

doi: 10.13241/j.cnki.pmb.2014.30.029

# 脉冲 Nd: YAG 激光照射氟斑牙后充填微渗漏的实验研究 \*

夏永华<sup>1</sup> 孙仲楠<sup>2</sup> 沈兰花<sup>2</sup> 王子初<sup>1</sup>

(1 哈尔滨医科大学第一临床医学院 黑龙江 哈尔滨 150001; 2 黑龙江省医院 黑龙江 哈尔滨 150001)

**摘要 目的:**观察氟斑牙经脉冲 Nd-YAG 激光照射后充填微渗漏的发生情况,为相关研究提供参考。**方法:**选取人体因各种原因而拔除的氟斑牙(重度)30 颗,分成 A、B 两组。A 组为 Nd: YAG 激光消除龋坏组织作为实验组,B 组用传统涡轮钻去龋作为对照组。所有牙齿用树脂充填,经冷热循环处理后,再进行微渗漏观察。**结果:**实验组充填体边缘微渗漏比对照组明显低( $P<0.01$ )。**结论:**脉冲 Nd: YAG 激光去除氟斑牙坏死组织有助于增强充填物与釉质连接,不增加微渗漏,有助于充填成功。

**关键词:**脉冲 Nd:YAG 激光;氟斑牙;牙钻;微渗漏

**中图分类号:**R781 **文献标识码:**A **文章编号:**1673-6273(2014)30-5911-03

## Experimental Research of Microleakage after Removal of Caries of Mottled Enamel with Pulse Nd: YAG Laser Irradiation\*

XIA Yong-hua<sup>1</sup>, SUN Zhong-nan<sup>2</sup>, SHEN Lan-hua<sup>2</sup>, WANG Zi-Chu<sup>1</sup>

(1 The First Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang, 150001, China;

2 Heilongjiang Provincial Hospital, Harbin, Heilongjiang, 150001, China)

**ABSTRACT Objective:** To observe the microleakage after removal of caries of mottled teeth with pulse Nd:YAG laser in order to make a reference to the related research. **Methods:** 30 thirty extracted mottled enamel of patients with stomatological disease were selected and randomly divided into two groups, namely, the group A and group B. The decayed enamel in the experimental group were removed by the pulse Nd:YAG laser, while in the control group were removed by drilling. All the teeth were filled with resin after the removal of caries. Then the filled teeth were investigated by microleakage experiment. **Results:** Statistically significant differences in amount of dye infiltration were found between the two groups ( $P<0.01$ ). **Conclusions:** It is implied that the removal of caries of Mottled enamel with pulse Nd: YAG laser enhanced the bonding of resin to enamel which could reduce the filling microleakage and improve the restoration.

**Key words:** Pulse Nd: YAG laser; Mottled enamel; Drilling; Microleakage

**Chinese Library Classification(CLC):** R781 **Document code:** A

**Article ID:** 1673-6273(2014)30-5911-03

### 前言

人体内过多摄入氟离子,渗透在牙釉质里则产生氟斑牙。按 Dean 法分类,可分为轻、中、重度。氟斑牙不止对身体造成损害,对牙齿也有损伤。氟斑牙可在牙的表面上形成不规则的凹陷。自上世纪七十年代末,激光激发以后,能产生各种作用,比如光膨胀化学作用、热能解离学作用、电离场作用以及物理刺激多种生物活性效应,广泛地应用于各行各业和齿学及口腔医学。特别是新世纪来,由于脉冲 Nd-YAG 激光的优秀的传导性、方向性、干涉性、单色性以及易于光导的传播,使得它的应用得到了极大的发展。随着 Nd-YAG 激光在口腔内科医学中应用得到普及,对牙齿牙釉质及牙本质的研究越来越多<sup>[1,2]</sup>。Polly<sup>[3]</sup>研究证实,Nd-YAG 激光照射可对牙釉质形成蜂窝状酸蚀形态的表面,且将激光的这一作用称为光腐蚀,证明光蚀可以提高牙齿与树脂之间的微拉伸及剪切力。作者通过检测观察了氟斑牙经脉冲 Nd:YAG 激光去龋后充填微渗漏发生的情况,实验步骤

