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Trends in indications and techniques of corneal Transplantation from 2010 through 2024 at a tertiary referral centre in Rabat, Morocco

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Article

Keywords:

Posted Date: July 31st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10350177/v1

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Additional Declarations: There is no conflict of interest

Abstract

Purpose: To evaluate trends in indications and surgical techniques of corneal transplantation in Morocco over 15 years.

Methods: Retrospective study including all consecutive corneal transplantations performed at a tertiary referral centre in Rabat- Morocco between 2010 and 2024. Demographic characteristics, surgical indications, graft techniques, and temporal trends were analyzed.

Results: A total of 3,097 corneal transplantations were performed. Corneal ectasia remained the leading indication of corneal graft (47.8%), followed by bullous keratopathy (20.2%) and corneal scars (11.3%). The proportion of ectatic diseases declined over time (57.4% in 2014 vs. 36.8% in 2024), whereas bullous keratopathy and Fuchs endothelial dystrophy increased significantly ($p<0.001$). Penetrating keratoplasty remained the most common procedure (70.0%) but decreased from 97.4% in 2010 to 57.0% in 2024. DALK accounted for 20.8% of procedures, while DMEK expanded rapidly after its introduction, representing 23.4% of grafts in 2024.

Conclusions: Corneal transplantation in Morocco is undergoing a major epidemiological and surgical transition. Although keratoconus remains the predominant indication, endothelial disorders are increasing and progressively reshaping surgical practice, with growing adoption of lamellar and endothelial keratoplasty techniques.

Introduction

Corneal transplantation is the most widely performed tissue transplantation worldwide, with over 185,000 procedures reported annually (1). Over the past two decades, both the epidemiology of indications and surgical approaches have undergone major changes. Once dominated by penetrating keratoplasty (PKP), practice has progressively shifted towards lamellar techniques such as Deep anterior lamellar keratoplasty **(**DALK), Descemet stripping automated endothelial keratoplasty (DSAEK), and Descemet membrane endothelial keratoplasty (DMEK**)**, which offer improved visual outcomes and lower rejection rates. (2)

The indications for corneal transplantation vary by region. In Western countries (Europe and the USA), endothelial pathologies—particularly Fuchs endothelial dystrophy—remain the leading indications for corneal grafting (3–5). In contrast, keratoconus remains a major indication for corneal transplantation in other regions. (6–8).

Corneal transplantation in Morocco dates back to 1949, when the first graft was performed. The subsequent development of legal regulations established the foundations for tissue procurement and transplantation (9).Nowadays, in Morocco, corneal transplantation relies heavily on imported donor grafts and is limited to a few university centres.

In 2003, Cheikh Zaid University Hospital of Rabat (CZH) initiated its corneal transplantation programme and progressively became one of the country's primary referral centres for corneal disease.

This study aims to evaluate the evolving indications and surgical approaches of corneal transplantation performed at CZH in Rabat, Morocco, over 15 years (2010–2024). It also aims to contextualize these trends within the broader international landscape to highlight both local particularities and points of global convergence.

Patients and Methods

Type and population of study

The records of all patients who underwent corneal transplantation at Cheikh Zaid University Hospital of Rabat (CZH) over 15 years, from 2010 to 2024, were retrospectively analysed.

Study eligibility criteria

Inclusion criteria

All patients who underwent corneal transplantation at the CZH between January 2010 and December 2024 were consecutively included. Patient data were collected from the electronic patients' medical records.

Non-inclusion criteria

- Patients who underwent keratoprosthesis implantation;
- Surgeries performed outside the 2010–2024 period;
- Corneal plug graft for small perforation.

Sampling

An exhaustive consecutive sampling method was used, including all eligible patients who underwent corneal transplantation at the CZH during the study period (2010–2024).

Data Collection

Data were retrospectively collected from the ophthalmology centre's electronic medical record system, then recorded using a standardized data extraction form designed to ensure consistent collection of demographic, clinical, surgical, and follow-up variables.

Indications were grouped according to the following criteria:

1. “Corneal ectasia” included keratoconus (KC), pellucid marginal degeneration (PMD), keratoglobus and post-LASIK ectasia.
2. “Post-surgical bullous keratopathy” (BK) included all cases of postoperative corneal endothelial decompensation.
3. “Sequelae corneal scars” included stromal opacities, for example, after herpetic keratitis, other microbial keratitis, mechanical trauma, trachoma, congenital glaucoma, and other causes of scars.
4. “Regraft” included cases of repeat keratoplasty due to graft failure.

(5) “Urgent keratoplasty” included all cases of therapeutic keratoplasty for progressive corneal melt due to bacteria, fungi, or acanthamoeba resistant to medical treatment. This group also included cases of tectonic keratoplasty for perforation or advanced thinning with a high risk of perforation.

(6) “Stromal congenital dystrophies” (SD).

(7) “Fuchs endothelial dystrophy” (FED).

Surgical techniques performed at our centre include Penetrating Keratoplasty (PK) as well as Lamellar Keratoplasties (LK), encompassing DALK, DMEK, and DSAEK procedures.

