· 口腔医学研究 ·

应用不同骨材料进行拔牙位点保存的效果评价

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[摘 要] **目的**:评价重度牙周炎非磨牙患牙进行拔牙位点保存的效果,比较分析Bio-Oss和Bio-Gene骨材料单独及联合应用于拔牙位点保存的疗效。**方法**:选取南京医科大学附属口腔医院牙周科患者26例,共计重度牙周炎非磨牙患牙32颗,随机分为4组,于牙周翻瓣术中拔除,实验组患牙同期分别植入Bio-Oss、Bio-Gene以及等比混合的Bio-Oss及Bio-Gene材料,对照组自然愈合。术前、术后即刻和术后6个月分别进行临床观察,并拍摄锥形束CT(cone beam CT,CBCT)测量相应骨高度、宽度及密度变化值,数据分析采用单因素方差分析及LSD-t检验。**结果**:临床观察显示,拔牙后6个月,对照组的牙槽骨吸收明显,牙槽嵴窄平,而实验组骨吸收较少,牙槽嵴保存丰满。CBCT检查显示,术前与术后6个月骨高度和宽度变化比较,对照组与3个实验组组间差异有统计学意义($P<0.05$);术后即刻与术后6个月骨高度、宽度和密度变化比较,实验组中混合组变化最小,Bio-Oss组其次,Bio-Gene组最大,组间差异有统计学意义($P<0.05$)。**结论**:对于重度牙周炎非磨牙患牙,拔牙同期位点保存比自然愈合在牙槽骨量的维持上具有优势;等比混合Bio-Oss及Bio-Gene材料对牙槽骨量的维持优于单独应用一种材料。

[关键词] 位点保存;骨材料;临床疗效;锥形束CT

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Effects of ridge preservation following tooth extraction with different bone graft materials

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[**Abstract**] **Objective**: To evaluate the effects of ridge preservation in non-molar sites with advanced periodontitis, and to compare the effects of Bio-Oss, Bio-Gene and equal-ratio mixed of both materials. **Methods**: A total of 26 patients with 32 non-molar regions who were diagnosed with advanced periodontitis at our institution were included. They were classified into three experimental groups and one control group. The experimental groups were grafted with Bio-Oss, or Bio-Gene or the equal-ratio mixed of both materials after the tooth extraction, while the control group did not graft any meterials. Clinical and CBCT parameters were measured before, immediately and 6 months after the extraction. Data statistics used one-way ANOVA and LSD-t analysis. **Results**: The alveolar ridges of the control group were narrow, while the experimental groups were relatively plump at 6 months after the extraction. The difference of changes of alveolar bone height and width among the control and experimental groups was statistically significant ($P<0.05$). The changes of alveolar bone height, width and density postoperatively of the mixed group were minimal, then was the Bio-Oss group, and last was the Bio-Gene group. The difference among the experimental groups was statistically. **Conclusion**: Ridge preservation after the extraction was superior in the maintenance of soft and hard tissues. The equal-ratio mixed of Bio-Oss and Bio-Gene was better than either one alone.

[**Key words**] ridge preservation; bone materials; clinical effects; CBCT

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拔牙后牙槽嵴会有不同程度的吸收,为保证种植骨量足够,拔牙位点保存越来越多开展于临床[1-2]。目前有关拔牙位点保存的研究多集中在骨材料的应用上,单一骨材料性能存在或多或少的局限性,因此国内外学者尝试应用复合材料进行位点保存治疗,如不同种类的骨材料相互混合[3],或骨材料结合非骨材料如生长因子、富血小板血浆等[4]。复合材料的应用,可以起到材料性能优势互补的效果。

异种骨材料Bio-Oss是从牛骨中提取的脱矿无机盐,具备多孔性的骨小梁结构,吸收率低,在位点保存及上颌窦提升术中广泛应用[5]。同种异体骨材料Bio-Gene,通过脱细胞处理降低免疫原性,保持天然三维孔隙骨结构,具有一定骨诱导能力,在牙周再生治疗中应用较多[6]。研究尝试将Bio-Oss及Bio-Gene材料等比混合,应用于重度牙周炎非磨牙患牙的拔牙位点保存治疗,对比拔牙后单独应用Bio-Oss、Bio-Gene材料及拔牙后自然愈合,术前、术后即刻和术后6个月分别进行临床观察,并拍摄锥形束CT(cone beam CT,CBCT),从临床和影像学方面评价位点保存的效果。

