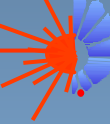


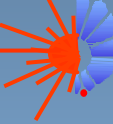
ATUAÇÃO CIRÚRGICA DO LASER: Laser de CO₂

Profa. Dra. Ester M. D. Nicola
Departamento Otorrinolaringologia e Laboratório Laser NMCE - FCM
e
UMML - HC / UNICAMP

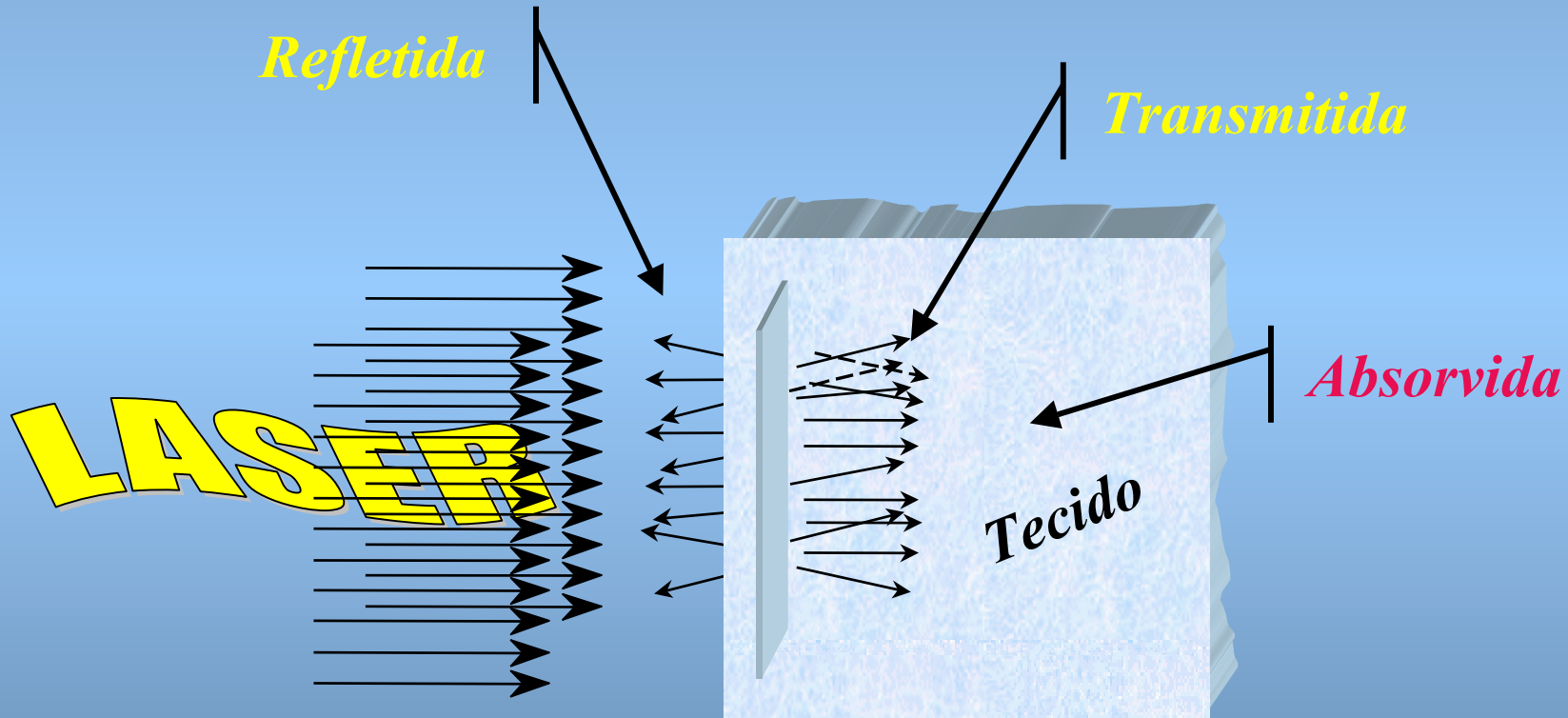


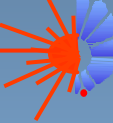
Por que usar Laser em cirurgias?

- Procedimento minimamente invasivo
- Facilitação Técnica
- Qualidade pós-operatória
- Resultados
- Especificidade de uso (vários λ)