如下:

### 1 材料与方法

#### 1.1 离体牙的选择

选取因各种原因而拔除的氟斑牙 30 颗,去除根尖周组织,放在双氧水中,置于 4℃ 冰箱中备用。所有样本均有浅龋。

#### 1.2 实验设备及材料

北京瑞尔科技有限公司生产的 MX-380 型计算机程序控制脉冲 Nd-YAG 激光机,齿科综合治疗机,美国 3M250 树脂。

#### 1.3 实验方法

将 30 颗牙齿随机分为两组,A 组作为实验组:Nd:YAG 激光(参数:2 W,每秒 60 个脉冲)去龋;B 组作为对照组:常规快钻去龋。去龋标准以色泽形态和硬度为准。两组牙齿在去龋后均以 35%的酸蚀剂酸蚀 30 s,用流水冲去酸蚀剂,压缩空气吹干,涂粘接剂,用 3 m 250 树脂充填,光照 30 s,车针抛光。所有标本充填后,在 0-5℃ 与 55-60℃ 的水中开始冷热交替实验,每

\* 基金项目:黑龙江省教育厅基金项目(11551182)

作者简介:夏永华(1965-),女,硕士,副主任医师,主要从事口腔临床工作,

E-mail: xiayonghua65@163.com

(收稿日期:2014-04-12 接受日期:2014-05-08)

一循环为 2 分钟,共 300 次。

#### 1.4 微渗漏实验

将所有样品干燥,于树脂周围 1 mm 范围以外的牙本质涂以风干油,凉干后将牙齿浸入 7%的亚甲蓝溶液中,让染液浸没树脂,5 小时后拿出来,去离子水冲洗干净,干燥,用金刚砂片沿着牙体长轴将牙齿剖开,在高倍显微镜下观察计分。

#### 1.5 微渗漏计分标准

0 级:无染料渗漏;1 级:染料渗漏不超过洞壁长度的 1/2;2 级:染料渗漏超过洞壁长度厚度的 1/2,但未达洞底;3 级:染料渗漏充满整个洞底。

#### 1.6 统计学分析

用等级资料的秩和检验。 $P < 0.01$ 。

## 2 结果

实验组以 Nd-YAG 激光去龋,对照组常规快钻去龋,在实验组 15 颗牙齿中,0 级微渗漏的有 1 例,1 级微渗漏的有 12 例,2 级微渗漏的有 3 例,3 级微渗漏的有 0 例;对照组 15 颗牙齿中,0 级微渗漏的有 3 例,1 级微渗漏的有 3 例,2 级微渗漏的有 7 例,3 级微渗漏的有 5 例,用等级资料的秩和检验  $P < 0.01$ 。染料渗入洞壁的情况见表 1。

表 1 微渗漏计分结果

Table 1 Results of score of micro-leakage

| Group        | Cases | Score |    |   |   |
|--------------|-------|-------|----|---|---|
|              |       | 0     | 1  | 2 | 3 |
| Experimental | 15    | 0     | 12 | 3 | 0 |
| Control      | 15    | 3     | 7  | 5 | 0 |

## 2 讨论

中国是氟斑牙高发的国家,在高发区检测结果表明,氟斑牙发病率为 60%<sup>[7]</sup>。这种疾病在我国北部、西部、华中等地区广泛流行,与饮用水中高氟离子的含量有关系<sup>[8]</sup>。其修复方法众多。在治疗中通常采用氧化法、瓷贴面修复、全牙烤瓷修复等,在磨牙区主要用充填修复法,而如何提高治疗效果,减少疼痛,减少治疗时间是临床医师面临的主要问题。自新世纪以后,各种激光技术不断用于医学以及牙齿学科,脉冲 Nd-YAG 激光是比较特殊的激光,它是一种新型的非高能的能量激光,在龋病、牙周病、菌斑控制、口腔黏膜病治疗等方面的疗效已经取得非常惊奇的治疗效果<sup>[4-6]</sup>,且疗效已经在国内外学者中达成广泛的一致。

