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不同根管器械去除弯曲根管内充填物的效果研究*

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摘要 目的:比较新型旋转器械马尼 GPR 和 ProTaper 再治疗系统、手用 H 锉在根管再治疗中去除弯曲根管内牙胶的清理效果。**方法:**选取 30 个弯曲度为 30° 的透明树脂根管模块,根管长度为 17mm。使用 ProTaper Next 机用镍钛器械预备至 30/.06,热压胶垂直加压根管充填。样本随机分为 3 组(n=10),用以下方法配合丁克除溶剂去除根管内充填材料,A 组手用 H 锉、B 组 ProTaper 再治疗系统和 C 组马尼 GPR,记录去除充填物所用总时间。从颊舌向和近远中向 2 个角度拍着数码 X 线片,使用 Image J 2X 图像分析软件分析根管内充填物残留量。用天平称量推出根尖孔碎屑量。**结果:**ProTaper 再治疗系统组根管壁充填物残留量明显多于马尼 GPR 组和 H 锉组($P<0.05$)。H 锉组操作时间明显高于 ProTaper 再治疗系统组和马尼 GPR 组($P<0.05$)。马尼 GPR 组推出根尖孔碎屑量明显少于 ProTaper 再治疗系统组($P<0.05$)。**结论:**马尼再治疗锉去除根管内充填物效率优于 ProTaper 再治疗系统和 H 锉,机用镍钛器械所用时间明显少于手用器械。

关键词:根管再治疗;弯曲根管;NiTi;马尼 GPR;Protaper

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Evaluation of the Efficiency of Different Files in Removing Gutta-percha from Curved Root Canals During Root Canal Retreatment*

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ABSTRACT Objective: To compare the cleaning effect of the new rotating instruments mani GPR and ProTaper retreatment system and hand H file in the removal of curved endodontic gum in root canal retreatment. **Methods:** Thirty simulated canals with a 30-degree curvature in resin blocks were instrumented up to #30/.06 with ProTaper Next NiTi rotary instruments and obturated using gutta percha and AH plus root canal sealer. The specimens were randomly divided into three groups (n=10 each). Removal of gutta-percha was performed with the following devices and techniques: Group 1 (H-files), Group 2 (ProTaper Universal Retreatment), Group 3 (Mani GPR). The retreatment time was recorded for each specimen using a stopwatch. After radiographing in buccolingual and mesiodistal directions, the amount of remaining gutta-percha in the roots was quantified using Image J 2X software. Apically extruded debris were weighted using balances. Statistical analysis was performed with one-way ANOVA test. **Results:** The volume of remaining filling material was significantly less in H-files and Mani GPR groups than in ProTaper Universal Retreatment group ($P<0.05$). The total retreatment time was significantly shorter in the ProTaper Universal Retreatment and Mani GPR groups compared with the manual group ($P<0.05$). Mani GPR files were associated with significantly less extruded debris than with the ProTaper Universal Retreatment ($P<0.05$). **Conclusions:** Mani GPR files left less gutta-percha and sealer than ProTaper Universal Retreatment and H-files. The NiTi rotary systems were significantly faster than the manual group in the time required for gutta-percha removal.

Key words: Root Canal Retreatment; Curved canals; NiTi; Mani GPR; Protaper

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前言

根管治疗术作为目前牙髓病和根尖周病最有效的治疗方法,其成功率约为 74%~98%。根管治疗长期成功疗效依赖于彻底清创和紧密充填整个根管系统^[1]。如果上述操作不完善,根管内致病菌将会持续存在,最终导致根管治疗失败^[2]。此时为

了保留患牙可进行根管再治疗或者根尖手术。在根管再治疗过程中,完全去除根管内充填材料是实现根管系统清洁和消毒的关键^[3]。手用器械或机用镍钛系统、超声等被应用在根管再治疗中^[4,5]。马尼 GPR 作为一种专门针对根管再治疗设计的新型机用镍钛器械,国内外研究极少。本实验通过以模拟弯曲根管树脂模块为模型来比较 ProTaper 再治疗系统、马尼 GPR 和手