Tissue procurement and processing. Corneal grafts are sourced internationally, predominantly from the United States Eye Banks. Each cornea used for transplantation is rigorously approved by the surgeon, the hospital administration and the Moroccan Ministry of Health, ensuring its quality and compliance with medical standards. Additionally, every patient undergoing this procedure has given their informed consent in accordance with ethical and regulatory requirements.

Ethical considerations. The present research adhered to the tenets of the Declaration of Helsinki, and Ethical Board Committee approval from the institution was obtained.

4. Statistical Analysis.

Continuous variables were summarized using appropriate measures of central tendency and dispersion (mean ± standard deviation or median with interquartile range, depending on data distribution). Trends in age, gender, indications, and techniques were assessed by linear regression. The chi-square test was used when appropriate. A p-value < 0.05 was considered statistically significant. All Data were collected using Excel (v14, Microsoft Corp.). Statistical analyses were performed with XLSTAT and JAMOVI Software.

Results

Description of the study population

Between January 2010 and December 2024, a total of 3,097 patients who underwent corneal transplantation were included in the present study.

All the corneas used were imported corneas, mainly from collaborating USA eye Banks.

Patient age ranged from 1 to 94 years, with a median age of 37 years [IQR: 24–64]. (Table 1).

The annual number of corneal transplantations increased overall between 2010 and 2019, although with some fluctuations. A marked decline was observed in 2020, followed by a progressive recovery from 2021, culminating in the highest annual number of transplantations in 2024. (Figure 1)

The age distribution of the study population demonstrated a predominance of younger and middle-aged adults. Patients aged between 18 and 40 years represented the largest proportion of the cohort, accounting for 42.3% of all cases (n = 1309), followed by patients aged over 60 years who constituted 30% (n = 930). The 40–59 years' age group represented 17.1% of patients (n = 531), whereas pediatric and adolescent patients aged <18 years accounted for 10.6% of the study population (n = 327).

No significant difference was observed between sex and the total number of patients in our cohort (Fisher's exact test, p = 0.065).

Surgical indications

The analysis of indications reveals that corneal ectasia is the leading cause, accounting for 47.56% of cases (n=1473), followed by post-surgical bullous keratopathy (20.21%, n=626) and sequelae of corneal scars (11.33%, n=351). Together, these three categories represent nearly 80% of all indications. *(Table 1)*

Stromal corneal dystrophies represented another important indication for keratoplasty, accounting for 8.78% (n=272), while graft rejection, Urgent keratoplasty, and Fuchs endothelial dystrophy were less frequent.*(Table 1)*

Median age varied significantly across surgical indication groups (Kruskal-Wallis test, p < 0.001). Patients with corneal ectasia were the youngest, with a median age of 25 years [IQR: 20–33], while those with bullous keratopathy and Fuchs endothelial dystrophy were significantly older, with median ages of 69 years [IQR: 62–76] and 66.5 years [IQR: 61.5–74.3], respectively (Table 2).

A significant association was observed between sex and surgical indication (Fisher's test, p < .001), with a higher prevalence of females in cases of corneal ectasia and Fuchs dystrophy, while males were more frequently affected by sequelae of corneal scars and regrafting *(Table 2)*.

Corneal ectasia, predominantly keratoconus, remained the leading indication for corneal transplantation throughout the study period. Its predominance was particularly marked during the earlier years, peaking at 61% of all indications in 2014 and 57% in 2015. However, a gradual decline was observed in more recent years, with its proportion dropping to 36.8% in 2024. A statistically significant temporal variation was observed between the different periods (p < 0.001). *(Figure 2)*

Analysis of the age distribution of patients undergoing keratoplasty for keratoconus between 2010 and 2024 revealed that most procedures were performed in young adults (Fisher test, p < 0.001), with a

relatively stable mean age ranging from 22 to 27 years. The 20–29-year age group was the most represented, accounting for 41.2% of cases (n = 591), followed by the 30–39-year group at 23.5% (n = 337). Patients aged 10–19 years constituted a substantial proportion of the cohort (22.8%; n = 327).

Among the 1,646 patients aged 1–39 years who underwent corneal transplantation, 1,266 (76.9%) were operated on for keratoconus, representing the dominant indication within this age subgroup.

Post-surgery bullous keratopathy was the second most frequent indication, accounting for 20.2% of all transplanted patients (n = 626). Its relative proportion has shown a marked increase over the years, rising from 10.53% in 2010 to 27.49% in 2024. This upward trend was statistically significant ($p < 0.001$) (Figure 2). The sex distribution was balanced, with 50.32% females and 49.68% male patients (Fisher test, $p < 0.001$). *(Table 2).*

Sequelae Corneal scars accounted for 11.33% of all indications (n = 351 out of 3,097 patients). *(Figure 2)*

Fuchs endothelial dystrophy represented 2.6% of all corneal transplantation indications in our series, totaling 80 cases out of 3,097 operated patients. *(Figure 2)*

Others: Stromal congenital dystrophies accounted for 8.3% of all indications (n=257), with a gradual decline over time from 15.7% in 2010 to 6.4% in 2024. In contrast, regraft procedures represented 6.0% of cases (n=186) and showed a progressive increase throughout the study period. Urgent keratoplasty accounted for 3.1% of indications (n=97) (Figure 2).