1 对象和方法

1.1 对象

选取2016年1月—2017年6月就诊于南京医科大学附属口腔医院牙周科的患者,因重度牙周炎而行牙周翻瓣手术拔除非磨牙位点的患牙,随机分4组,其中3组为实验组,应用不同骨材料进行位点保存治疗,1组为对照组,拔牙后自然愈合。所有患者知情同意本研究过程,并经医院伦理委员会审批通过。

纳入标准:①患者依从性良好,纳入的患牙位点有足够的修复空间;②患牙至少1颗邻牙;③患牙拔除后,剩余牙槽嵴一侧骨壁缺失≥50%,至少存留两侧骨壁高度≥5 mm。排除标准:①患者<18周岁;②患牙急性炎症期,牙周病控制不佳;③吸烟超过10支/d;④未经控制或控制不佳的糖尿病或高血压、其他对本实验有影响的系统疾病;⑤处于怀孕期、哺乳期及计划怀孕者;⑥长期服用非甾体类抗炎药、双磷酸盐、皮质类固醇、四环素、免疫抑制剂等影响骨代谢或骨愈合的药物;⑦头颈部放疗史;⑧牙严重错位或术前评估拔牙后缺损区与种植体植入位置偏差大的位点。

同种异体骨Bio-Gene(0.5 mL,北京大清生物技术公司),异种骨Bio-Oss(0.5 g,Geistlich公司,瑞士),Bio-Gide胶原膜(25×25 mm,Geistlich公司,瑞士)。

1.2 方法

1.2.1 分组

实验组:Bio-Oss组、Bio-Gene组、混合组(1∶1混合Bio-Gene及Bio-Oss);对照组:自然愈合。

1.2.2 治疗过程

术前完善牙周基础治疗,牙周炎症控制良好。术中局麻下,沿患牙位点向近远中延伸1~2个牙位行沟内切口切开翻瓣,分离患牙牙周膜,轴向拔出,拔牙窝彻底清创,生理盐水冲洗3次,将骨材料充填拔牙窝,稍高于剩余牙槽嵴顶,修剪放置大小匹配的Bio-Gide膜,龈骨膜瓣减张,复位严密缝合拔牙创。术后3 d口服头孢克洛缓释片(0.375 g,1 d 2次),2周内使用西吡氯铵漱口液(10 mL,1 d 3次)。2周后拆线。以上步骤均由同一术者进行。术后6周患者行胶连式过渡义齿修复。

1.2.3 临床检查记录

术前(D1)、术后即刻(D2)及术后6个月(D3)分别检查记录拔牙位点邻牙的牙周指数,包括:①菌斑指数(plaque index,PLI);②牙龈指数(gingival index,GI);③牙齿松动度(tooth mobility),所有测量均由同一医师完成。

1.2.4 影像学检查

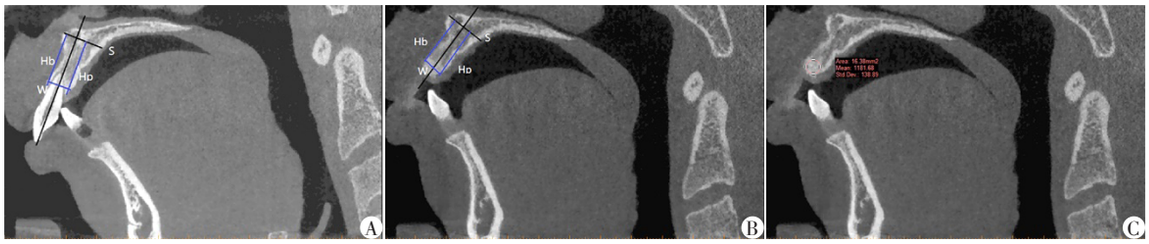
术前(D1)、术后即刻(D2)及术后6个月(D3)分别拍摄CBCT(NewTom,意大利),将原始数据以DICOM格式导入Simplant Pro11.0软件(Materialise,比利时),三维重建后进行测量分析。