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用 H 锉在去除弯曲根管内充填物的效果,为临床操作提供参考。

1 材料和方法

1.1 材料

GG 钻(MANI 公司,日本);K 锉(MANI,日本);ProTaper NEXT 机用镍钛系统(Dentsply Maillefer 公司,瑞士);H 锉(MANI 公司,日本);ProTaper 再治疗系统(Dentsply Maillefer 公司,瑞士);马尼 GPR(MANI 公司,日本);树脂模块(徐州木森科贸发展有限公司);丁克除(必兰公司,法国);牙胶尖(Dentsply Maillefer 公司,瑞士);AH Plus 糊剂(Dentsply Maillefer 公司,瑞士);吸潮纸尖(天津加发医疗器械有限公司);蒸馏水;天平。

1.2 实验方法

1.2.1 样本处理 本实验选取经检测弯曲度统一为 30° 的透明弯曲根管树脂模块,弯曲根管树脂模块的根管长度统一为 17 mm,工作长度定为 16.5 mm。ProTaper NEXT 机用镍钛系统以冠向下技术预备至 X2(25/06),再用 30 号 K 锉预备根尖,形成根管大小为 30 号 0.06 锥度。每更换一次器械均以 2 mL 蒸馏水冲洗根管。选用 X-smart 机用根管马达(Dentsply Maillefer 公司,瑞士),根据出厂设置转速为 250 r/min。

根管预备完成后用 5 mL 蒸馏水进行终末冲洗,吸潮纸尖干燥根管。随后用锥度匹配的牙胶尖蘸取 AH Plus 根充糊剂以热牙胶垂直加压技术充填根管,氧化锌暂封膏暂封。所有样本于 100%湿度、 37°C 恒温水箱中存放 7 天。

1.2.2 实验进程 以上样本随机分为三组,每组 10 个样本。去除暂封材料后,上端 2-3 mm 牙胶用 GG 钻去除,滴入 0.1 mL

丁克除溶剂作用两分钟。将样本用橡皮障遮挡视线后置于培养皿(35 mm×10 mm 规格)上方,以便收集推出根尖孔碎屑。分组如下:

A 组(手用 H 锉):使用手用不锈钢 H 锉以冠向下技术去除根管内充填物,30 号、25 号、20 号 H 锉旋转提拉方式进入根管直到到达工作长度。

B 组(ProTaper 再治疗系统):ProTaper 再治疗系统中 D1 锉(30 号,0.09 锥度)用于去除根管冠三分之一的充填物,D2 锉(25 号,0.08 锥度)用于去除根管中三分之一的充填物,D3 锉(20 号,0.07 锥度)用于去除根尖三分之一的充填物直到到达工作长度。

C 组(马尼 GPR):选择马尼 GPR 中 2S(50 号,18 mm 长,0.04 锥度)和 4N(30 号,21 mm 长,0.04 锥度)以冠向下技术去除根管内充填物。2S 锉去除根管中上方充填物,4N 去除距根尖 1~2 mm 附近的充填物,H 锉去除根尖剩余部分充填物(器械说明距根尖 1~2 mm 的充填材料要配合手用器械去除)。

各组每更换一支器械均使用 2 mL 蒸馏水冲洗根管,最终再治疗完成后用 5 mL 蒸馏水进行终末冲洗。以最后一支器械到达工作长度,器械表面没有充填物残留;冲洗液中肉眼观察不到明显充填物碎屑,根管壁光滑视为根管再治疗彻底完成。记录器械分离情况,每支器械使用 5 个根管。以上操作均由一名医生操作完成。