Graft techniques' particularities

Cheikh Zaid University Hospital of Rabat (CZH) progressively became one of the country's primary referral centres performing PKP since 2003, DALK since 2011, and DMEK since 2018. A very small number of DSEAKs were performed during the study period

In our study, PKP procedures, either on its own or in combination with other procedures, accounted for the majority of cases (70.0%). DALK accounted for 20.8% of all procedures. Endothelial keratoplasty accounted for 9.2% of cases.

Nevertheless, a notable evolution was observed in the annual distribution of these procedures, with a clear trend towards the progressive decline in PKP, decreasing from 97.37% in 2010 to 57.02% in 2024. (Figure 3)

DALK constituted the second most frequent procedure, with 642 cases (20.73%). Its use increased mainly between 2012 and 2016, during which its annual proportion repeatedly exceeded 20%, peaking at 28.0% in 2014 and 26.0% in 2023. Thereafter, the technique remained relatively stable, maintaining a regular presence throughout the study period. (Figure 3)

For their part, Endothelial keratoplasties, accounted for 284 cases (9.17%) of all transplants. Their evolution was particularly notable from 2017, with a steady increase in subsequent years, reaching a

peak of 23.39% in 2024. (Figure 3)

Figure 3 illustrates the evolution of corneal transplantation techniques over the study period. Although PKP remained the predominant procedure, its proportional use gradually decreased over time, while lamellar keratoplasty techniques showed a progressive increase.

Indications and Surgical techniques' comparisons

Cross-analysis of indications and surgical techniques demonstrated a significant association between surgical indication and the type of keratoplasty performed *(χ^2 test, $p < 0.001$).* PKP — whether performed in isolation or in combination — remained the predominant surgical approach across most indication groups (69.94%).

For corneal ectasias (mainly keratoconus), 60.07% of grafts were performed with PKP, while a substantial proportion (39.93%) underwent DALK.

In post-surgical bullous keratopathy, DMEK was performed in 34.19% of cases, while PKP continued to represent the majority (65.18%). This pattern reflects an ongoing transition towards endothelial lamellar technique. For Fuchs endothelial dystrophy, the trend was even more pronounced towards modern techniques: 72.5% of patients underwent DMEK,while only 26.25% were managed with PKP. *(Table 3)*

Sequelae Corneal scars are managed predominantly with PKP in 93.89% of cases, as were graft rejections (92.48%) and Urgent keratoplasty (89.69%), reflecting the need for full-thickness corneal reconstruction in these contexts. *(Table 3)*

Discussion

Age distribution: *a younger population*

The relatively young median age observed in our series is consistent with reports from several Middle Eastern and Asian countries where keratoconus remains one of the leading indications for corneal transplantation (11–15). This profile is well established in the literature and was recently reported by Chung et al. (2024) (10). Studies from Saudi Arabia reported a mean recipient age of 28.8 years, largely attributed to the high prevalence of keratoconus and its early onset in this population(12). Similar trends have been observed in Iranian series, where keratoconus represented a major indication for keratoplasty, as well as in reports from New Zealand and other regions with a high burden of keratoconus among young adults (11, 13–15). These findings highlight the persistent impact of ectatic corneal diseases in younger populations and reinforce the importance of early screening and timely therapeutic interventions, particularly corneal cross-linking, to delay or even prevent the need for keratoplasty.

The findings from our centre are consistent with trends reported in several countries across North Africa, Middle East, and South Asia. In Saudi Arabia, Al-Towerki (16) reported that keratoconus accounted for 53.1% of transplant indications at the King Khaled Eye Specialist Hospital. Similarly, in Iran, Zare et al.

(15) observed a proportion of 38.4% of keratoconus among keratoplasty indications. In Turkey, a recent 2025 study conducted in Istanbul reported rates above 35.1% (17). In Australia, Coster et al. also observed a proportion of 29.8% (18). In contrast, in other regions, keratoconus has become a less frequent indication over recent years, largely due to improved early detection and the widespread adoption of corneal cross-linking. In a Brazilian study, keratoconus accounted for only 13.1% of indications (19). According to the UK Transplant Registry, keratoconus represents less than 10% of total indications (20), whereas in the United States, data from the Eye Bank Association of America (EBAA) in 2022 reported a rate of 7.1% (21) *(*Fig. 4*)*.

In our Cohort, despite its clear predominance, the proportion of keratoplasties performed for keratoconus progressively decreased, from 57.4% in 2014 to 36.8% in 2024. This relative decline can be interpreted in light of several factors:

- Improved knowledge and advances in keratoconus detection methods, and the availability across the country of the tools for early detection of corneal ectasia.
- The growing use of corneal cross-linking (CXL) across the country, applied to stabilize the disease at early stages, thereby avoiding the need for a corneal graft (22).