D1:调整矢状位及冠状位三维位置,选取经过拔牙位点中心的层面,标记经过患牙长轴的线,选择上腭顶点或下颌骨下缘作为固定参照点,作与患牙长轴垂直的线S。取颊侧牙槽嵴顶至S的距离记为颊侧牙槽嵴高度Hb1,腭侧牙槽嵴顶至S距离记为腭侧牙槽嵴高度Hp1,颊腭侧牙槽嵴顶之间距离记为牙槽嵴宽度W1。D2、D3:选取与D1相同层面,标记出患牙长轴及固定参照点,作出相应的标记线,测量颊、腭侧牙槽嵴高度Hb2、Hb3和Hp2、Hp3,牙槽嵴宽度W2、W3。另外,选取经过拔牙位点中心的层面,标记拔牙位点的骨密度值T2、T3(图1)。

影像学标记点及测量均在放射科医师指导下完成。所有数值测量均由同一医师完成,选取非同日3次测量的均值。计算在D1~D3、D2~D3时期对应Hb、Hp、W及T值及变化值。

1.3 统计学方法

采用SPSS 22.0软件对所测数据进行分析,测量



A：拔牙前CBCT，选取经过患牙中心的矢状面，标记牙长轴及垂直牙长轴的线S，测量拔牙前Hb、Hp、W；B：拔牙后CBCT，选取与拔牙前相同的层面，标记牙长轴及S，测量位点保存后Hb、Hp、W；C：拔牙后CBCT，测量位点保存位点的密度T。

图1　CBCT定点标记测量

Figure 1　Mark the fixed-points and measure the lines on CBCT

数据以均数±标准差（$\bar{x} \pm s$）表示。组间对应变量采用单因素方差分析及LSD-t检验，$P \leqslant 0.05$ 为差异有统计学意义。

2　结　果

2.1　临床评价

4组患者基本情况如下（表1），纳入研究的共计32颗患牙，包括切牙17颗，尖牙5颗，前磨牙10颗。患者平均年龄（42.3 ± 16.5）岁，其中男14例计17颗，女12例计15颗。

术前、术后即刻及6个月口内PLI均≤1，GI均≤2，邻牙松动度不超过Ⅱ度。所有位点手术完成顺利，G1和G2组分别有2个位点在术后拆线时出现膜暴露情况，局部以3%双氧水轻轻冲洗，嘱患者继续使用西吡氯铵漱口液1周，术后1个月复查膜暴露情况消失。所有位点愈合过程中均未出现感染症状。术后6个月时位点保存治疗的3组牙槽嵴均较为丰满，而对照组牙槽嵴相对狭窄（图2）。

表1　4组患者基本情况

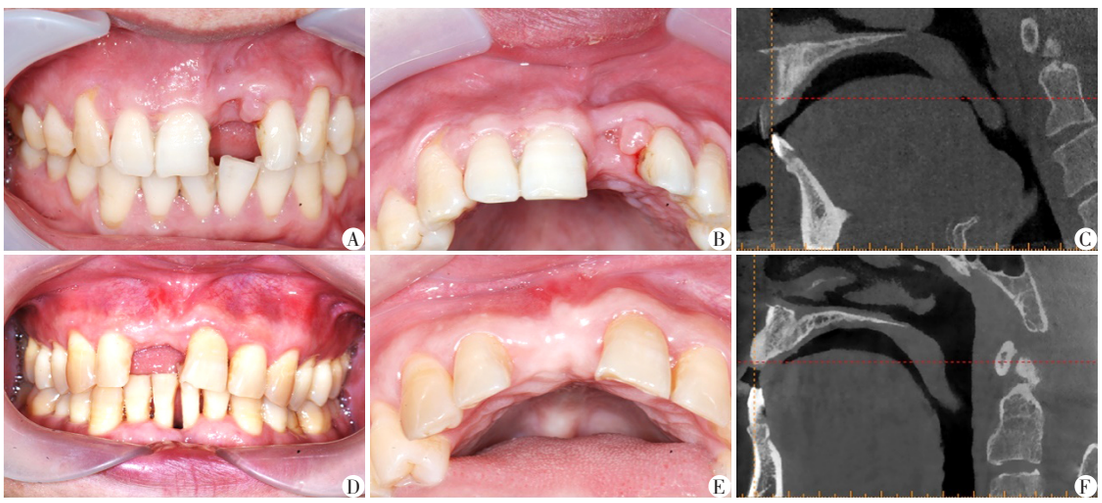
Table 1　The basic conditions of four groups