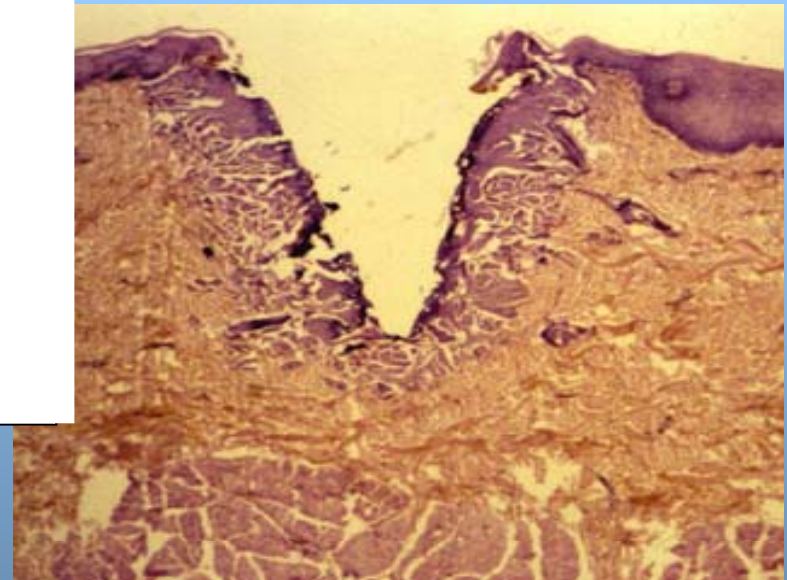
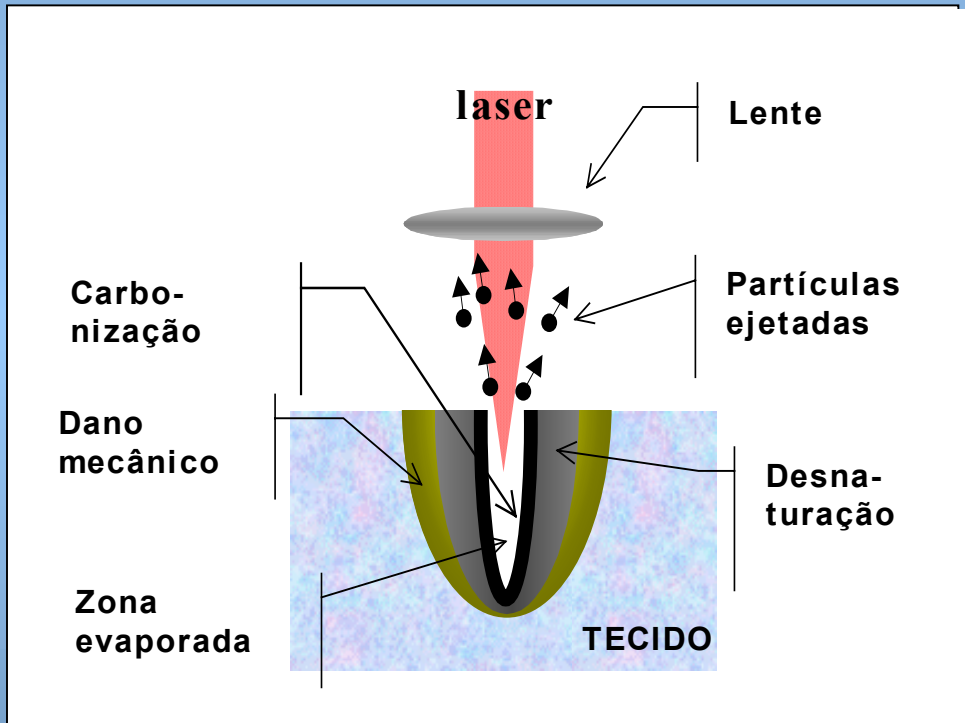
Interação da radiação laser com o tecido biológico

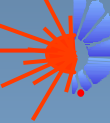




LASER de CO₂

Absorção

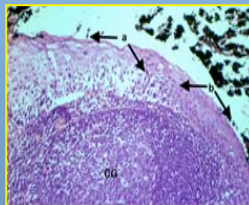




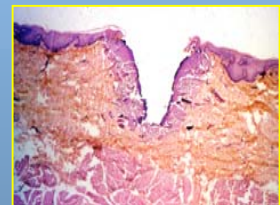
Efeitos de absorção

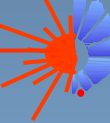
- Desnaturação proteica
- Necrose de superfície
- Vaporização (sublimação) tecidual
- Corte

