

髌股关节骨性关节炎治疗方案的研究进展

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摘要

髌股关节是膝关节的重要组成部分。随着人口老龄化的不断加重, 髌股关节骨性关节炎(PFOA)的患病率正在逐渐升高, 成为导致老年人群膝关节疼痛和功能障碍的重要原因之一。目前对髌股关节骨性关节炎的治疗包括非手术治疗和手术治疗, 而随着研究的不断加深, 这两方面已涵盖多种不同的治疗方案, 本文将从控制体重、功能锻炼、髌股关节置换等多方面对髌股关节骨性关节炎治疗方案的研究进展进行总结, 主要目的在于为临床医生选择治疗方案提供参考, 现作如下综述。

关键词

髌股关节骨性关节炎, 骨性关节炎, 治疗

Research Progress on the Treatment of Patellofemoral Osteoarthritis

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Abstract

Patellofemoral joint is an important part of the knee joint. With the increasing aging of the population, the prevalence of patellofemoral osteoarthritis (PFOA) is gradually increasing, which has become one of the important causes of knee pain and dysfunction in the elderly population. At

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present, the treatment of patellofemoral osteoarthritis includes non-surgical treatment and surgical treatment, and with the deepening of research, these two aspects have covered a variety of different treatment options. This article will summarize the research progress in the treatment options of patellofemoral osteoarthritis from various aspects such as weight control, functional exercise and patellofemoral arthroplasty. The primary objective is to provide reference for clinicians to choose treatment plan, and the following review is hereby made.

Keywords

Patellofemoral Osteoarthritis, Osteoarthritis, Treatment

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1. 引言

髌股关节骨性关节炎(Patellofemoral Osteoarthritis, PFOA)是临床上常见的膝关节疾病之一,是由于髌股关节面的软骨退行性变及骨质增生所引起的慢性关节疾病,常见风险因素包括使髌股关节负荷增加的活动(上下楼梯、下蹲等)、股四头肌萎缩无力和髌骨轨迹不良等[1] [2]。该病常见于中老年和女性人群,典型的临床表现为膝前痛和关节活动受限。随着研究的进展,人们发现 PFOA 是膝关节骨性关节炎的其中一个发展阶段,单纯的 PFOA 又被称为孤立性髌股关节骨性关节炎(Isolated Patellofemoral Osteoarthritis),因此患有膝关节骨性关节炎的患者常常伴有 PFOA, Kobayashi 等[3]对 18,194 名膝关节骨性关节炎患者分析后发现,其中超过一半的患者伴有 PFOA。目前临床对于 PFOA 与膝关节骨性关节炎治疗方案的划分仍模糊不清,对 PFOA 的针对性治疗较为有限。本文旨在对近年来关于 PFOA 治疗方案的研究进展进行总结,以为临床医生针对不同患者选取合适的治疗方案提供参考。

2. 非手术治疗

非手术治疗通常对大多数早期 PFOA 有较好疗效。

2.1. 控制体重

作为膝关节的组成部分,髌股关节(PFJ)在膝关节功能中有至关重要的作用,包括协助伸膝和承受负荷等[4]。在上下楼梯时,PFJ 需要承受约 2~3 倍体重的负荷,在下蹲时甚至达到了 7 倍以上[5] [6]。有研究[7]表明,与健康人群相比,PFOA 患者的平均 BMI 更高,因此其 PFJ 需要承受比普通人更大的负荷,这可能会引发恶性循环。减轻体重可降低 PFJ 所承受的负荷,从而减轻关节磨损,延缓关节炎的进展,是 PFOA 的核心预防和治疗手段[8]。

2.2. 功能锻炼

包括跑步、力量锻炼、水上运动等,目的是通过选择股四头肌等肌群的拉伸、增强肌肉力量等方法改善髌骨的运动轨迹,从而改善下肢力线及增强关节稳定,起到减轻疼痛的作用。已有研究[9]表明,与膝关节单独进行的运动相比,髌关节和膝关节联合进行的运动不仅减轻疼痛的效果更加显著,患者的下肢功能评分也有更加明显的提高。

在股四头肌中, 股内斜肌是唯一具有将髌骨向内、后侧牵拉作用的动力性结构, 是髌骨侧倾的主要动力约束[10] [11]。近年有学者([12], p. 1)发现膝关节在屈曲 $0^{\circ}\sim 30^{\circ}$ 体位进行股四头肌训练能让股内斜肌得到最为充分的锻炼, 可在一定程度上防止髌骨侧倾, 该方案适用于有肌肉萎缩或无力所致髌骨外移的患者。此外, 在对 815 名患者进行的长达 24 周的随访中, 太极拳等中国传统运动改善了患者的心理健康和关节功能, 减轻了关节疼痛和僵硬([12], p. 2) [13]。