微渗漏是指牙体硬组织与修复材料之间,由于各种原因产生的极为细小的只能在显微镜下观察到的微小缝隙,其形成主要是因为牙齿与材料之间的密合程度不是很理想。检测树脂与牙齿外部边缘牙釉质微渗漏的方法,目前主要有透入法、媒介跟踪法、电化学腐蚀法、胶体分散法、抗体中心阻抗法、压缩空气法、再循环热法、同位素元素方法等,而化学物质染料渗入法也是目前经常使用、而且最方便最有效的检测。它的基本构成是染料浸入,使牙齿的牙釉质、牙本质和树脂着色来显示材料与牙齿的密合程度,而免去了辐射和化学反应。价格低廉,方便操作,因此,本实验选择此方法检测脉冲 Nd-YAG 激光去龋充填微渗漏情况。

国内外相关文献证实,激光是增加牙体表面蜂窝状的有效手段<sup>[9]</sup>。脉冲 Nd-YAG 激光粗化牙釉质,主要是利用激光的电磁波效应、化学物理磁效应、物理机械效应、高热量效应等引起牙齿的牙釉质表面硬组织的熔融和液化以及气化,从而形成不典型不规则的粗糙结构。虽然脉冲 Nd-YAG 激光可以粗化牙釉质表面,但很难改变牙齿的微拉伸和剪切力,主要是因为脉冲 Nd-YAG 激光的效应产生再矿化的反应。此过程会导致釉质表面的微硬度减低<sup>[10]</sup>,影响粘结界面混合层的强度。Bell 的研究<sup>[11]</sup>

发现了牙齿经过 Nd-YAG 激光照射以后,牙釉质表面可形成凹坑蜂窝形态变化,这种改变增大了粘接面积,形成了紧密的嵌合,增强了树脂与釉质之间的接合,有利于增加充填物强度,减少脱落率。而反射和散映射可使牙齿的牙釉质、牙本质溶解,在其表面形成类似一层毛玻璃样物质,封闭牙齿的牙本质小管,减少激光对牙釉质、牙本质的损坏,也可以大大的降低微渗漏<sup>[12-13]</sup>。此外,Nd-YAG 激光照射可使牙釉质表面晶体构象发生改变,新的结晶颗粒呈不规则球状、刺猬状和圆柱状,且颗粒较大,使牙釉质的抗腐蚀能力增加<sup>[14]</sup>。还有实验<sup>[15-20]</sup>证实,Nd-YAG 激光照射可以使氟离子渗透到牙釉质内,提高釉质的微强。激光的这些作用均能加强牙体的牙釉质和牙本质的抗外界刺激能力,防止细菌的发生和发展,这是增加治疗效果的又一优点。从而证实激光去除氟斑牙龋坏组织有助于增强充填体和牙齿的结合,增加强度,有助于充填成功。

综上所述,用脉冲 Nd-YAG 激光照射氟斑牙,去除龋坏的牙体组织,然后用树脂材料充填龋洞修复缺损的牙体组织,恢复牙体外形及牙齿功能,经本实验证实,该方法可以减少微渗漏,提高充填的成功率,降低了充填体的脱落率,达到了预期的结果,从而为治疗氟斑牙提供了一种新的备洞方法,提高了治疗效果。因此可以推断这种方法是治疗氟斑牙的安全、有效的方法之一。在以后的工作中,我们将把此方法与漂白法结合用于前牙重度氟斑牙的修复中,以便寻求到一种快速、有效,同时损伤小的,达到患者美观要求的治疗方法。