desnaturação



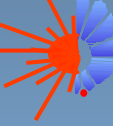
corte



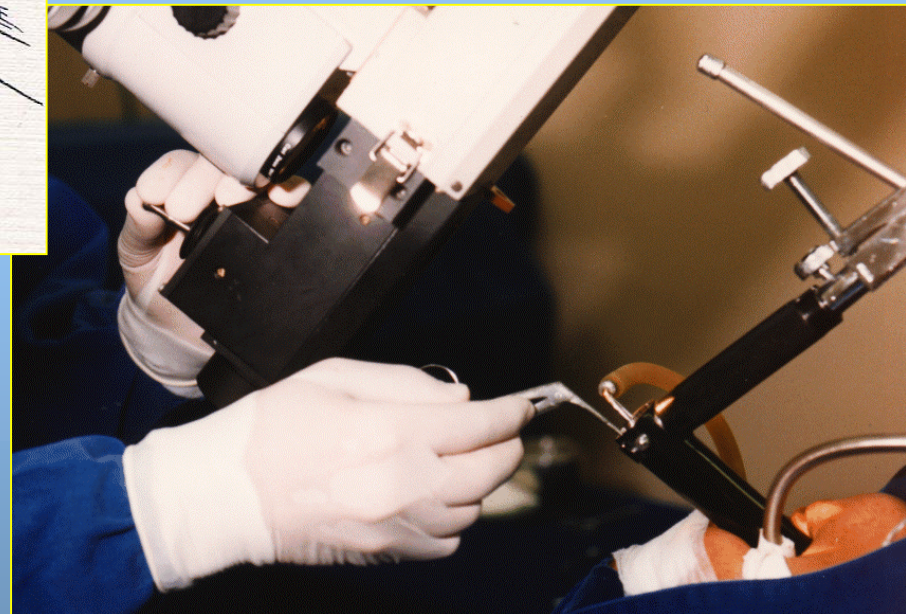
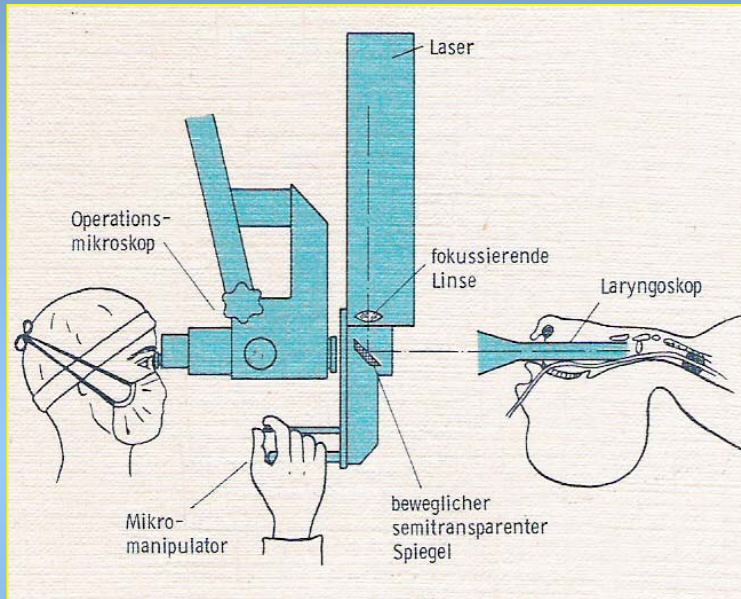


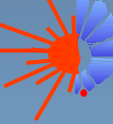
Parâmetros fundamentais relacionados à absorção da radiação laser

- Área de focalização
 - lente
 - foco - defoco
- Potência
- Tempo



Lente de focalização

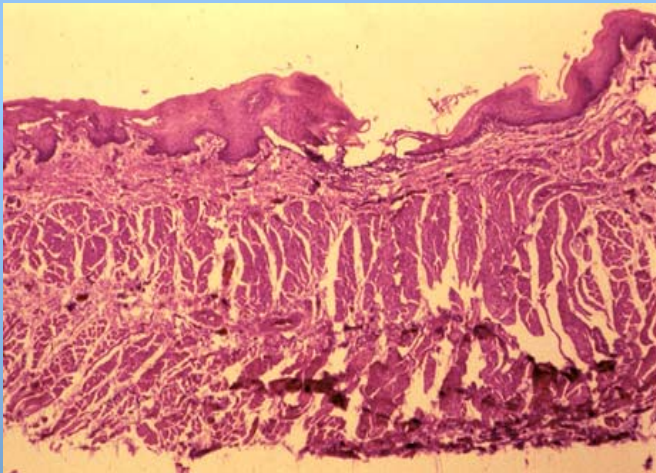




Efeito decorrente da lente utilizada

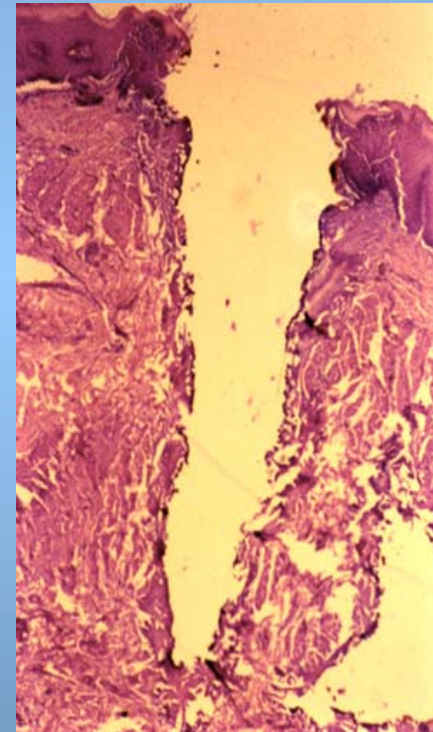
(Potência e tempo constantes)

