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【应用研究】

四点悬吊固定术后患者人工晶状体的倾斜与偏心情况及其与视力预后的关系△

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【摘要】 **目的** 对比分析四点和两点悬吊固定术后患者人工晶状体的倾斜和偏心情况及其与视力预后的关系。**方法** 选取2021年6月至2022年4月于保定市第一中心医院眼科因各种原因行人工晶状体悬吊固定术的患者80例80眼作为研究对象。将患者随机分为2组,试验组41例41眼,均行四点悬吊固定术;对照组39例39眼,均行传统的两点悬吊固定术。术后至少随访6个月,记录两组术眼术前及末次随访裸眼视力(UCVA)、最佳矫正视力(BCVA),应用全景超声生物显微镜(UBM)测量两组术眼术后人工晶状体倾斜角度及偏心距离。比较两组术眼术前及末次随访UCVA、BCVA,术后人工晶状体倾斜角度与偏心距离,采用Pearson相关分析对倾斜角度及偏心距离与术后UCVA、BCVA的相关性进行分析。**结果** 试验组和对照组术眼末次随访时UCVA和BCVA均优于术前(均为$P<0.05$)。试验组与对照组术眼术后UCVA相比,差异有统计学意义($t=-6.20$,$P=0.00$),试验组术眼术后UCVA优于对照组;两组术眼术后BCVA相比,差异无统计学意义($t=-1.43$,$P=0.16$)。试验组术眼术后人工晶状体水平倾斜度为0.70°±0.24°,垂直倾斜度为0.60°±0.16°;对照组术眼术后人工晶状体水平倾斜度为2.66°±1.40°,垂直倾斜度为3.76°±0.67°,两组比较差异均有统计学意义($t=-8.51$、-29.42,$P=0.00$、0.00)。试验组术眼术后人工晶状体水平偏心距离为(0.24±0.10)mm,垂直偏心距离为(0.25±0.10)mm,对照组术后人工晶状体水平偏心距离为(0.85±0.77)mm,垂直偏心距离为(2.14±0.50)mm,两组比较差异均有统计学意义($t=-4.82$、-21.68,$P=0.00$、0.00)。试验组术眼人工晶状体水平倾斜度及垂直倾斜度与术后UCVA和术后BCVA均不相关;水平偏心距离及垂直偏心距离与术后UCVA和术后BCVA均不相关(均为$P>0.05$)。对照组术眼人工晶状体水平倾斜度与术后UCVA和术后BCVA均呈正相关(均为$P<0.05$);垂直倾斜度与术后UCVA和术后BCVA均不相关(均为$P>0.05$),水平偏心距离与术后UCVA和术后BCVA均呈正相关(均为$P<0.05$),垂直偏心距离与术后UCVA和术后BCVA均不相关(均为$P>0.05$)。**结论** 四点悬吊固定术与传统两点悬吊固定术均可有效提高患者术后视力,但四点悬吊固定术后术眼人工晶状体倾斜和偏心程度更小。

【关键词】 人工晶状体悬吊固定术;人工晶状体;倾斜;偏心
【中图分类号】 R776.2

临床上因各种原因导致晶状体囊膜支撑不足,无法囊袋内或睫状沟内植入人工晶状体时,人们可以选择的手术方式有前房植入术、虹膜固定植入术、巩膜悬吊固定术。巩膜悬吊固定植入的人工晶状体更符合人体生理位置,可为患者提供更自然的视觉[1],且避免了前房植入及虹膜固定植入所产生的较多并发症[2-3]。它已成为目前临床常用的手术方式。研究显示,传统的两点悬吊固定术存在术后人工晶状体倾斜及偏心、视力不理想等问题[4-5]。Akreos Adapt AO型折叠式人工晶状体具有四个孔眼,可进行四点悬吊固定,从理论上讲,四点固定受力更均匀,可提高术后人工晶状体的稳定性。本研究对比分析四点和两点悬吊固定术后患者人工晶状体的倾斜和偏心情况及其与视力预后的关系。