#### 参 考 文 献(References)

- [1] 张西莉, 刘小川. 脉冲 Nd-YAG 激光加氟化物液对牙体组织的影响 [J]. 第四军医大学学报, 2003, 25(6): 543-545  
Zhang Xi-li, Liu Xiao-chuan. The effects of the pulsed Nd-YAG laser and fluoride fluid on dentine [J]. Journal of the Fourth Military Medical University, 2003, 25(6): 543-545
- [2] Shirasuka T, Kadaka T, Debari K, et al. Aser irradiation and fluoride treatment Acid resistance on human dental enamel by I [J]. J. Dent Res, 1991, 70(5): 350-350

- [3] Hess JA. SEM study of laser induced morphologic changes of a coated enamel etching with phosphoric acid and a pulsed Nd:YAG laser [J]. *Laser Surg Med*, 1990, 10(5): 458-462
- [4] Terry DM, Jeanne MR. Comparative morphological effects of enamel etching with phosphoric acid and a pulsed Nd:YAG laser [M]. Congress on Laser Science, Paris, 1990
- [5] 颜学德, 陈良健. 激光联合氟化物治疗牙本质过敏症 [J]. *湖南医科大学学报*, 2005, 27(4): 334-336  
Yan Xue-de, Chen Liang-jian. Laser and fluorides in the treatment of dentin hypersensitivity [J]. *Bulletin of Hunan Medical University*, 2005, 27(4): 334-336
- [6] 朱雪华, 张学云. 激光照射后流体窝沟封闭 5 年疗效观察 [J]. *实用口腔医学杂志*, 2005, 18(4): 122-126  
Zhu Xue-hua, Zhang Xue-yun. The effect of fluid fissure sealant after laser on sealing the teeth fissure in 5 Years [J]. *Journal of Practical Stomatology*, 2005, 18(4): 122-126
- [7] 全国地方性氟中毒监测组. 2003 年和 2004 年全国饮水型氟中毒重点监测报告 [J]. *中国地方病学杂志*, 2007, 26(2): 161-164  
Collaboration Group of National Endemic Fluorosis Surveillance. Surveillance on endemic fluorosis of drinking water type in China: a two-year report of 2003 and 2004 [J]. *Chinese Journal of Endemiology*, 2007, 26(2): 161-164
- [8] Kuramoto JM, Matson E, Turbino ML, et al. Nd: YAG laser irradiated enamel surfaces micro hardness [J]. *Braz Dent J*, 2001, 12(1): 31-33
- [9] 黄长青, 王成海, 张秀丽, 等. 东北氟中毒病区与南方儿童氟斑牙区别 [J]. *中国地方病学杂志*, 2005, 24(1): 64-66  
Huang Chang-qing, Wang Cheng-hai, Zhang Xiu-li, et al. The distinction between the endemic fluorosis areas in Northeast China and dental fluorosis in children in South China [J]. *Chinese Journal of Endemiology*, 2005, 24(1): 64-66
- [10] Tay FR, Pashley DH. Depth of penetration beyond dentin smear layers [J]. *Dent Mater*, 2001, 17(4): 296-308
- [11] Hess JA. Subsurface morphologic changes of Nd: YAG laser etched on human dentin [J]. *Lasers Surg Med*, 1997, 21(2): 193-197
- [12] Miserendino LJ, Levy GC, Rizoir IM. Effects of Nd: YAG laser on the permeability of root canal wall dentin [J]. *J Endod*, 1995, 21(2): 83-87
- [13] Hsir Cheng liu. Chur Pin Lin, Warbong Lan. Sealing depth of Nd: YAG laser on human dentin tubular [J]. *J Endod*, 1997, 23 (11): 691-693
- [14] Tagomori S, Iwase T. Nd: YAG on human dentin exposed to a normal pulsed Nd: YAG laser [J]. *Caries Res*, 1999, 29(6): 513-520
- [15] Kimura Y, Wider SP, Arrastia JAM, et al. Effects of pulsed Nd: YAG laser irradiation on dentin resistance to artificial caries like lesions [J]. *Lasers Surg Med*, 1997, 20(1): 15-21
- [16] Cobb CM, McCawley TK, Killoy WJ. A Nd: YAG preliminary study on the effects of the Nd: YAG laser on root surfaces and subgingival microflora in vivo [J]. *Journal of periodontology*, 1992, 63 (8): 701-707
- [17] White JM, Goodies HE, Wang WS. Nd: YAG Laser treatment effects on micro hardness of dentin [J]. *J Dent Res*, 1991, 70(5): 309
- [18] Gelskey SC, White JM, Pruthi VK. The effectiveness of the Nd: YAG laser in the treatment of dental hypersensitivity [J]. *Journal (Canadian Dental Association)*, 1993, 59(4): 377-384
- [19] Stabholz A, Khayat A, Ravanshad SH, et al. Effects of Nd:YAG laser on apical seal of teeth after apicoectomy and retrofill [J]. *Journal of Endodontics*, 1992, 18(8): 371-375
- [20] White JM, Fagan MC. Nd: YAG temperatures during pulsed Nd: YAG laser treatment of dental hypersensitivity dentin, in vitro [J]. *Journal of Periodontology*, 1994, 65(3): 255-259