10 w X 0,5 s = 5 joules

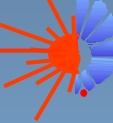


Lente, $f = 400$ mm

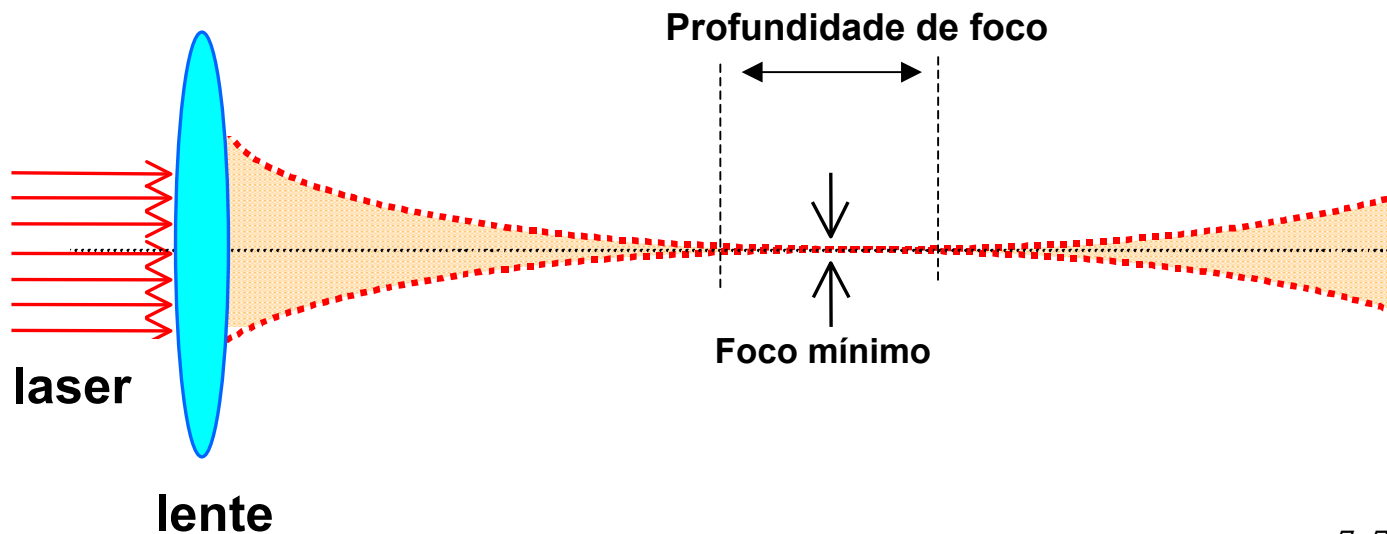
$$D = \text{Energia} / \text{área}$$

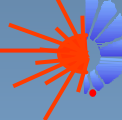


Lente, $f = 200$ mm



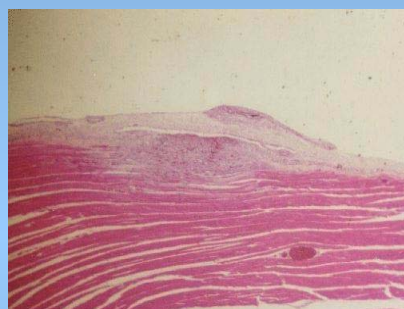
Focalização



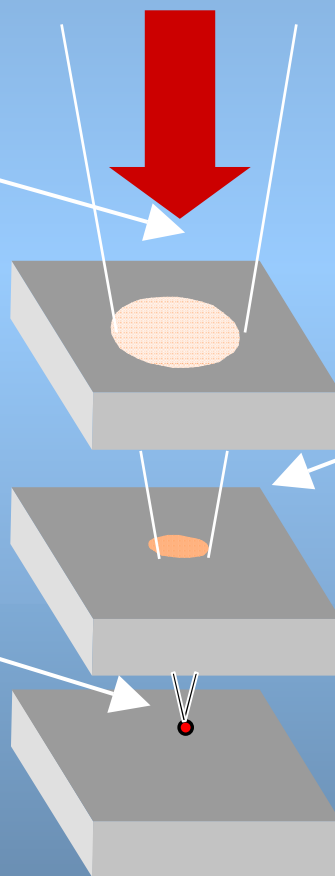


Efeitos de focalização

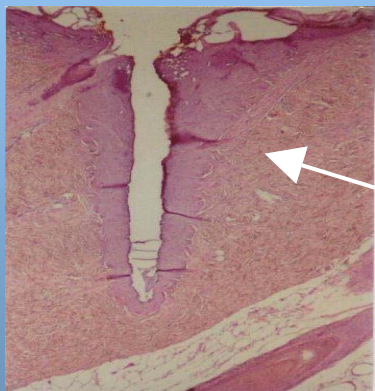
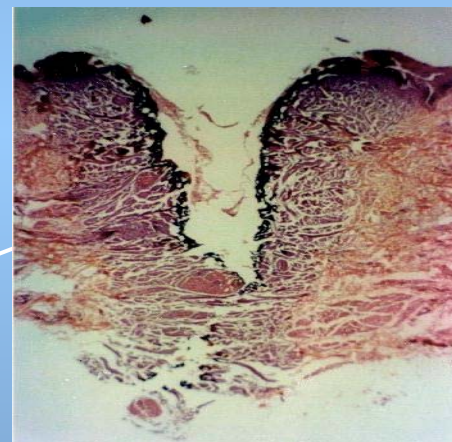
“D” baixa



Laser focalizado



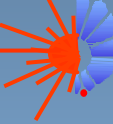
“D” média



“D” alta

$$E (J) = P (W) \times t (s)$$

$$\text{Densidade de Energia} \\ D (J/cm^2) = E / \text{área}$$



Focalização e energia constantes

Potência x Tempo = Energia

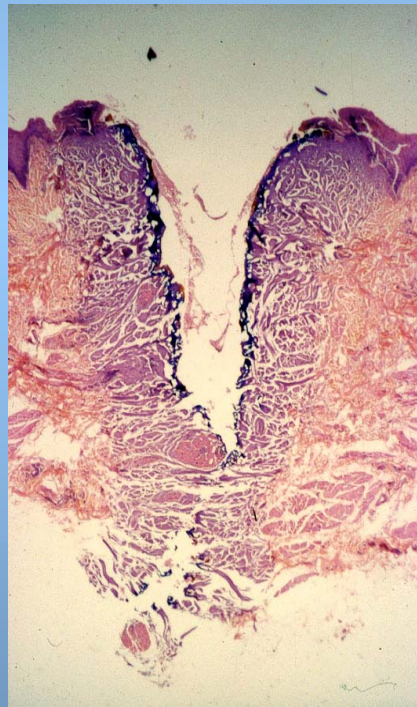
$$20 \text{ W} \times 0,5\text{s} = 10\text{J}$$