1 资料与方法

1.1 一般资料

选取2021年6月至2022年4月于保定市第一中心医院眼科因各种原因行人工晶状体悬吊固定术的患者80例80眼作为研究对象。将患者随机分为2组,试验组41例41眼,均行四点悬吊固定术;其中,男33例33眼,女8例8眼,年龄45.0~64.0(57.1±4.6)岁,术前眼压11.0~21.0(15.9±2.5)mmHg(1 kPa=7.5 mmHg);41眼中,晶状体不全脱位26眼,无晶状体眼2眼,晶状体全脱位9眼,人工晶状体不全脱位2眼,人工晶状体全脱位1眼,白内障术中后囊膜破裂1眼。对照组39例39眼,均行传统的两点悬吊固定术;其中,男29例29眼,女10例10眼,年龄47.0~66.0(58.1±4.8)岁,术前眼压10.0~21.0(15.7±2.5)mmHg;39眼中晶状体不全脱位24眼,无晶状体眼2眼,晶状体全脱位9眼,人工晶状体不全脱位2眼,人工晶状体全脱位1眼,白内障术中后囊膜破裂1眼。本研究已经获得我院医学伦理委员会批准,并遵循《赫尔辛基宣言》所要求的伦理学原则,患者均知情并签署知情同意书。

1.2　纳入与排除标准

纳入标准：各种原因导致的晶状体囊膜支撑不足，囊袋内及睫状沟内不能植入人工晶状体。排除标准：(1)心脑血管等疾病急性期不能耐受手术者；(2)术中未植入人工晶状体者；(3)既往开放性眼外伤者；(4)存在角膜瘢痕者；(5)青光眼、葡萄膜炎或合并其他眼底疾病者；(6)术前眼压未降至正常水平(<21 mmHg)者；(7)随访期间失访者。

1.3　方法

1.3.1　术前准备

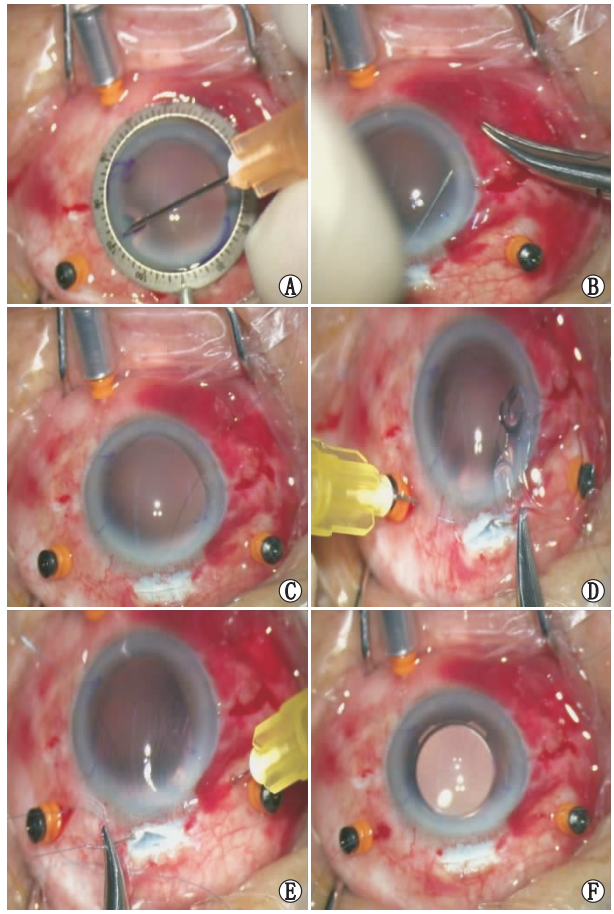
所有患者术前行裸眼视力(UCVA)、眼压、裂隙灯、最佳矫正视力(BCVA)、眼底照相等检查，采用IOL-Master测量患者人工晶状体度数。术前应用复方托吡卡胺滴眼液散瞳，排除手术禁忌；术前3 d应用加替沙星眼用凝胶滴术眼，每天4次。