A similar trend has also been observed in Asia. In India, a recent nationwide study (2022) reported that the proportion of keratoconus cases decreased from 35% to 20% over 10 years, in favor of post-surgical bullous keratopathy and regrafts (23).

In parallel with the relative decline of keratoconus in our cohort, we observed a steady increase in post-surgical bullous keratopathy, rising from 10.5% in 2010 to 27.4% in 2024 *(*Fig. 2*)*, making it the second most frequent indication overall with 20.21% of all cases *(*Table 1*)*. This trend is consistent with international data: in the United States, pseudophakic bullous keratopathy currently accounts for about 20% of keratoplasty indications, largely related to population aging and the growing number of cataract surgeries performed in patients with comorbidities (24). Recent German, Canadian Greek, and New Zealand series have also confirmed the rise of iatrogenic endothelial keratopathies as the second leading indication for transplantation (25–28), while in Japan and France, it has become the primary indication (5, 29). *(*Table 4*)*

Table 4
Indications of keratoplasty reported from different countries

Study	Place of study	Number of procedures	Indications
Palma-Carvajal et al 2019 (27)	**Barcelone2014-2018**	332	- Re-graft (34,64%) - Fuchs endothelial dystrophy (28,31%) - **Bullous keratopathy (20,48%)** - Leucoma (9,94%) - Non-Fuchs dystrophy (1,20%) - Others (2,71%)
Zhang et al 2013(30)	**Canada 2009–2012**	3539	- Endothelial corneal dystrophy (25,0%) - **Pseudophakic corneal oedema (21,6%)** - Re-graft (20,4%) - Corneal ectasia (10,8%) - Viral/post-viral keratitis (2,3%) - Others (18, 4)
Kim et al 2017(13)	**New zealand 2011–2015**	5574	- Keratoconus (34,5%) - Regraft (23,1%) - Fuchs endothelial dystrophy (17,0%) - **Bullous keratopathy (13,5%)** - Keratitis (4,4%) - Trauma (3,0%) - Others
Sharma et al 2019(31)	**India2013-2014**	6884	- Active infection (33,1%) - **Bullous keratopathy (13,6%)** - Re-graft (11,0%) - Keratoconus (5,5%) - Congenital corneal opacities (4,9%) - Fuchs endothelial dystrophy (2,1%)

Study	Place of study	Number of procedures	Indications
			- Others (19,5%)
Flockerzi et al 2018(28)	**Germany 2016**	7325	- Fuchs endothelial dystrophy (46%) - **Pseudophakic bullous keratopathy (13%)** - Re-graft (16%) - Keratoconus (8%) - Corneal scarring (6%) - Others (16%)
Takahashi et al 2021(29)	**Japan 1991–2017**	46911	- **Bullous keratopathy (30,0%)** - Re-graft (24,2%) - Post-keratitis scar (17,1%) - Keratoconus (11,4%) - Dystrophy degeneration (4,9%) - Others (12,2%)
Eye Bank Assosiation of America 2022(20)	**USA 2021**	13223	- **Endothelial diseases (Fuchs& bullous keratopathy) (56,4%)** - Stromal diseases (ectasia / dystrophies / refractive / microbial keratitis, trauma ...) (15,5%) - Re-graft (12,2%) - Others (14,6%)

Study	Place of study	Number of procedures	Indications
Malleron et al (32)	**French 2000–2020** **French 2016–2020**	1042	- **Bullous dystrophy (31%)** - Fuchs dystrophy (24%) - Regraft (21%) - Keratoconus (11%) - Infectious pathologies (8%) - Trauma (5%) - Fuchs dystrophy (43%) - **Bullous dystrophy (24%)** - Regraft (21%) - Keratoconus (3%)
Present study 2024	**Morocco 2010–2024**	3097	- Corneal ectasia (47,56%) - **Bullous dystrophy (20,21%)** - Sequelae corneal scars (11,33%) - Corneal dystrophy (8,78%) - Re-graft (6,01%) - Urgent keratoplasty (3,13%) - Fuchs dystrophy (2,58%) - Others (0,39%)

In our study, while PKP had historically been the reference technique for these patients, its proportion declined with the introduction of DMEK, which now accounts for 34.2% of bullous keratopathy cases. Such a shift is consistent with the scientific recommendations, which advocate the use of DMEK for purely endothelial disease (30).

As for Fuchs endothelial dystrophy, it remains relatively uncommon in our cohort **(**2.6%**)** (Table 1), but shows a marked temporal increase, rising from 0% between 2010 and 2014 to 5.8% in 2024. This proportion is still lower than the rates reported in Western countries, where Fuchs dystrophy is the leading indication for corneal transplantation, representing up to 40% of cases in French, German (GEKID), and American (EBAA) registries (21, 28, 31). The progressive rise observed in our centre nonetheless reflects improved diagnostic recognition, better access to endothelial keratoplasty **(**DMEK), and increasing awareness of the visual impairment associated with chronic corneal oedema, even at

non-advanced stages (32). In our cohort, DMEK (alone or combined) was performed in over 72% of Fuchs dystrophy cases,(Table 3).