$$10 \text{ W} \times 1,0\text{s} = 10\text{J}$$

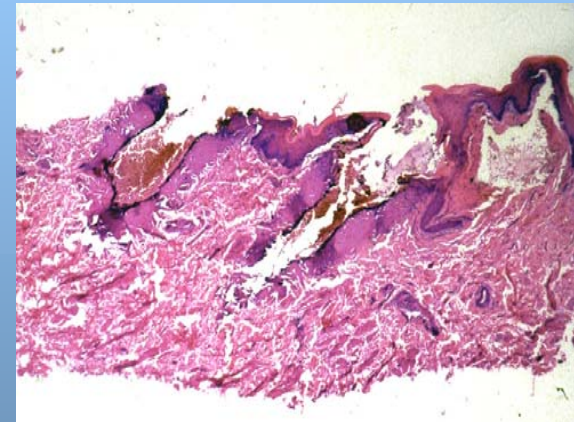
$$5 \text{ W} \times 2,0\text{s} = 10\text{J}$$



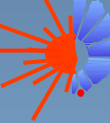
20 W x 0,5 s



10 W x 1 s

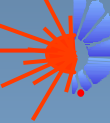


5 W x 2 s



Modos de aplicação do laser de CO₂

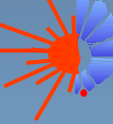
- **Lesões delimitadas e volumosas:**
 - Corte, focalizado, 15 a 30 W (cw) ou superpulso 8 a 12 W.
Remoção total, mínimo dano aos tecidos circunvizinhos.
- **Lesões extensas e pouco volumosas**
 - Vaporização da superfície por varredura, 8 a 10 W (cw) modo normal ou scaneado, vaporizando por camadas.



Modos de aplicação do laser de CO₂

- **Lesões pequenas, puntiformes ou em áreas que necessitam grande preservação:**
 - Pulsos isolados ou repetidos, potência e tempo adequados a cada situação. Focalizado ou desfocado.

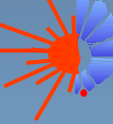
- **Lesões Vasculares:**
 - Vasos até 0,5 mm de diâmetro, cauterização imediata.
 - Vasos de 0,5 até 1,0 mm de diâmetro - laser desfocado, potência baixa .



Lesões delimitadas e volumosas:

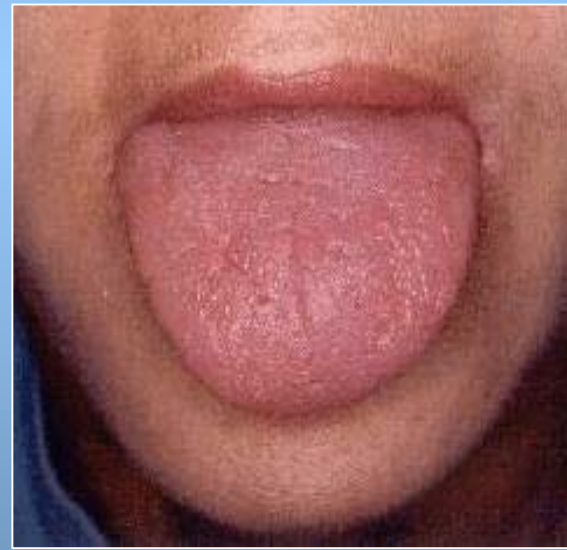
Hiperplasia gengival

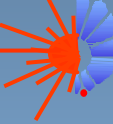




Lesões delimitadas e volumosas:

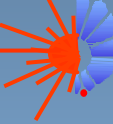
Fibroma de língua





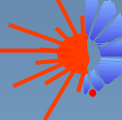
Lesões extensas e pouco volumosas: Hiperplasia gengival medicamentosa





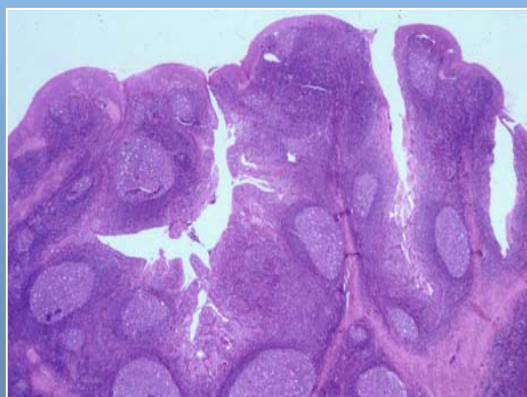
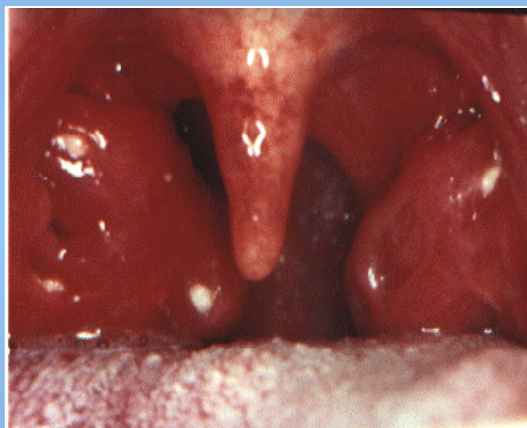
Lesões extensas e pouco volumosas: Lesões leucoplásicas (brancas)