1.2.3 根管壁充填物残留量比较 3 组样本分别拍摄颊舌向和近远中向两个角度的数码 X 线照片。使用 Image J 2X 图像分析软件分析根管壁上充填物残留量,充填物残留量数值以所测得像素的数量来表示。见图 1。

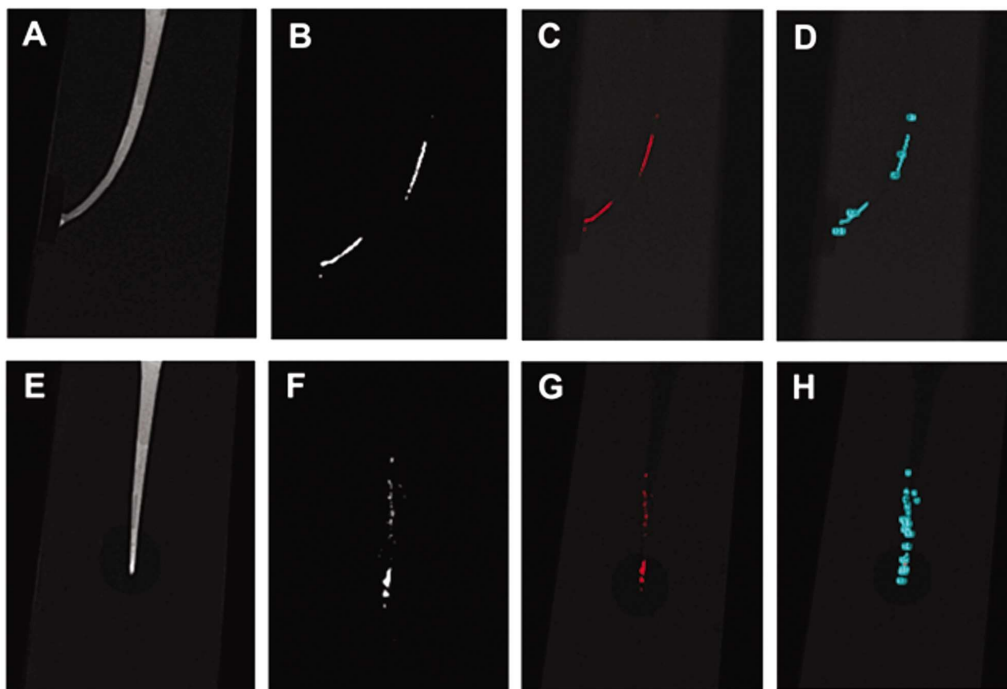


图 1 使用 Image J 2X 软件选取并计算颊舌向(A, B, C, D)和近远中向(E, F, G, H)根管壁上充填物残留量。根充后(A, E)和再治疗后(B, F)的 X 线;选取残留充填物(C, G)并使用 Image J 2X 软件计算充填物残留量(D, H)。

Fig. 1 Assessment of residual gutta-percha using Image J 2X software in buccolingual (A, B, C, D) and mesiodistal (E, F, G, H) directions. (A, E) After root canal obturation and (B, F) the residual filling material in the root canal recorded by digital X-ray photograph; (C, G) Defining the outline of remaining gutta-percha and (D, H) measuring the surface area by Image J 2X.

1.2.4 根管再治疗时间比较 以秒表记录各组完成再治疗所应用的总时间。

1.2.5 推出根尖孔碎屑量比较 收集推出根尖孔碎屑量用精确到 0.0001 g 的天平进行称量。治疗前用天平称量培养皿的重量记为 W1, 根管再治疗后以 1 mL 蒸馏水冲洗根尖部碎屑于培养皿内, 置于烘干箱内烘干水分得到干燥碎片, 称量此时培养皿重量记为 W2。W2-W1 即为推出根尖孔碎屑量。