1.3.2　手术方法

手术由同一位经验丰富的眼科主任医师完成。依据患者病情完成玻璃体切割联合晶状体切除或人工晶状体取出。

试验组手术方法：剪开术眼上方及3：00、9：00钟位球结膜，巩膜表面电凝止血，于上方角膜缘后1.5 mm做一长5 mm平行角膜缘的巩膜隧道切口，于3：00、9：00钟位角膜缘后1.5 mm各做一长3 mm垂直角膜缘的巩膜隧道切口，角膜标记器标记2：00、4：00、8：00、10：00钟位(图1A)，用一条8-0聚丙烯不可吸收缝线自8：00钟位角膜缘后2 mm巩膜面处穿入，30G针头与之对接于上方巩膜隧道切口处，引出缝线(图1B)，用另一条8-0聚丙烯缝线自4：00钟位角膜缘后2 mm巩膜面穿入，30G针头与之对接于上方巩膜隧道切口处，引出缝线(图1C)，两条缝线分别穿过四襻Akreos Adapt AO型折叠式人工晶状体一侧两襻，30G针头自2：00钟位角膜缘后2 mm巩膜面引出自4：00钟位穿入的第2条缝线(图1D)，30G针头自10：00钟位角膜缘后2 mm巩膜面引出自8：00钟位穿入的第1条缝线(图1E)，将人工晶状体折叠后于上方巩膜隧道切口送入后房，调整人工晶状体位置至位正(图1F)，缝线从巩膜层间穿行固定于3：00、9：00钟位，采用7-0可吸收缝线缝合巩膜及结膜切口。

对照组手术方法：剪开术眼上方及3：00、9：00钟位球结膜，巩膜表面电凝止血，于上方角膜缘后1.5 mm做一长5 mm平行角膜缘的巩膜隧道切口，于3：00、9：00钟位角膜缘后1.5 mm各做一长3 mm垂直角膜缘的巩膜隧道切口，用一条8-0聚丙烯不可吸收缝线自3：00钟位角膜缘后2 mm巩膜面处穿入，30G针头于9：00钟位角膜缘后2 mm巩膜面穿入与之对接，引出缝线，于上方巩膜隧道口处勾出缝线并剪开，分别悬吊博士伦人工晶状体(四襻Akreos Adapt AO型折叠式人工晶状体)，将人工晶状体折叠后于上方巩膜隧道切口处送入后房，调整人工晶状体位置至位正，将缝线固定于3：00、9：00钟位，采用7-0可吸收缝线缝合巩膜及结膜切口。



A：角膜标记器标记2：00、4：00、8：00、10：00钟位；B：用一条8-0聚丙烯不可吸收缝线自8：00钟位角膜缘后2 mm巩膜面处穿入，30G针头与之对接于上方巩膜隧道切口处，引出缝线；C：用另一条8-0聚丙烯缝线自4：00钟位角膜缘后2 mm巩膜面穿入，30G针头与之对接于上方巩膜隧道切口处，引出缝线；D：30G针头自2：00钟位角膜缘后2 mm巩膜面引出自4：00钟位穿入的第2条缝线；E：30G针头自10：00钟位角膜缘后2 mm巩膜面引出自8：00钟位穿入的第1条缝线；F：将人工晶状体折叠后于上方巩膜隧道切口送入后房，调整人工晶状体位置至位正。

图1　试验组患者四点悬吊固定术的手术过程图

1.3.3　观察指标

术后至少随访6个月，记录两组术眼术前及末次随访UCVA、BCVA，应用全景超声生物显微镜(UBM)(天津市索维电子技术有限公司)测量两组术眼术后人工晶状体倾斜角度及偏心距离，每眼测量3次取平均值。

1.4　统计学方法

采用SPSS 26.0统计学软件进行统计学分析，把视力转换为logMAR视力，计量资料采用($\bar{x} \pm s$)表示，手术前后比较采用配对样本t检验，组间比较采用独立样本t检验，人工晶状体倾斜角度及偏心距离与术后UCVA、BCVA的相关性采用Pearson相关性