Urgent keratoplasty—primarily for active infectious keratitis—accounted for only 3.1% of transplant indications, a relatively low figure compared with other developing countries. In Thailand, for instance, Booranapong et al. reported a rate of approximately 26.1%, while in India, Sharma et al. found similar results with over 33% (33, 34). Similar observations have been reported in East China, where therapeutic keratoplasty for infectious keratitis represented up to 41% of all corneal transplantations, reflecting the substantial burden of severe corneal infections in these settings.(35)

In contrast, in industrialised countries, infections generally represent only 1–2% of transplant indications, according to U.S. registry data (21). Al-Mahrouqi et al. reported that emergency keratoplasty accounted for only 5.6% of all corneal transplantations in New Zealand over 21 years, with microbial keratitis being the leading indication (36).

Graft rejections accounted for 6% of indications, a rate lower than those reported in several countries: 12.2% in the United States (21), 9.5% in Spain (27), 23.1% in New Zealand (14), and 11% in India (33). This difference may be explained by the relatively recent establishment of our transplantation programme.

Finally, congenital stromal dystrophies represented 8.3% of transplantation indications, a proportion markedly higher than that reported in large international series. Indeed, they accounted for only 1.1% of indications in France (31), 1.4% in Spain (27), and 1.8% in Germany (28). Similarly, lower rates have been reported in Japan (1.7%), New Zealand (2.2%), and India (4.9%) (14, 29, 33). The historical delay in access to transplantation may partly explain this discrepancy. Before 2010, corneal transplants were rare in our country; once surgical activity became more structured and regular, many long-standing cases of congenital dystrophies could finally be managed, accounting for the initially elevated proportion.

At the beginning of our study period in 2010, PKP accounted for 97.3% of all corneal transplants performed. By 2024, this proportion had fallen to 57%, although it remained the most frequently used technique overall (nearly 70% of cases across all years). This decline parallels a global trend documented by the European Cornea and Cell Transplantation Registry (ECCTR) and the Eye Bank Association of America (EBAA), both of which demonstrate that PKP, once the universal standard, has now become a minority procedure in many developed countries (21, 37).

According to the 2022 EBAA report, PKP represented only 19% of all keratoplasties in the United States, with endothelial keratoplasty emerging as the dominant approach (21).

DALK was performed in 20.7% of our cases, mainly in patients with keratoconus. This proportion is consistent with the scientific recommendations where DALK is regarded as the technique of choice for non-endothelial ectasias (38, 39).

In a recent systematic review, DALK was reported in 15–30% of corneal grafts for keratoconus, depending on the surgeon's expertise and the availability of assisted dissection instruments (40). The main advantages of DALK—preservation of the endothelium, reduced risk of endothelial rejection, and satisfactory visual recovery—make it a safe and effective alternative, although its steep learning curve remains a barrier to universal adoption (41).

DMEK, introduced into our practice in 2018, accounted for 23.4% of all corneal transplants performed in 2024. At the international level, DMEK has progressively emerged as the preferred method for endothelial transplantation, owing to its lower rejection rates and superior functional outcomes compared with penetrating keratoplasty, as recently reported in several multicentre studies (42). In the United States, DMEK increased from 2% of corneal transplants in 2011 to over 44% in 2022, according to data from the EBAA (21, 43).

Study limitations and recommendations

This study has some limitations. While it provides one of the most comprehensive overviews of corneal transplantation in Morocco to date and offers valuable insight into local epidemiological trends, the data originate from a single institution, which may limit the applicability of the results to all regions of the country. Nevertheless, our centre performs the vast majority of corneal transplantations in Morocco, accounting for nearly 90% of national activity, which enhances the representativeness of the cohort. Future multicentre studies, ideally supported by a national corneal transplantation registry, are needed to provide a more comprehensive overview of transplantation indications, surgical trends, and outcomes across Morocco.

A decline was observed in 2020 and 2021, when the number of corneal transplants temporarily decreased, a phenomenon largely attributable to the COVID-19 pandemic. During this period, international procurement and importation of corneal grafts were severely disrupted, leading to a shortage of available donor tissue and a consequent reduction in surgical activity. This situation had a particularly significant impact in countries such as Morocco, where the absence of an active local eye bank makes access to grafts heavily dependent on importation. Thus, despite a substantial clinical need for corneal transplants during the pandemic, the interruption of international supply chains made it impossible to obtain tissue in sufficient quantity, creating delays in patient care. This experience underscores the urgent need to establish a local eye bank to ensure greater autonomy, strengthen resilience in the face of global crises, and guarantee a steady supply of grafts to meet the growing needs of our patients.

Conclusion

This 15-year review highlights a clear epidemiological and surgical transition in corneal transplantation in Morocco. While keratoconus remains the leading indication, its relative decline is paralleled by a steady increase in bullous keratopathy and Fuchs dystrophy, in line with global trends.

