nm to 600 nm, wherein
the emitted radiation of the irradiation light sources (32, 33; 32', 33') each have spectral components which can be absorbed by endogenous porphyrins produced by the pathogenic microorganisms, whereby fluorescence formation and inactivation of the pathogenic microorganisms occurs on the basis of subsequent processes, and
the hand-held device (1; 1') further comprises a pressure sensor which, upon detection of a pressure of the hand-held device (1; 1') onto an affected surface area, increases an irradiation light intensity to values in a range of 10 mW/cm^2 to 100 mW/cm^2 to achieve inactivation of the pathogenic microorganisms.

2. The handheld device (1; 1') according to claim 1, wherein the excitation light source (31; 31') emits an excitation radiation corresponding to an absorption maximum of porphyrins, preferably in a range of 400 nm to 410 nm, further preferably in a range of 405 nm.

3. The hand-held device (1; 1') according to any one of the preceding claims, wherein the primary irradiation has a wavelength component in a range from 630 nm to 700 nm, preferably in a range from 630 nm to 635 nm, further preferably in a range of 633 nm.

4. The hand-held device (1; 1') according to any one of the preceding claims, wherein the optional secondary irradiation has a wavelength component in a range from 490 nm to 560 nm, preferably in the range of 505 nm.

5. The hand-held device (1; 1') according to any one of the preceding claims, wherein emission of the excitation light source (31; 31') radiation, the primary irradiation light source (32; 32') radiation and the optional secondary irradiation light source (33; 33') radiation is performed in the manner of a traffic light circuit.

6. The handheld device (1; 1') according to any one of the preceding claims, wherein the handheld device (1; 1') further comprises at least one light detection device for detecting an intrinsic fluorescence radiation of the pathogenic microorganisms, preferably wherein the handheld device (1; 1') further comprises a transmission device for transmitting the detection output of the light detection means to an external device.

7. The handheld device (1; 1') according to any one of the preceding claims, wherein the excitation light source (31; 31'), the primary irradiation light source (32; 32') and/or the optional secondary irradiation light source (33; 33') comprises at least one of a light-emitting diode LED, an organic light-emitting diode OLED and/or a laser.

8. The hand-held device (1; 1') according to any one of the preceding claims, wherein the hand-held device (1; 1') is a dental cleaning device (1; 1') for use during daily dental hygiene, preferably wherein the excitation light source (31; 31'), the primary irradiation light source (32; 32') and/or the optional secondary irradiation light source (33; 33') are located in a brush head (3; 3') of the dental cleaning device (1; 1') and irradiation occurs in the bristle direction, further preferably wherein the excitation light source, at low intensity, is for bacterial detection in the throat by fluorescence activation of porphyrins in the pathogenic microorganisms and, at higher intensity, for inactivation of surface pathogenic microorganisms, the primary irradiation light source is for inactivation of deeper located pathogenic microorganisms and as a transmission source by

transillumination for the detection and follow-up of sinusitis, and the optional secondary irradiation light source is for inactivation of deeper located pathogenic microorganisms.

9. The hand-held device (1; 1') according to claim 8, wherein
the hand-held device (1) is a manually operated toothbrush (1), preferably wherein the brush head (3) is provided with a replaceable bristle carrier (4); or
the hand-held device (1') is an electrically operated toothbrush (1'), preferably wherein the brush head (3') which can be put into in rotation and/or oscillation is replaceable, and wherein a power supply to the electric drive (24') of the brush head (3') and a power supply to the excitation light source (31; 31'), the primary irradiation light source (32; 32') and/or the secondary irradiation light source (33; 33') is provided by the same power source (21').

10. The handheld device (1; 1') according to any one of the preceding claims, wherein the handheld device (1; 1') comprises an integrated power source (21; 21') for supplying power to the excitation light source (31; 31'), the primary irradiation light source (32; 32') and/or the optional secondary irradiation light source (33; 33'), preferably wherein the integrated power source (21; 21') is wirelessly chargeable.