DEVELOPMENT OF PRACTICALLY USEFUL LASER TECHNIQUES

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(1) REPETITION PULSE LASER

In practice, we must after need such delicate laser irradiating technique as to give little thermal damage and yet to be effective on the tissues, for example in laser treatment of hard tissue or so small or so thin tissues. The author has developed a useful laser exposing technique named 'Repetition Pulse Laser (R.P.L.)', which is easy to control the lasing condition and the operation of lasers.

The fundamental technique of R.P.L. is as follows (Fig. 1) : The laser energy PW necessary for achievement of a therapeutic effect in a tissue is divided into numerous short pulse laser of small energy and they are exposed on the tissue repeatedly. Fig.2 shows an example of the effect of CO₂ laser R.P.L. in making pin-hole on lased tissue. A fixed amount of CO₂ laser energy is exposed to the tissue surface both in one shot and with different types of R.P.L. as shown here. The length of each pin hole is approximately the same. The factors affecting R.P.L. involves power P , pulse width W_r , frequency of the pulse T , duty factor W_r/T , number of repetition N and the total energy E_g . The most greatest advantage of R.P.L. is that it is applicable to any case in order to be able to select the most suitable laser condition varying widely the factors of R.P.L., R.P.L. technique is easy to operate and to be controlled the cutting depth of tissues at will, and the thermal damage of it is much less than CW waves.

(2) COMBINED YAG LASER AND CO₂ LASER THERAPY

Combined laser therapy (CLT) is a method to achieve the therapeutic purpose using a few kinds of laser together and takes advantage of their different effects on tissue.

The authors have developed purposive laser therapy for cancer combining YAG laser and CO₂ laser. Figure 3 shows the process of this operation. ① First of all, a tumor tissue is coagulated to cause necrosis with a YAG laser. ② Secondly, the coagulated area

only is vaporized with CO₂ laser. The two processes are repeated one after the other alternately till the tumor is completely removed. (Fig.3) The advantages of this method as follows :

- ① Freedom from metastatic risks. ② Effective inhibition of bleeding. ③ Relief from deformity. ④ Easy operation. ⑤ Harmless. ⑥ Available for an sizes of tumor.

(3) NEW SPECIAL LASER HANDPIECE

The author has developed multi-directional irradiation laser handpieces and the irradiation field variable laser handpieces with a zoom lens, which are both useful in various field (Fig.4).

(4) PAINLESS DENTAL TREATMENT WITH YAG LASER

The author has developed the painless dental treatment using Nd-YAG laser which has been used practically in the author's hospital with patient's great gratitude. Any dental treatment of the teeth after exposure to mild and short pulse Nd-YAG laser can be perform without feeling any pain.

FUTURE PROSPECTS

The author has discovered that the tooth pulp can be filled with secondary dentin with stimulation of some kinds of lasers, which may be applicable to the biological endodontic therapy in future (Fig.5).

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5