1.3 统计分析

利用 SPSS16.0 软件, 对实验所得数据进行单因素方差分

析, $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 各组根管壁充填物残留量比较

ProTaper 再治疗系统组根管壁充填物残留量明显多于 H 锉组和马尼 GPR 组 ($P < 0.05$), 马尼 GPR 组与 H 锉组之间无统计学差异 ($P > 0.05$)。见表 1。根管壁残留充填物多位于根尖三分之一。

表 1 各组根管壁充填物残留量 ($\bar{x} \pm SD, n=10$)

Table 1 The amount of remaning filling material on canal walls in 3 groups ($\bar{x} \pm SD, n=10$)

Groups	Buccolingual	Mesiodistal
H-files	744.40± 453.41	482.00± 297.73
ProTaper Universal Retreatment	1494.60± 987.80	991.80± 826.47
NRT GPR	702.80± 414.59	412.00± 335.62

Note: Values are expressed as the number of pixels.

2.2 各组根管再治疗时间比较

H 锉组操作时间明显高于 ProTaper 再治疗系统组和马尼 GPR 组 ($P < 0.05$), ProTaper 再治疗系统组与马尼 GPR 组之间无统计学差异 ($P > 0.05$)。见表 2。

表 2 各组去除充填材料所用时间 ($\bar{x} \pm SD, n=10$)

Table 2 Time(s) required to removal the filling material in 3 groups ($\bar{x} \pm SD, n=10$)

Groups	Time(s)
H-files	1066.80± 268.06
ProTaper Universal Retreatment	252.00± 108.83
NRT GPR	266.90± 91.37

2.3 各组推出根尖孔碎屑量比较

马尼 GPR 组推出根尖孔碎屑量明显少于 ProTaper 再治疗系统组 ($P < 0.05$), 其余组间比较无统计学差异。见表 3。

表 3 各组推出根尖孔的碎屑量 ($\bar{x} \pm SD, n=10$)

Table 3 Weight of apically extruded debris in 3 groups ($\bar{x} \pm SD, n=10$)

Groups	Apically extruded debris(g)
H-files	0.0002± 0.0001
ProTaper Universal Retreatment	0.0003± 0.0002
NRT GPR	0.0001± 0.00007

3 讨论

根管再治疗中最关键的一步就是彻底清除根管内充填物以便于进一步的预备和消毒根管系统^[6]。据有关文献报道, 再治疗方面的研究主要集中在单根牙的直根管^[7], 仅有一少部分关于弯曲根管再治疗的研究^[8-10]。弯曲根管由于其形态复杂无法直视弯曲部位以及镍钛旋转器械在根尖部容易造成严重的根管偏移^[11], 使其在再治疗过程中相对困难。因此, 本实验研究了

手动器械 H 锉、Protaper 再治疗系统和马尼 GPR 在去除弯曲根管中充填物的效果。

树脂根管模块广泛应用于对不同器械根管成型能力的评价^[12], 本实验使用弯曲根管树脂模块是为了使样本标准化, 通过消除由根管弯曲形态引起的变量来得到一个可靠的比较结果。在以往实验中, 多使用次氯酸钠进行根管冲洗, 因其抑菌作用、溶解坏死牙髓组织等作用良好^[13]。而本实验中使用的树脂根管模块不涉及此类研究, 所以使用蒸馏水作为根管冲洗液。

经报道有许多方法来评价根管壁充填物残留量, 如矢状劈开法、透明标本法、X 线片法、CT 扫描法等^[14,15]。然而矢状劈开法在处理过程中破坏牙体组织, 不可避免的导致残留充填物碎屑的丢失, 影响测量的准确性^[16,17]。CT 扫描法作为一种非破坏性方法, 能够从三维层面上准确评价剩余充填物的量, 但成本较高。因此本实验选择 X 线片法测量残留充填物的量。鉴于 X 线片只是提供了三维物体的二维图像, 本实验从颊舌向和近远中向两个角度拍摄 X 线片进行测量, 以减小实验结果的误差。