肌肉力量锻炼可能会加重关节疼痛和负荷, 相比之下, 低负荷血流限制(blood flow restriction, BFR)训练通过限制动脉血流动和静脉血回流, 可以在无痛的前提下引起更大的肌肉疲劳率, 其不仅可以诱导肌肉肥大, 而且比单一使用的低负荷训练更能提升力量[14]。对于因疼痛而无法行力量训练的 PFOA 患者, 在 8 周内行 BFR 训练后, 患者在日常活动中的产生的疼痛有了更明显的改善, 但在 6 个月时与标准化训练无差异[15]。

PFOA 的发生发展与某些非正常运动方式有关, 包括髌关节内收、内旋增加和对侧骨盆下降等, 以这些异常方式进行运动锻炼可能会加重 PFJ 的负荷[16]。Davis 等[17]提出, 步态训练可通过纠正错误的运动方式降低 PFJ 应力, 常见方案为减少髌关节内收、从足跟接触地面调整为前足接触地面以及使躯干前倾。该训练的局限是需要大量的时间投入以培养训练者的运动习惯, 一般训练阶段需要持续 4~6 周, 然后是 2~3 个月的适应期。

2.3. 佩戴支具及其他辅助用具

佩戴支具已被证明是一种有效的短期治疗方法, 常见支具有膝关节支具和 PFJ 支具等。髌骨运动轨迹不良是很多 PFOA 的病因和风险因素, 如髌骨倾斜和外移, 佩戴成本低且安全的支具可纠正这些生物力学异常并提供支撑, 也能减少关节的屈曲活动[18]。国际髌股疼痛研究会[19]建议患者在佩戴支具的同时进行功能锻炼, 相比单一佩戴支具或功能锻炼, 二者结合使用可在中短期内更好减轻患者疼痛。Peterson 等[20]将患者分为运动疗法联合膝关节支具组和单独运动疗法组, 对两组随访后发现, 联合治疗组在 6 周和 12 周日常活动中的疼痛有所改善, 但在 52 周以后效果减弱。

极简鞋是一种可以使穿戴者足部在奔跑状态下模拟为赤足状态的鞋具, 其可减少足跟部接触地面、增加脚掌中心接触地面, 从而减少步长、加快频率, 使肢体更接近身体中心, 这可以减少膝关节屈曲的角度, 降低跑步时的关节负荷峰值, 因此该足具对跑步运动员而言可能是一种比较有前景的 PFOA 防治措施[21]。

2.4. 物理治疗

针灸推拿、红外线、超声波等都可在一定程度上减轻炎症反应, 但效果难以长期维持。有学者[22]认为中医的理筋动髌手法可对髌周支持带进行重点松解, 改善髌骨的外移程度, 纠正其运动轨迹, 有效地改善 PFJ 对合关系, 但目前缺乏长期随访。

体外冲击波疗法(extracorporeal shock waves therapy, ESWT)可通过在正相产生压缩应力, 在负相产生牵拉和剪切应力, 引发区域内的微气泡空化效应, 引起细胞间和细胞外反应, 促进组织再生。此外, 还可通过调节炎症因子和生长因子信号增强软骨下骨合成代谢, 改善骨小梁质量[23]-[27]。有分析[28]显示, ESWT 在长达 6 个月的随访中可改善关节功能。目前 ESWT 的局限为其参数、剂量和长期疗效目前仍需进一步统一确定。

2.5. 药物治疗

包括镇痛药、透明质酸和糖皮质激素等。镇痛药包括非甾体类抗炎药、对乙酰氨基酚和阿片类药物等, 其中以非甾体类抗炎药为代表, 是骨性关节炎的主要治疗药物, 但因其有胃肠道、心血管和肾脏方

面的副作用, 对中老年人患者要慎重, 应严格按照最低有效剂量、最短用药时间、尽量局部用药的原则来使用[29]。Towheed 等人[30]的一项针对 5986 名参与者的研究显示, 对中至重度 PFOA, NSAIDs 比乙酰氨基酚更有效。国际骨关节炎研究学会指南[31]中提到, 由于对乙酰氨基酚的肝毒性[32], 目前不建议长期使用作为一线治疗。Busse 等[33]强调了阿片类药物在 3 个月至 1 年时治疗非癌性疼痛时的效果较为有限, 但当患者有 NSAIDs 禁忌证或其他治疗无效时可以考虑使用。有研究[34]提出, 含有辣椒素的局部贴剂可缓解 PFOA 导致的疼痛, 是一种有效且安全的非甾体类抗炎药替代品。辣椒素会选择性地刺激传入神经纤维导致 P 物质和其他神经肽释放, 持续使用会使 P 物质耗竭以及疼痛脱敏, 此外它还具有良好的安全性, 最常见的不良反应是轻度的局部烧灼感, 但通常会随着持续使用而逐渐减轻[35]。