The predominance of keratoconus as the leading indication for corneal transplantation in our series highlights the need for a national screening programme targeting school-aged children. The establishment of a regulatory framework incorporating keratoconus screening into school health examinations could facilitate the early identification and management of progressive disease.

Surgically, although PKP remains predominant, its share is decreasing in favour of lamellar techniques, with DALK consolidating its role for ectasias and DMEK showing rapid growth in endothelial diseases.

The progress is real, but so are the constraints. The absence of a local eye bank remains the most significant structural limitation, leaving the programme dependent on imported tissue and vulnerable to disruptions like those seen during the COVID-19 pandemic. Addressing this alongside earlier intervention for keratoconus through CXL and broader access to modern keratoplasty will determine how far outcomes in Morocco can converge with those reported in high-volume international centres.

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Tables

Tables 1 to 3 are available in the Supplementary Files section.

Figures

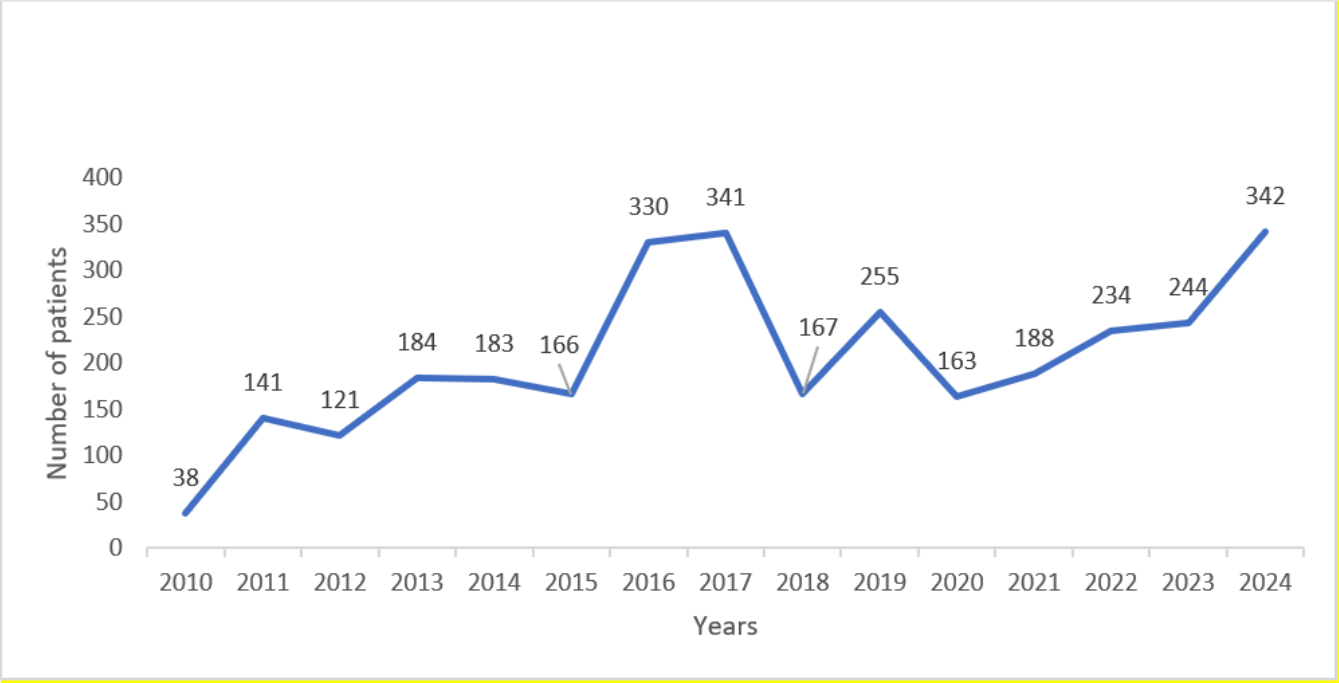


Figure 1

Progress of patients (in numbers) who have undergone corneal transplants

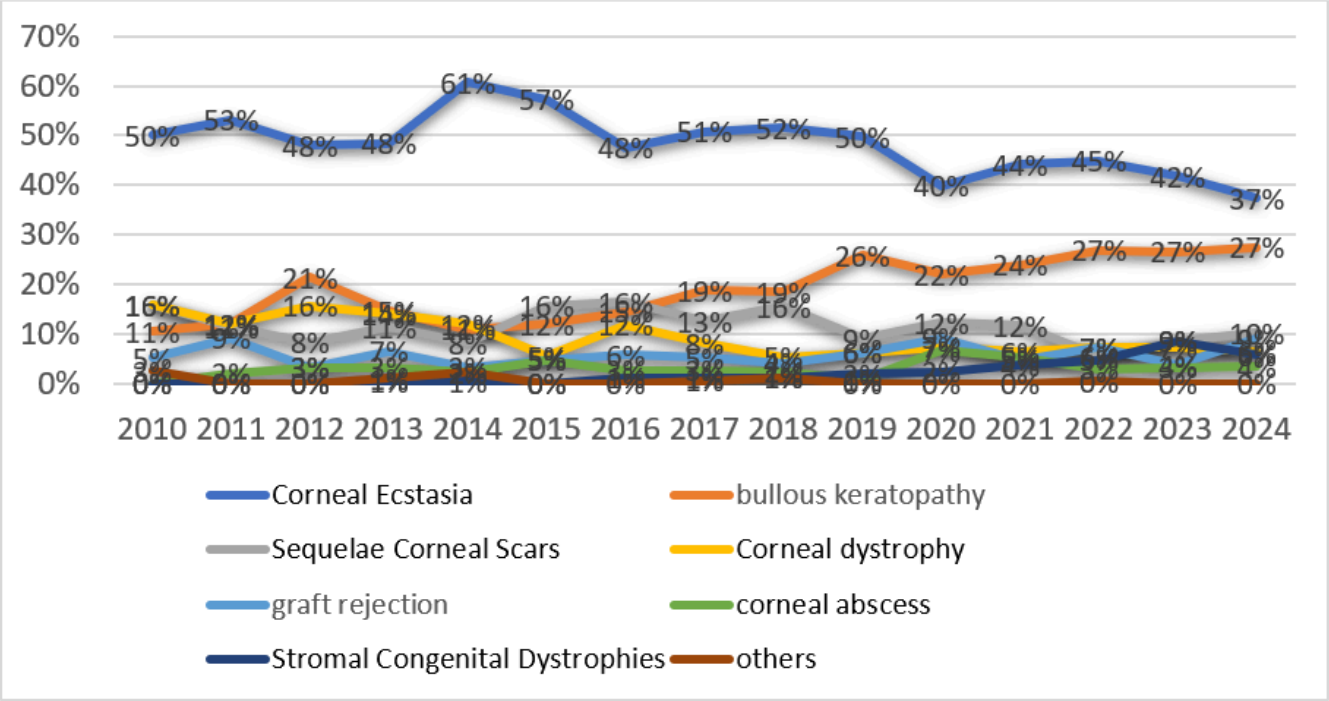


Figure 2

The annual evolution of corneal graft indications (2010-2024)