目前国内外关于根管再治疗的研究主要是关于机用镍钛系统和手动器械的效果对比, 但由于实验器械不同、样本的根管形态不同以及评价方法的不同等使得实验结果差异较大^[18,19]。例如 Unal 等^[20]表明在弯曲根管再治疗中, 手动器械比机用镍钛器械清洁效果更好; Gergi 等^[21]表明在弯曲根管再治疗中, 手动器械和机用器械差异无统计学意义。Kasra 等^[22]则表明在直根管再治疗中, 机用镍钛器械比手动器械效果好。本研究结果显示 ProTaper 再治疗系统组根管壁充填物残留量明显多于 H 锉和马尼 GPR ($P < 0.05$), 马尼 GPR 根管壁充填物残留量最少, 这与 Mercy^[23]等人的结果相反, 造成这一差异的原因可能是根管形态的不同和马尼 GPR 使用方法的不同。马尼 GPR 是日本马尼公司推出的一款专用于去除牙胶根管器械, 其工作刃设有深螺旋状凹槽, 刃部的波峰逐渐变宽、变深, 使牙胶的排出性增高。本实验中选择 4N 去除距根尖孔 1~2 mm 的充填材料, 剩余 1~2 mm 的充填物用手用 H 锉去除以防止台阶或穿孔。手用 H 锉相对于机用器械来说锥度更小, 更易于贴近椭圆形根

管的侧壁^[24]。机用镍钛器械和手用器械结合,可更好的去除根尖部充填物。本实验中没有任何一组器械能完全去除根管内充填物,3组器械的残留根充物都集中在根管中下三分之一,与大部分研究^[20,21,25]结果相一致,其原因可能为根尖三分之一解剖变异较多,根管的弯曲形态更加大了治疗的难度。

大量研究表明,机用镍钛器械在根管再治疗过程中比手用器械所用时间更短更有效率,能明显减少术者疲劳^[25,26]。本研究中 ProTaper 再治疗系统去除充填物所用时间少于马尼 GPR,原因在于马尼 GPR 在 2S 和 4N 去除根管内大部分牙胶后,要配合手用器械去除剩余的距根尖孔 1~2 mm 的牙胶,较 ProTaper 再治疗系统 3 支均为机用器械相比要耗费更长一些的时间。

通过根尖孔推出的碎屑包含的有机或无机的残留物、牙胶、糊剂、冲洗液等并不有利于根尖病变的愈合^[27,28]。推出根尖孔的碎屑会导致患者术后的不适^[29,30]。本实验中 ProTaper 再治疗系统组推出的碎屑比手用 H 锉组的碎屑多,这与 Somma 等^[26]的结论一致。马尼 GPR 组推出根尖孔碎屑量最少。原因可能是机用镍钛器械通过摩擦热软化牙胶尖,而马尼 GPR 由于其独特的凹槽设计,深螺旋状凹槽使排除软化牙胶的空间更大,会更加容易的让牙胶尖卷在锉针刃部,将牙胶尖塑形后完整带出,产生碎屑较少。

本实验中有 1 支 ProTaper 再治疗 D3 锉折断。ProTaper 再治疗系统的大锥度可能是导致其折断的原因之一,据实验表明锥度设计是影响器械折断性的重要因素^[20]。而马尼 GPR 的优点是不容易在根尖部折断,因为其末梢没有切割功能,不发生应力集中^[23]。马尼 GPR 的刃部构造为一个切割刃,极大的减少锉针折断的可能性。此外,马尼 GPR 中的 3N 和 4N 是镍钛材质,其尖端 5 mm 处有形状记忆特性,柔韧性更佳。如果不慎折断,也将会在柄部与工作端接触的地方折断,更方便取出断针。

综上所述,目前尚无一种器械可以完全清除根管内充填物。机用镍钛器械比手用器械所用时间更短,马尼 GPR 在去除根管内充填物和推出根尖孔碎屑量方面均优于 ProTaper 再治疗系统。

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