(上接第 5965 页)

- [12] Vélez Dí az-Pallarés M, Delgado Silveira E, Alvarez Dí az AM, et al. Analysis of the valproic acid-meropenem interaction in hospitalised patients [J]. *Neurologia*, 2012, 27(1):34-38
- [13] Riera E, Cabot G, Mulet X, et al. Pseudomonas aeruginosa carbapenem resistance mechanisms in Spain: impact on the activity of imipenem, meropenem and doripenem [J]. *J Antimicrob Chemother*, 2011, 66(9): 2022-2207
- [14] Angkasekwinai N, Werarak P, Chaiyasoot K, et al. Monitoring of effectiveness and safety of generic formulation of meropenem for treatment of infections at Siriraj Hospital [J]. *J Med Assoc Thai*, 2011, 94(1):S217-224
- [15] Pea F, Cojutti P, Sbrojavacca R, et al. TDM-guided therapy with daptomycin and meropenem in a morbidly obese, critically ill patient [J]. *Ann Pharmacother*, 2011, 45(7-8): e37
- [16] 贾育红, 袁天柱. ICU 下呼吸道常见非发酵菌医院内感染临床研究 [J]. *广西医学*, 2012, 34(11): 1564-1566
- Jia Yu-hong, Yuan Tian-zhu. Clinical study of ICU lower respiratory tract infection of non fermentation bacteria in hospital [J]. *Guangxi Medical Journal*, 2012, 34(11):1564-1566
- [17] Tanaka T, Sakamoto H, Kato N, et al. Successful treatment of brain stem and thalamic abscesses with high-dose meropenem [J]. *Brain and Nerve*, 2011, 63(8): 75-88
- [18] Lutsar I, Trafojer UM, Heath PT, et al. Meropenem vs standard of care for treatment of late onset sepsis in children of less than 90 days of age: study protocol for a randomised controlled trial [J]. *Trials*, 2011, 12(1):215
- [19] Martin-Canal G, Saavedra A, Asensi JM, et al. Meropenem monotherapy is as effective as and safer than imipenem to treat brain abscesses [J]. *Int J Antimicrob Agents*, 2010, 35(3): 301-304
- [20] Deshpande P, Chen J, Gofran A, et al. Meropenem removal in critically ill patients undergoing sustained low-efficiency dialysis (SLED) [J]. *Nephrol Dial Transplant*, 2010, 25(8): 2632-2636