透明质酸的主要成分为黏多糖物质, 可润滑关节, 减轻软骨破坏和关节粘连, 关节内注射透明质酸可取得较好的短期疗效。有研究[36]认为, 接受富血小板血浆治疗的患者可以获得比注射透明质酸更好的治疗效果。PRP 可通过释放生长因子和诱导干细胞迁移等机制引发愈合反应[37]。然而, 一些因素挑战着其临床实用性, 包括疗效不统一和缺乏制备方案的标准化共识[38]。

糖皮质激素是目前广泛使用的关节内治疗药物之一, 其通过抑制磷脂酶 A2 和炎症因子等化合物来阻断炎症级联反应[39]。主要有三种: 甲泼尼龙、曲安奈德和倍他米松, 其中曲安奈德已被证实细胞毒性最小[40]。

间充质干细胞是软骨再生研究的热点, 其可来源于骨髓、胎盘和脂肪组织。间充质干细胞可分化为软骨细胞, 促进软骨再生; 另一方面, 它可以通过本身携带的生物活性分子作用于软骨细胞, 保护软骨[41]。Tan 等[42]对 19 个涉及 440 个膝关节的研究分析后发现, 关节内注射间充质干细胞可改善关节功能。Wang 等[43]分析了 7 个涉及 256 名患者的研究, 结果显示关节疼痛和功能评分均有所改善。而两项分析都认为, 相比脂肪或脐带来源的间充质干细胞, 骨髓来源的间充质干细胞获得了更好的效果。目前间充质干细胞需要进一步的研究来确定成分和剂量。

3. 手术治疗

3.1. 关节镜下手术

关节镜手术创伤小、术后恢复快, 适用于保守治疗后效果不理想的患者, 可以在一定程度上推迟行关节置换的时间, 延缓 PFOA 的进展。

3.1.1. 关节镜下软组织紧张度平衡术

与 PFOA 有关的髌骨周围软组织主要是髌骨内侧和外侧支持带, 二者挛缩或松弛都会导致髌骨轨迹偏移和髌骨不稳, 最终导致 PFOA 的发生。软组织紧张度平衡术就是通过将髌骨周围支持带的紧张度调整至合理范围, 使髌骨运动轨迹恢复正常。以往主要针对髌骨外侧支持带进行松解, 用于治疗髌骨软化症等各种髌骨疾病[44], 也适用于早期的孤立性 PFOA。有研究[45]认为外侧支持带延长术应该取代外侧支持带松解术, 因外侧支持带松解术可能会使关节囊的完整性受到影响, 导致 PFJ 不稳定, 而外侧支持带延长术不会影响关节囊完整性, 并且可以使支持带达到更精确的张力。Joan 等[46]对 36 例有髌骨不稳的患者用自体股薄肌行髌骨内侧支持带重建术, 术后髌骨不稳的情况得以纠正, IKDC、VAS 等评分均有所改善, 且短期随访未出现复发情况。

3.1.2. 关节镜下髌骨去神经化处理联合微骨折术

髌骨周围去神经化是通过减少髌骨周围的神经纤维数量来减轻疼痛。微骨折术是将关节软骨损伤处的软骨下骨髓暴露, 使骨髓内的间充质干细胞募集于损伤部位, 形成纤维软骨, 以达到修复的作用。Ouyang 等[47]对 30 例进行过关节镜下髌骨去神经化处理联合微骨折术的 PFOA 患者随访后发现, 相比单