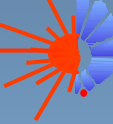


Lesões extensas e pouco volumosas:

Tonsilite crônica caseosa

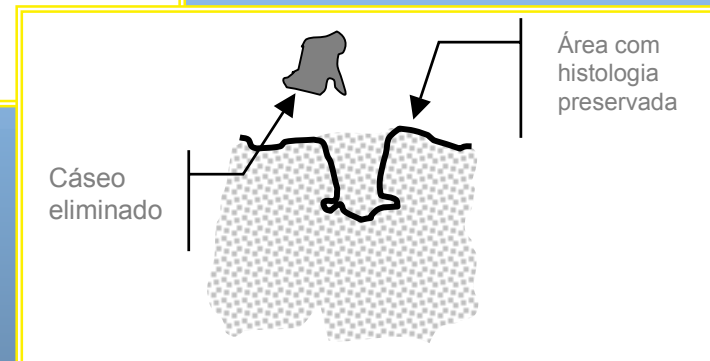
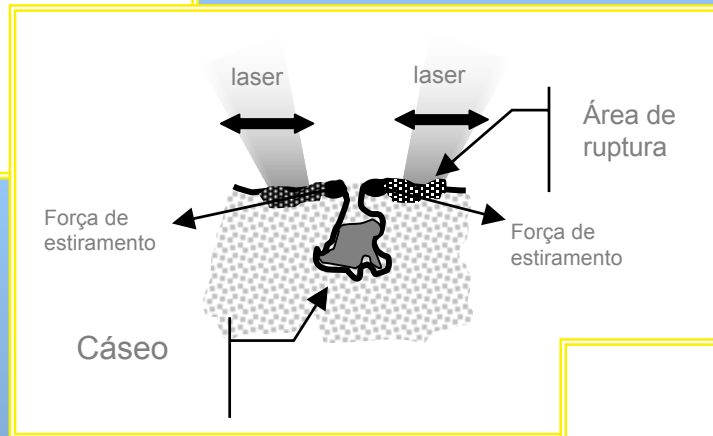
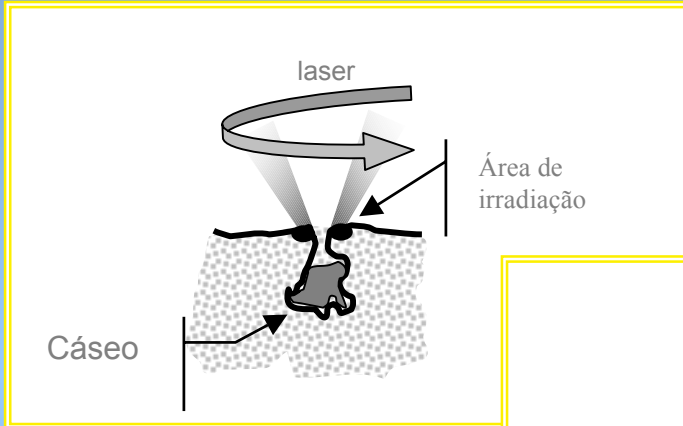


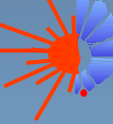
P = 6 W Área = 2 mm²
velocidade = 5 mm/s - D = 54,5 J/cm²
velocidade = 15 mm/s - D = 18 J/cm²



Lesões extensas e pouco volumosas:

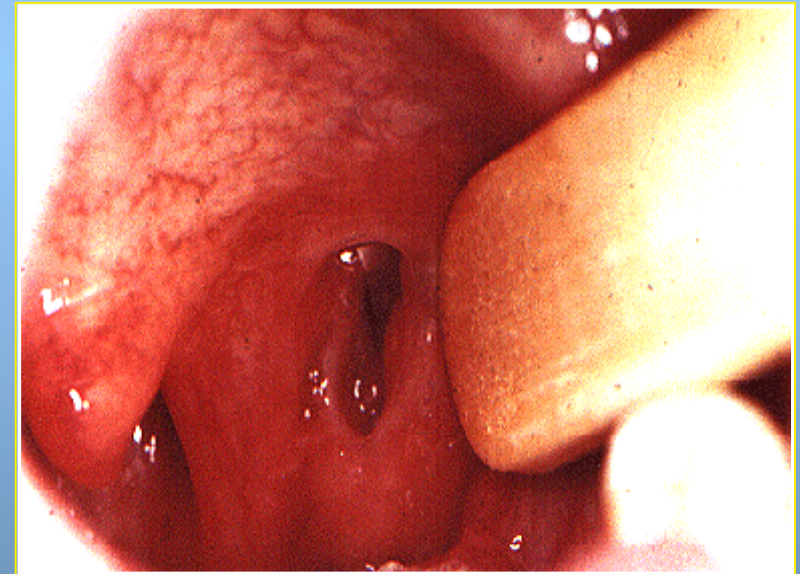
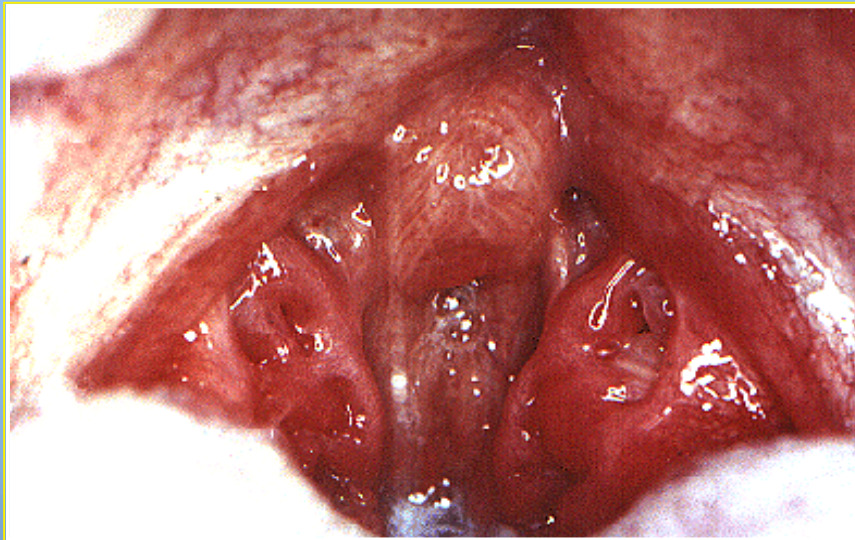
Mecanismo da ação do laser

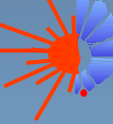




Lesões extensas e pouco volumosas:

Aspecto ao final do tratamento

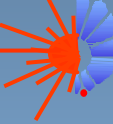




Lesões pequenas, puntiformes ou em áreas que necessitam grande preservação

Granuloma piogênico





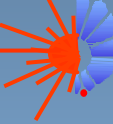
Lesões vasculares

Excisão cirúrgica (corte)

Tratamento:

- extensão
- localização
- vascularização





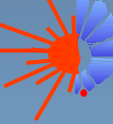
Lesões vasculares

Técnicas minimamente invasivas

Técnica de pontos

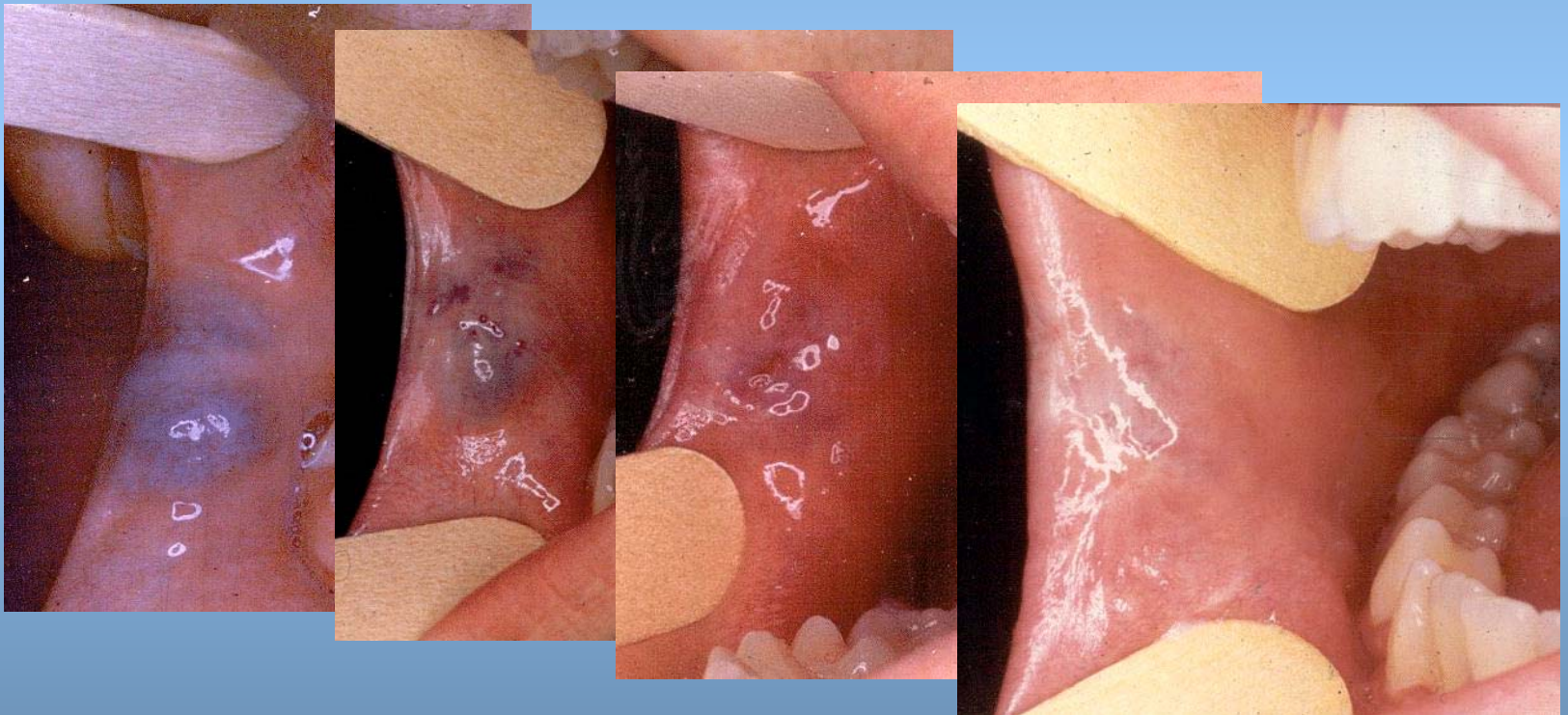


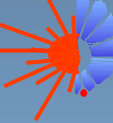
P = 8 a 15 W
t = 0,2 a 0,5 s



Lesões vasculares

Técnica de pontos





Lesões vasculares

Técnica de cerclagem

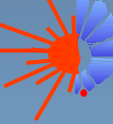


Cerclagem

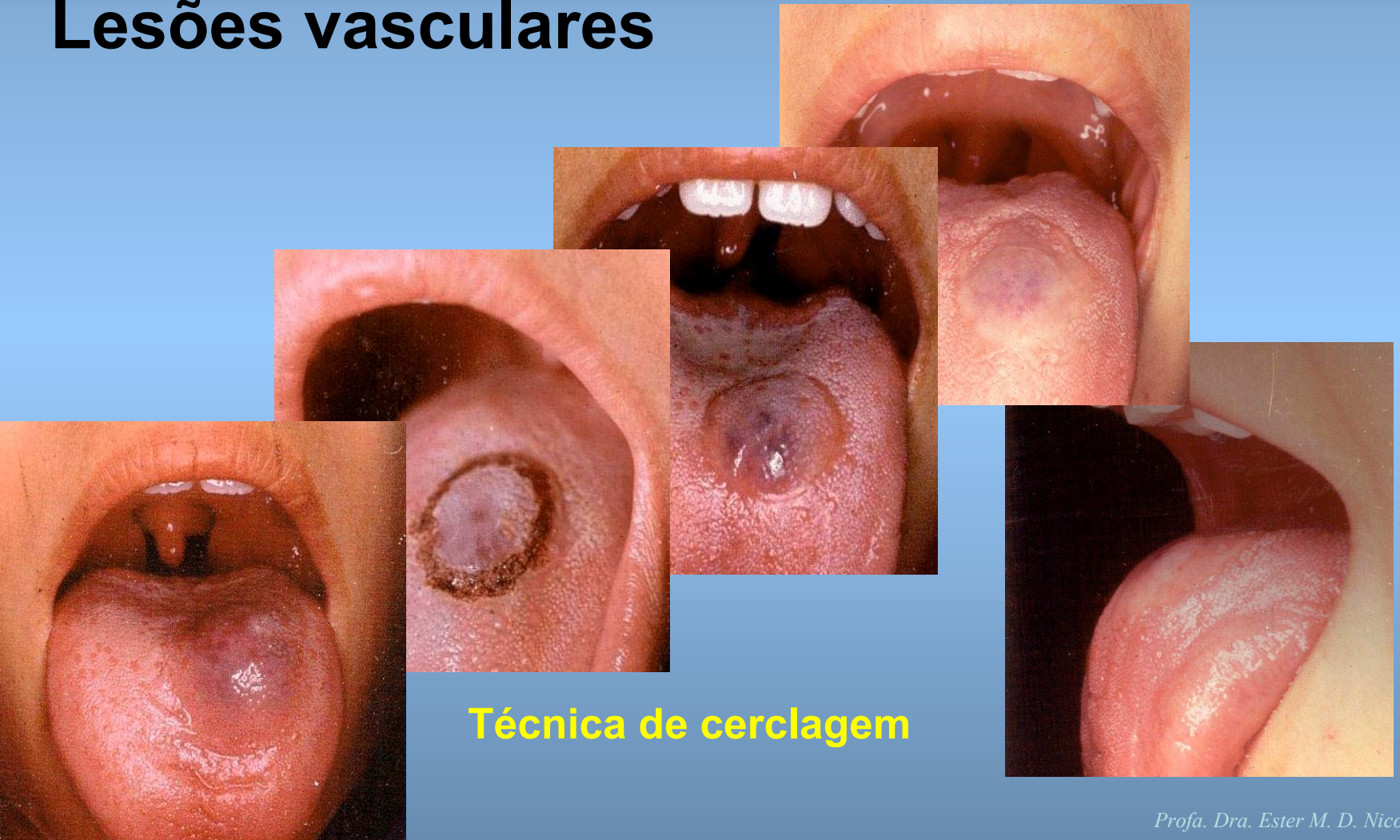
P = 8 a 12 W
t = 0,2 a 0,5 s

Sobre lesão

P = 4 a 6 W
t = 0,1 a 0,2 s



Lesões vasculares



Técnica de cerclagem

Obrigada

enicola@fcm.unicamp.br