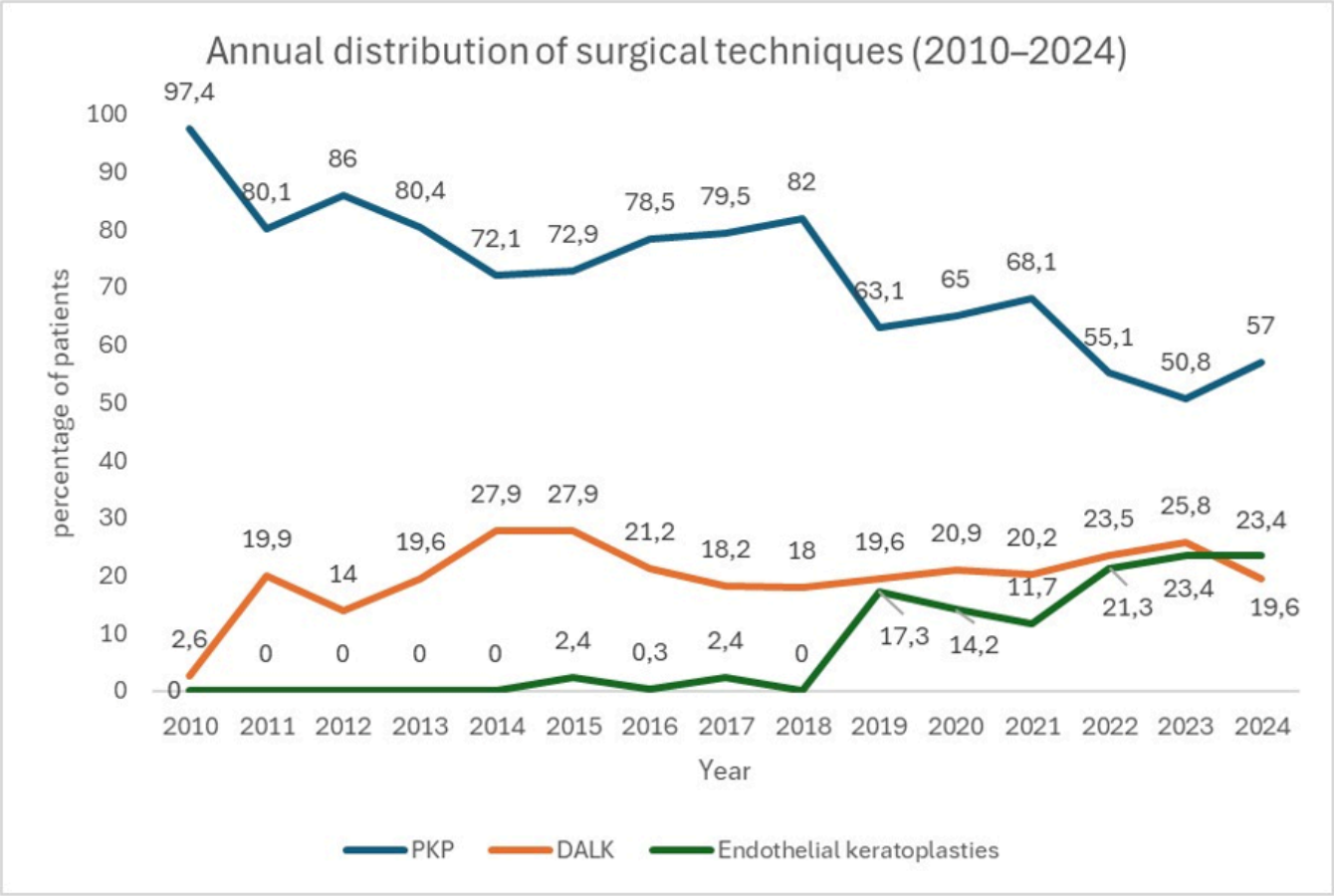


Figure 3

Annual distribution of surgical techniques 2010 _ 2024

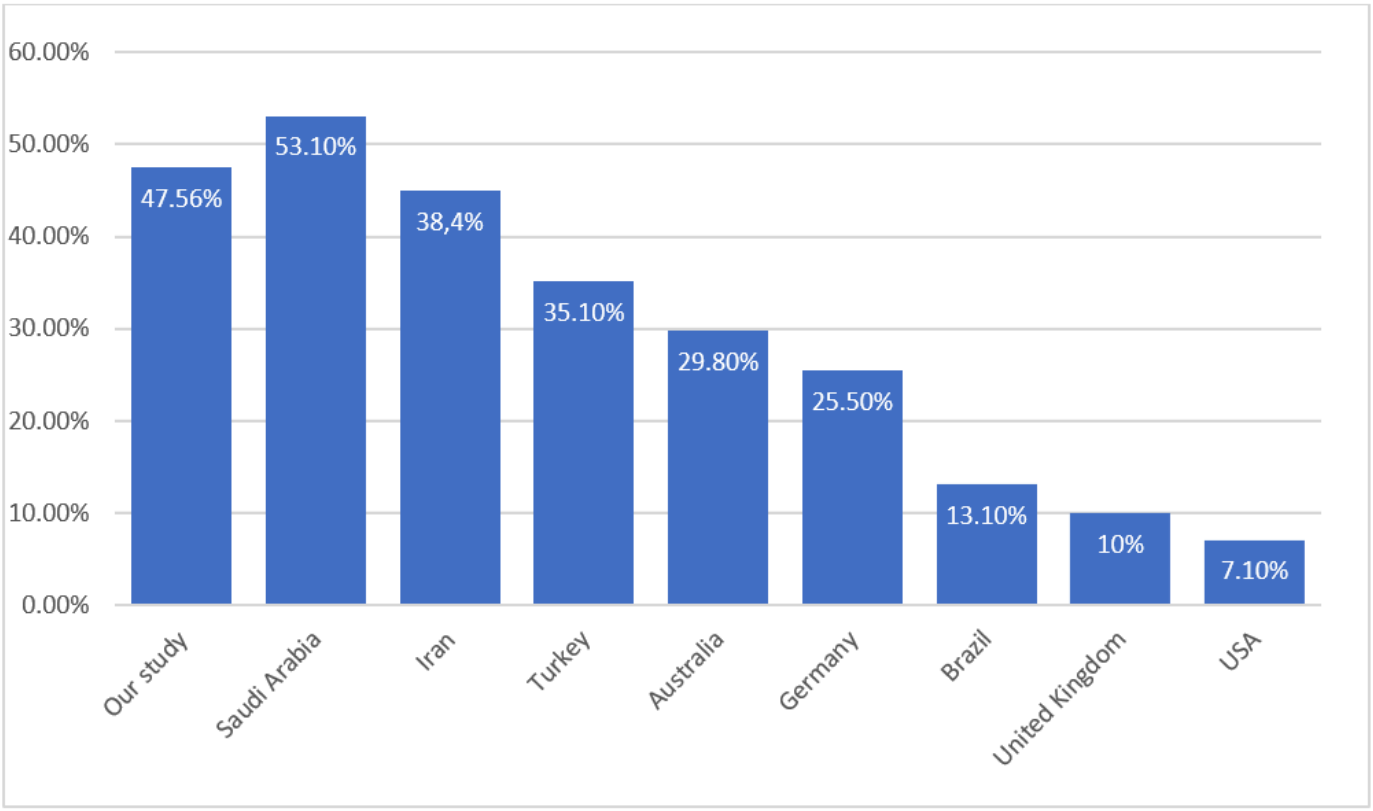


Figure 4

comparison of the place of keratoconus as an indication for corneal graft across diffrents countries

Supplementary Files

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- Table1.docx
- Table2.docx
- Table3.docx