一的关节镜下清理, 髌骨去神经化处理联合微骨折术能更好缓解疼痛, 改善患者膝关节功能。

3.2. 截骨术

包括胫骨结节截骨术、股骨远端截骨术和滑车成型术等, 其目的都是通过纠正髌骨轨迹延缓 PFOA 的进展。胫骨结节截骨术是一种无需额外植骨即可调整伸肌机制的手术方法, 其能够降低 PFJ 的接触力和应力, 以及纠正冠状面错位导致的髌骨不稳。Liu 等[48]对 80 例进行单侧或双侧胫骨结节截骨术的患者随访至少 1 年后发现, 术后 7 个月左右恢复 1 次或 1 次以上体育活动的患者占 83.3%, 且多数患者恢复的强度与术前相同甚至更高。胫骨高位截骨术通过纠正胫股关节冠状线降低内侧关节软骨负荷, 减少软骨磨损, 从而创造软骨修复机会[49]。Akamatsu 等[50]将 47 例行双水平截骨术的患者与 116 例行胫骨高位截骨术的患者随访对比后发现, 膝内侧关节间隙 ≥ 13 mm 的患者行胫骨高位截骨术术后 PFOA 的进展速度更快, 相比之下, 双水平截骨术可以降低内侧间隙距离, 减慢 PFOA 进展。Maximilian 等[51]提出内翻截骨术作为一种补救性手术可显著改善关节功能及减轻疼痛, 该术式一般用于有膝外翻畸形 $\geq 3^\circ$ 的 PFOA。Martínez-Sánchez 等[52]对比了 32 例行胫骨结节截骨术和髌股关节置换术的 PFOA 患者, 发现对于 Kellgren-Lawrence III~IV 级的 PFOA, 髌股关节置换的疗效要优于胫骨结节截骨术。

3.3. 髌股关节置换术

髌股关节置换术(patellofemoral arthroplasty, PFA), 即髌股关节单间室表面置换术, 主要适用于非手术治疗和非置换类手术治疗无效的患者。相比全膝关节置换(total knee arthroplasty, TKA), PFA 保留了胫股关节、半月板以及髌骨周围韧带等结构, 从而更好地维持了膝关节运动学, 且患者住院天数更少, 术后感受度更佳[53]。随着医疗技术的发展, 目前髌股关节置换假体已经从第一代的嵌入式假体更新为新一代嵌入式假体和覆盖式假体, 经对比新型假体的术后并发症更少、翻修率更低, 术后功能恢复的效果也更佳, 而植入新一代嵌入式假体和覆盖式假体的 PFA 其术后的临床表现和功能恢复情况目前没有较大差异[54]-[56]。Fredborg 等[57]对 100 例行 PFA 和 TKA 的孤立性 PFOA 患者进行 12 个月的随访, 发现 PFA 不仅手术成本、手术时间和住院时间低于 TKA, 术后短期内关节功能恢复效果也优于 TKA。Pagano 等[58]报告了对 114 例平均年龄 60 岁的 PFOA 患者进行长达十年的随访结果, 结果显示对于孤立性 PFOA, PFA 是一种具有良好预后和临床疗效的手术, 且与 TKA 在预后和主观临床评分上大致等同。Batailler 等[59]将 77 例行 PFA 的 PFOA 分为常规技术组、无影像功能的机械辅助技术组和有影像功能的机械辅助技术组, 并随访至少 1 年, 发现对于因滑车发育不良导致的 PFOA, 相比精确度较低的传统 PFA 技术, 有机器人辅助系统的 PFA 能更精准地纠正髌骨倾斜, 改善髌骨不稳, 但该技术仍待进一步普及。

4. 小结与展望

目前临床上的非手术治疗主要是缓解疼痛和延缓 PFOA 进展, 手术治疗的目的是纠正髌骨轨迹不良和改善髌骨与股骨的对合情况从而延缓关节炎进展、改善关节功能。对大多数早期 PFOA, 非手术治疗通常有较好疗效, 手术治疗一般用于非手术治疗无效、影像学改变较重的患者。步态以及运动方式的矫正虽然需要大量时间适应, 但可有效降低治疗的成本, 因而是运动医学领域对 PFOA 非手术治疗的主要研究方向, 适用于早期、无症状或症状较轻的患者。间充质干细胞是近年软骨再生研究的热点, 该细胞可来源于自体或异体组织, 既可通过其内在机制作用于软骨细胞而保护软骨, 也能通过在体外培养后在损伤部位进行移植, 从而达到修复的目的, 但该方向目前的局限在于缺乏具体成分和剂量的标准化统一, 以及需要更多的研究对象及证据支撑。关节镜下手术创伤小、术后恢复快, 适用于保守治疗后效果不理想、软骨损伤程度较轻的患者, 目前关节镜下清理和外侧支持带松解在临床应用最广, 而在未来

髌骨周围韧带重建技术的发展可能会带来更好的软组织平衡效果。对于关节软骨磨损严重、关节功能损失较大的患者, 目前 PFA 和 TKA 是较好的手段, 而相比之下, PFA 保留了更多关节周围组织, 使关节运动结构更为理想, 因此近年的众多报道均显示了更少的并发症、更低的术后翻修率以及更好的临床疗效。随着对新一代 PFJ 假体的研究, 未来 PFA 的大体方向主要是通过创建更佳关节生物力学结构而扩大其临床适应证和进一步降低术后翻修率。

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