分组	平均年龄（岁）	男/女	切牙（颗）	尖牙（颗）	前磨牙（颗）
对照组	42.7 ± 16.6	3/5	4	1	3
Bio-Oss组	47.4 ± 15.2	4/4	3	2	3
Bio-Gene组	39.4 ± 14.1	4/4	5	1	2
混合组	39.5 ± 15.8	6/2	5	1	2
共计	42.2 ± 16.5	17/15	17	5	10

2.2　影像学评价

2.2.1　D1与D3牙槽骨高度和宽度变化对比

实验组术后6个月（D3）颊腭侧牙槽骨高度均较术前（D1）增高，其中Bio-Gene组术后牙槽骨宽度增加，而Bio-Oss组和混合组牙槽嵴宽度则少量降低；对照组的牙槽嵴高度和宽度均明显降低，组间差异具有统计学意义（表2）。



A~C：对照组术后6个月，21口内照及CBCT；D~F：实验组术后6个月，11口内照及CBCT。

图2　术后6个月口内状况及CBCT

Figure 2　Intra-oral photographs and CBCT after the extraction

表2 D1与D3牙槽骨高度和宽度变化比较

Table 2 Comparison of changes of the height and width between D1 and D3 (mm,$\bar{x} \pm s$)

分组	样本量	Hb1-Hb3	Hp1-Hp3	W1-W3
对照组	8	3.07 ± 0.94	1.70 ± 1.14	1.94 ± 0.63
Bio-Oss组	8	−1.78 ± 2.35[a]	−0.93 ± 2.09[a]	0.01 ± 1.70[a]
Bio-Gene组	8	−0.79 ± 2.21[a]	−0.14 ± 2.75[a]	−0.83 ± 2.33[a]
混合组	8	−1.48 ± 2.08[a]	−2.18 ± 3.20[a]	0.17 ± 1.66[a]
*F*值		10.360	5.015	3.762
*P*值		< 0.001	0.007	0.022

与对照组相比,[a]$P<0.05$;与Bio-Oss组相比,[b]$P<0.05$;与Bio-Gene组相比,[c]$P<0.05$。

表3 D2与D3牙槽骨高度和宽度变化比较

Table 3 Comparison of changes of the height and width between D2 and D3 (mm,$\bar{x} \pm s$)

分组	样本量	Hb2-Hb3	Hp2-Hp3	W2-W3
对照组	8	2.40 ± 0.84	1.38 ± 1.05	1.76 ± 0.63
Bio-Oss组	8	1.42 ± 0.66[a]	0.56 ± 0.78[a]	0.40 ± 0.50[a]
Bio-Gene组	8	2.04 ± 0.70	1.49 ± 1.36	0.89 ± 0.86[a]
混合组	8	0.61 ± 0.28[abc]	0.22 ± 0.35[ac]	0.11 ± 0.63[ac]
*F*值		11.643	3.337	9.485
*P*值		< 0.001	0.033	< 0.001

与对照组相比,[a]$P<0.05$;与Bio-Oss组相比,[b]$P<0.05$;与Bio-Gene组相比,[c]$P<0.05$。

2.2.2 D2与D3牙槽骨高度和宽度变化对比

在术后即刻(D2)至术后6个月(D3),实验组和对照组颊腭侧牙槽骨高度和宽度均有降低。实验组中,混合组的骨高度和宽度变化最小,Bio-Oss组其次,Bio-Gene组变化最大,组间差异有统计学意义(表3)。

2.2.3 D2与D3位点骨密度及变化值对比

实验组在术后即刻(D2)、术后6个月(D3)的骨密度绝对值T2、T3均较对照组显著增高。但D2到D3期间实验组骨密度均有明显降低,而对照组则明显增加。组间比较具统计学差异。实验组中,Bio-Oss组骨密度绝对值最高,混合组其次,Bio-Gene组最低;骨密度变化值的比较中,混合组最低,Bio-Oss组其次,Bio-Gene组变化最大,组间比较具统计学差异(表4)。

3 讨 论

牙拔除后,剩余牙槽骨将发生不可逆的吸收,原有的牙槽骨高度、宽度将会降低[7]。Hammerle等[8]研究上颌牙拔除后牙槽骨变化,发现拔牙后1个月即可从影像学观察到颊侧骨板明显的吸收。Morjaria等[9]系统回顾了拔牙后6个月的牙槽嵴改变,牙槽骨水平性和垂直性平均吸收的比例分别是63%和22%。重度牙周炎患牙常常出现牙槽骨壁缺损、牙槽骨吸收至根尖的情况,骨量不足会影响后期的种植修复。本研究患牙拔除后,对照组在术后6个月牙槽嵴高度和宽度均明显降低,而实验组牙槽嵴高度和宽度不减反增,说明重度牙周炎的患牙拔牙同期植入骨材料,不仅能较好地维持牙槽骨高度和宽度,还可以起到骨缺损修复和牙槽嵴增量的作用[10]。