分析。检验水准:$\alpha=0.05$。

2 结果

2.1 两组术眼手术前后 UCVA 和 BCVA 比较

试验组术眼术后随访(7.84±1.37)个月,术前 UCVA(logMAR)为 1.15±0.38,末次随访时为 0.29±0.13,术前与末次随访相比,差异有统计学意义($t=15.85$,$P=0.00$);术前 BCVA(logMAR)为 0.36±0.14,末次随访时为 0.20±0.11,术前与末次随访相比,差异有统计学意义($t=11.65$,$P=0.00$)。对照组术眼术后随访(7.35±0.92)个月,术前 UCVA(logMAR)为 1.09±0.31,末次随访时为 0.47±0.16,术前与末次随访相比,差异有统计学意义($t=13.10$,$P=0.00$);术前 BCVA(logMAR)为 0.34±0.10,末次随访时为 0.24±0.15,术前与末次随访相比,差异有统计学意义($t=5.84$,$P=0.00$)。试验组与对照组术眼术后 UCVA 相比,差异有统计学意义($t=-6.20$,$P=0.00$),试验组术眼术后 UCVA 优于对照组;两组术眼术后 BCVA 相比,差异无统计学意义($t=-1.43$,$P=0.16$)。

2.2 两组术眼术后人工晶状体倾斜角度及偏心距离

试验组术眼术后人工晶状体水平倾斜度为 0.70°±0.24°,垂直倾斜度为 0.60°±0.16°;对照组术眼术后人工晶状体水平倾斜度为 2.66°±1.40°,垂直倾斜度为 3.76°±0.67°,两组比较差异均有统计学意义($t=-8.51$、-29.42,$P=0.00$、0.00)。试验组术眼术后人工晶状体水平偏心距离为(0.24±0.10)mm,垂直偏心距离为(0.25±0.10)mm,对照组术后人工晶状体水平偏心距离为(0.85±0.77)mm,垂直偏心距离为(2.14±0.50)mm,两组比较差异均有统计学意义($t=-4.82$、-21.68,$P=0.00$、0.00)。

2.3 人工晶状体倾斜角度及偏心距离与术后 UCVA、BCVA 的相关性

Pearson 相关性分析显示,试验组术眼人工晶状体水平倾斜度及垂直倾斜度与术后 UCVA 不相关($r=0.18$、-0.22,$P=0.25$、0.16),与术后 BCVA 也不相关($r=0.11$、-0.22,$P=0.49$、0.15);试验组术眼人工晶状体水平偏心距离及垂直偏心距离与术后 UCVA 不相关($r=0.18$、0.01,$P=0.25$、0.93),与术后 BCVA 也不相关($r=0.11$、0.16,$P=0.48$、0.31);对照组术眼人工晶状体水平倾斜度与术后 UCVA 呈正相关($r=0.43$,$P=0.00$),与术后 BCVA 也呈正相关($r=0.57$,$P=0.00$);垂直倾斜度与术后 UCVA 不相关($r=0.22$,$P=0.16$),与术后 BCVA 也不相关($r=0.14$,$P=0.37$);对照组术眼人工晶状体水平偏心距离与术后 UCVA 呈正相关($r=0.45$,$P=0.00$),与术后 BCVA 也呈正相关($r=0.60$,$P=0.00$),垂直偏心距离与术后 UCVA 不相关($r=-0.06$,$P=0.69$),与术后 BCVA 也不相关($r=-0.08$,$P=0.60$)。

3 讨论

晶状体手术后的人工晶状体倾斜与偏心可使患者术后视觉质量下降,导致眩光、散光、视觉光晕和单眼复视。研究表明,人工晶状体倾斜超过 5°即可引起无法矫正的高阶像差[6],人工晶状体倾斜超过 5°或偏心距离超过 0.5 mm 可导致明显的视觉不适症状[7-8]。因此,尽可能减少人工晶状体的倾斜与偏心是眼科手术医师追求的目标。

Teichmann 等[9]研究显示,人工晶状体的倾斜无法完全避免。近年来,有关白内障术后囊袋内人工晶状体倾斜与偏心的研究很多[10-11]。Hayashi 等[12]通过比较两点悬吊固定术与囊袋内植入术发现,术后人工晶状体的倾斜角度平均增加了 2 倍。与两点悬吊固定比较,四点悬吊固定受力均匀,理论上更稳定,可降低人工晶状体倾斜与偏心的风险。本研究应用可折叠四襻人工晶状体进行四点悬吊固定,取得了较为理想的效果。

