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ORIGINAL ARTICLE

Visual outcome of penetrating keratoplasty, deep anterior lamellar keratoplasty and Descemet membrane endothelial keratoplasty

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KEYWORDS
Deep anterior lamellar keratoplasty;
Descemet membrane endothelial keratoplasty;
Penetrating keratoplasty;
Quality of vision;
Visual acuity

Abstract
Purpose: A single-center, cross-sectional study was designed to assess and compare objective and subjective quality of vision of patients intervened with penetrating keratoplasty (PK), deep anterior lamellar keratoplasty (DALK) and Descemet membrane endothelial keratoplasty (DMEK).
Methods: Forty-six patients previously intervened with PK (22 eyes), DALK (7 eyes) and DMEK (17 eyes) were recruited. Visual evaluation included spherical and cylindrical refraction, distance corrected visual acuity (DCVA), photopic contrast sensitivity (CS), optical quality, measured with the HD Analyzer (objective scattering index [OSI], MTF cut-off and Strehl ratio), and ocular and corneal aberrometry, measured with the KR-1W Wavefront Analyzer.
Results: Statistically significant between-group differences were found in age ($p = 0.006$, DMEK patients were older) and time since surgery ($p < 0.001$, longest time for PK patients). No statistically significant differences were found in DCVA between the techniques. Between-group differences were encountered in CS at 12 ($p = 0.007$) and 18 ($p < 0.001$) cycles per degree, with DMEK and DALK obtaining the best and worst outcomes, respectively. Differences in optical quality were found between the techniques (OSI, $p = 0.004$; MTF cut-off, $p = 0.048$; Strehl ratio $p = 0.022$), with DMEK displaying the best outcomes. Highest and lowest values in ocular and corneal aberrations were for DALK and DMEK patients, respectively. Between-group differences were found in corneal astigmatism ($p < 0.001$; -3.31 ± 2.00 D in PK; -2.68 ± 0.94 D in DALK; -1.09 ± 0.62 D in DMEK).

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Conclusion: Overall, DMEK proved superior over PK and DALK in terms of quality of vision, with PK offering slightly better outcomes than DALK in most visual function parameters under evaluation.

PALABRAS CLAVE
Queratoplastia lamelar anterior profunda;
queratoplastia endotelial de membrana de Descemet;
queratoplastia penetrante;
calidad de visión;
agudeza visual.

Resultados visuales de la queratoplastia penetrante, la queratoplastia lamelar anterior profunda y la queratoplastia endotelial de membrana de Descemet

Resumen
Objetivo: Se diseñó un estudio en un único centro y transversal para evaluar y comparar la calidad de la visión subjetiva de los pacientes intervenidos de queratoplastia penetrante (QP), queratoplastia lamelar anterior profunda (QLAP) y queratoplastia endotelial de membrana de Descemet (DMEK).
Métodos: Se incluyó a cuarenta y seis pacientes previamente intervenidos de QP (22 ojos), QLAP (7 ojos) y DMEK (17 ojos). La evaluación visual incluyó la refracción esférica y cilíndrica, la agudeza visual de lejos corregida (AVDC), la sensibilidad al contraste fotópica (SC), la calidad óptica, medidas con el HD Analyzer (índice de dispersión objetiva [OSI], punto de corte MTF y ratio Strehl), así como la aberrometría ocular y corneal, medidas con el KR-1W Wavefront Analyzer.
Resultados: Se encontraron diferencias estadísticamente significativas entre los grupos en cuanto a edad ($p = 0{,}006$, los pacientes de DMEK eran mayores) y el tiempo transcurrido desde la cirugía ($p < 0{,}001$, tiempo superior para los pacientes de QP). No se encontraron diferencias estadísticamente significativas en cuanto a AVDC entre las técnicas. Se encontraron diferencias entre los grupos en cuanto a SC en 12 ($p = 0{,}007$) y 18 ($p < 0{,}001$) ciclos por grado, obteniendo DMEK y QLAP los mejores y peores resultados, respectivamente. Se encontraron diferencias en cuanto a calidad óptica entre las técnicas (OSI, $p = 0{,}004$; punto de corte MTF, $p = 0{,}048$; ratio Strehl $p = 0{,}022$), reflejando DMEK los mejores resultados. Los mejores y peores valores en cuanto a aberraciones oculares y corneales fueron registrados por los pacientes de QLAP y DMEK, respectivamente. Se hallaron diferencias entre grupos en cuanto a astigmatismo corneal ($p < 0{,}001$; $-3{,}31 \pm 2$ D en QP; $-2{,}68 \pm 0{,}94$ D en QLAP; $-1{,}09 \pm 0{,}62$ D en DMEK).
Conclusión: En general, DMEK demostró ser superior a QP y QLAP en términos de calidad de visión, y QP ofreció mejores resultados que QLAP en la mayoría de los parámetros de la función visual evaluados.

Introduction

Nowadays, many options are available to the corneal transplant surgeon for the treatment of corneal disorders. The keratoplasty surgical procedure has been modified to improve drawbacks associated with penetrating keratoplasty (PK), including delayed wound healing, major vulnerability to trauma, risk of immune rejection, unpredictable refractive outcomes, prolonged visual rehabilitation and high or irregular astigmatism.[1,2] Although PK, in which the full corneal thickness is replaced, remains the gold standard,[3] current keratoplasty procedures focus on replacing only the essential amount of tissue (also known as ''selective keratoplasty''). Thus, in deep anterior lamellar keratoplasty (DALK),[4] the whole corneal tissue is replaced with the exception of Descemet membrane and endothelium; in Descemet membrane endothelial keratoplasty (DMEK),[5,6] the Descemet membrane and endothelium are replaced by the corresponding layers from the donor cornea; and in Descemet stripping (automated) endothelial keratoplasty (DSEK or DSAEK)[7,8] the Descemet membrane and endothelium are replaced by a thin layer of donor stroma, Descemet membrane and endothelium. Lamellar corneal grafts have proved superior in terms of fast visual rehabilitation and more predictable refractive outcomes, requiring only partial rather than full-thickness incisions.[9] Besides, DMEK has been reported to provide similar endothelial cell count but higher rebubbling rate than other endothelial keratoplasty techniques, while also restoring physiologic pachymetry.[10,11]

The present study aimed at describing and comparing visual outcomes of PK, DALK and DMEK. Previous researchers have assessed subjective and objective quality of vision of DALK with reference to PK. Thus, Güell and colleagues reported better best-corrected visual acuity (VA) and optical quality with PK than DALK, also noting a good correlation

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