表4 D2与D3位点骨密度及变化比较

Table 4 Comparison of the values and changes of the site bone density between D2 and D3 (HU,$\bar{x} \pm s$)

分组	样本量	T2	T3	T2-T3
对照组	8	612.63 ± 92.76	663.13 ± 91.06	−50.50 ± 32.13
Bio-Oss组	8	1 533.38 ± 229.88[a]	1 482.63 ± 230.21[a]	50.75 ± 26.78[a]
Bio-Gene组	8	1 004.62 ± 170.09[ab]	924.50 ± 166.34[ab]	80.13 ± 80.62[a]
混合组	8	1 005.38 ± 76.08[ab]	979.50 ± 78.97[ab]	25.88 ± 22.27[ac]
*F*值		47.532	39.434	11.458
*P*值		< 0.001	< 0.001	< 0.001

与对照组相比,[a]$P<0.05$;与Bio-Oss组相比,[b]$P<0.05$;与Bio-Gene组相比,[c]$P<0.05$。

骨移植材料包括自体骨、同种异体骨、异种骨和人工骨材料等,其中临床常用于位点保存治疗的是同种异体骨和异种骨材料[11]。同种异体骨材料,包括冻干骨和脱矿冻干骨,在位点保存治疗中可以作为支架引导新骨形成[12],此外同种异体骨可以释放骨成形蛋白,具备良好的骨诱导性[13]。Mastrogiacomo等[14]系统回顾认为同种异体骨是最适合作为保存牙槽嵴高度的骨材料。但同种异体骨材料吸收速率快[15],且透射性不佳,不利于影像学评估[16]。Bio-Gene是同种异体冻干骨材料,其骨量维持效果不如Bio-Oss及混合骨材料组,可能与其吸收速率快有关。异种骨包括牛源性、猪源性或马源性的骨材料[17-18],Bio-Oss疏松多孔结构使其同样具备较好的骨引导性,又因吸收速率慢而具备较佳的空间

占位性。此外，Bio-Oss放射阻射性优于Bio-Gene，在影像学检查评估中更为容易[19]。但异种骨的缺陷在于缺乏骨诱导能力。

为了弥补不同骨材料的缺点，目前很多学者尝试联合多种材料进行骨增量治疗。Jensen等[19]将自体骨和Bio-Oss以不同比例混合用于上颌窦提升术，发现联合材料比单一材料获得更高的骨-种植体接触率。自体骨具有骨生成和诱导性，Bio-Oss空间占位性和骨引导性良好，故两者结合后性能较为理想。Eskan等[20]应用同种异体松质骨混合富血小板血浆进行无牙颌牙槽嵴增量治疗，术后4个月临床和组织学分析显示，混合材料组牙槽嵴宽度及新生骨量较单独应用同种异体骨组显著增加。富血小板血浆富含自体生长因子，加速术创愈合，联合使用可提高骨增量效率。

本研究将Bio-Gene及Bio-Oss等比混合，结果显示，在术后即刻及术后6个月的牙槽骨高度和宽度的维持上，混合组效果最佳，Bio-Oss组其次，Bio-Gene组最差，这也证明混合此两种骨材料在拔牙位点骨量保存的性能优于单一骨材料。而在术后骨密度比较中，Bio-Oss组密度值高于混合组及Bio-Gene组，符合Bio-Oss材料高占位、高阻射性的特点；混合组在术后即刻的骨密度值与Bio-Gene组相近，但术后6个月的密度变化小于Bio-Gene组和Bio-Oss组，可能是混合骨材料具备低吸收率和骨诱导性，引导新骨再生。

研究认为，拔牙同期位点保存较单纯拔牙在软硬组织的维持上具有优势。等比混合Bio-Oss及Bio-Gene材料在牙槽骨量维持的效果上优于单独应用Bio-Oss或Bio-Gene材料。本研究仅从临床和影像学方面评价了位点保存效果，后期可探索其他材料之间联合方式和比例，从组织学和种植初期稳定性等方面进一步评估。

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