人工晶状体倾斜与偏心的测量方法有 Pentacam 眼前节分析系统、UBM、前节 OCT。Luo 等[13]应用 UBM 对 39 眼术后 1~3 个月人工晶状体的倾斜与偏心进行测量,发现两点悬吊固定术后人工晶状体水平倾斜度为 2.27°±2.15°;Yamane 等[14]对 100 眼应用无缝线巩膜两点悬吊固定术后随访 24 个月,术眼人工晶状体水平倾斜度为 3.4°±2.5°;章征等[15]检测到无缝线巩膜层间两点悬吊固定术后术眼人工晶状体水平倾斜度为 2.21°±1.47°,垂直倾斜度为 5.61°±4.21°,水平偏心距离为(1.76±1.45)mm,垂直偏心距离为(2.47±1.33)mm,传统睫状沟缝线两点悬吊固定术后术眼人工晶状体水平倾斜度为 2.34°±2.30°,垂直倾斜度为 3.03°±4.77°,水平偏心距离为(1.37±0.97)mm,垂直偏心距离为(1.16±1.30)mm;Raina 等[16]应用新型缝合材料 Gore-Tex 进行四点分别悬吊固定,使用 UBM 观察术后人工晶状体的倾斜,使用裂隙灯观察术后人工晶状体的偏心,但未进行量化研究。本研究采用 Yamane 等[14]的测量方法,使用 UBM 进行水平位及垂直位测量,取 3:00 至 9:00 钟位两端前房角连线作为水平参考线,角膜顶点至水平参考线中点作为视轴线。研究显示,对照组术眼术后人工晶状体水平倾斜度为 2.66°±1.40°,垂直倾斜度为 3.76°±0.67°,与以往研究结果大致相同;试验组术眼术后人工晶状体水平倾斜度为 0.70°±0.24°,垂直倾斜度为 0.60°±0.16°,两组差异明显。我们认为这与四点受力均匀,术后人工晶状体更稳定相关;对照组术后人工晶状体水平偏心距离为(0.85±0.77)mm,垂直偏心距离为(2.14±0.50)mm,低于以往研究,考虑这与缝线的选择有关,以往多应用 10-0 聚丙烯

缝线进行悬吊，本研究应用8-0聚丙烯缝线进行悬吊，此缝线具有高抗拉及低降解率的优势[17-18]，术后人工晶状体状体更稳定；试验组术眼术后人工晶状体水平偏心距离为(0.24±0.10)mm，垂直偏心距离为(0.25±0.10)mm，与两点固定组相比差异明显，这也与四点受力均匀，术后人工晶状体更稳定相关。此外，我们还发现两点悬吊固定术后垂直倾斜较水平倾斜角度更大，术后垂直偏心距离较水平偏心距离更大，考虑与人工晶状体受重力作用相关，四点悬吊固定术后垂直倾斜与水平倾斜角度、垂直偏心与水平偏心距离大致相同，考虑四点平均受力，受重力作用影响较小。因此，我们得出四点悬吊固定术后人工晶状体倾斜角度更小，偏心距离更小，这与四点受力更均匀有关，患者术后视力更佳。

另外，经相关性分析研究显示，四点悬吊固定术后术眼人工晶状体倾斜及偏心与术后UCVA及BCVA无相关性，分析原因与四点悬吊固定术后倾斜角度和偏心距离较小有关，两点悬吊固定术后术眼人工晶状体水平倾斜及水平偏心与术后UCVA及BCVA呈显著相关，而垂直倾斜及垂直偏心与术后UCVA及BCVA不相关。因此，我们得出相较于垂直位，水平位的倾斜与偏心对患者视力预后影响更大。

4　结论

四点悬吊固定术与传统两点悬吊固定术均可有效提高患者术后视力，但四点悬吊固定术后术眼人工晶状体倾斜和偏心程度更小。

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Tilt and decentration of intraocular lens after four-point suspension fixation and their relationship with visual prognosis

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【Abstract】 **Objective** To compare and analyze the tilt and decentration of the intraocular lens in patients receiving four-point and two-point suspension fixation, as well as their relationship with visual prognosis. **Methods** A total of 80 patients (80 eyes) who underwent intraocular lens suspension fixation at the Ophthalmology Department of Baoding No. 1 Central Hospital from June 2021 to April 2022 were selected as the subjects. These patients were randomly divided into the

experimental group (41 patients, 41 eyes, underwent four-point suspension fixation) and the control group (39 patients, 39 eyes, underwent traditional two-point suspension fixation). They were followed up for at least 6 months after surgery to record their uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA) before surgery and at the last follow-up. The tilt angle and decentration distance of the intraocular lens of patients in the two groups were measured after surgery by a panoramic ultrasound biomicroscope. The preoperative and last follow-up UCVA and BCVA of patients in the two groups, as well as tilt angle and decentration distance of the intraocular lens after surgery, were compared, and the correlation between tilt angle, decentration distance and postoperative UCVA, BCVA was analyzed by Person correlation analysis. **Results** The UCVA and BCVA at the last follow-up in the experimental group and control group were better than those before surgery (all $P<0.05$). The difference in postoperative UCVA between the experimental group and the control group was statistically significant ($t=-6.20$, $P=0.00$), and the experimental group had better postoperative UCVA than the control group. There was no statistically significant difference in postoperative BCVA between the experimental group and the control group ($t=-1.43$, $P=0.16$). The postoperative horizontal and vertical tilt angles of the intraocular lens in the experimental group were 0.70° ± 0.24° and 0.60° ± 0.16°, respectively; while those in the control group were 2.66° ± 1.40° and 3.76° ± 0.67°, respectively. The differences between the two groups were statistically significant ($t=-8.51$ and -29.42, $P=0.00$ and 0.00). The postoperative horizontal and vertical decentration distances of the intraocular lens in the experimental group were (0.24 ± 0.10) mm and (0.25 ± 0.10) mm, respectively, while those in the control group were (0.85 ± 0.77) mm and (2.14 ± 0.50) mm, respectively. The differences between the two groups were statistically significant ($t=-4.82$ and -21.68, $P=0.00$ and 0.00). In the experimental group, neither the horizontal and vertical tilt angles of intraocular lenses nor the horizontal and vertical decentration distances were correlated with postoperative UCVA and BCVA (all $P>0.05$). In the control group, the horizontal tilt angle of intraocular lenses was positively correlated with postoperative UCVA and BCVA (both $P<0.05$), while the vertical tilt angle was not correlated with postoperative UCVA and BCVA (both $P>0.05$); the horizontal decentration distance was positively correlated with postoperative UCVA and BCVA (both $P<0.05$), but the vertical decentration distance was not correlated with postoperative UCVA and BCVA (both $P>0.05$). **Conclusion** Both four-point suspension fixation and traditional two-point suspension fixation can effectively improve postoperative vision of patients, while the tilt and decentration of the intraocular lens are smaller after four-point suspension fixation.

【Key words】 intraocular lens suspension fixation; intraocular lens; tilt; decentration

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tion, while the rate of reaching the standard sleep duration of junior high and senior high school students was 60.09% and 64.99%, respectively. Most (55.74%) primary and secondary school students have an average outdoor activity duration of 1-2 hours daily. The results of multivariate logistic regression analysis showed that the risk of myopia in primary school students was correlated with the time spent using electronic products (including learning and entertainment), the time spent reading paper materials at a close range, outdoor activities, time to fall asleep, and sleep duration (all $P<0.05$); the risk of myopia among junior high school students was related to the time spent using electronic entertainment products, reading paper materials at a close range, outdoor activities, and sleep duration (all $P<0.05$); the risk of myopia among senior high school students was only related to the time spent reading paper materials at a close range and the duration of outdoor activities (both $P<0.05$). **Conclusion** The proportion of primary school students, junior high school students and senior high school students in Tianjin who use electronic products for more than 2 hours is gradually increasing, and the rate of reaching the standard sleep duration is gradually increasing. The risk of myopia among these students is related to the time spent reading paper materials at a close range and outdoor activities. Science popularization should be carried out and management of eye behaviors should be strengthened in the whole society to reduce myopia rates in children and adolescents in China.

【Key words】 myopia; risk factor; behavior management; health education