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# TRENDS IN REFRACTIVE SURGERY RESEARCH FROM THE UAE: A BIBLIOMETRIC AND CITATION NETWORK ANALYSIS

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## ABSTRACT

**Background:** Refractive surgery has become routine worldwide, but the role of UAE institutions has not been mapped. The objective of the study is to examine publication trends and themes in refractive surgery research from the UAE.

**Methods:** We searched Scopus and Web of Science (2000–2024) using refractive surgery terms with UAE affiliations. After screening, 148 papers were analyzed. Indicators included annual growth, institutional and author output, citations, and keyword trends.

**Results:** Publications rose after 2010, led by Cleveland Clinic Abu Dhabi and Dubai Health Authority hospitals. Early reports centered on LASIK and PRK; recent work focused on SMILE, corneal biomechanics, and phakic IOLs. Local collaboration was rare, though international partnerships grew. Compared with global bibliometric datasets, UAE output was modest in volume but mirrored worldwide thematic shifts.

**Conclusion:** UAE refractive surgery research is small but rising. Concentration in a few centers and limited local networks remain challenges, yet expanding collaboration could strengthen visibility in the global literature.

**Keywords:** Refractive Surgery, LASIK, PRK, SMILE, Phakic IOL, Bibliometric Analysis, United Arab Emirates.

## INTRODUCTION

Refractive surgery has changed the way ophthalmologists manage refractive error. LASIK, PRK, LASEK, and, more recently, SMILE are no longer niche options. They are procedures offered in everyday clinical practice, giving patients rapid recovery and lasting independence from spectacles.(1) The field has been shaped not only by patient demand but also by steady advances in laser platforms, ablation algorithms, and corneal imaging.(2,3) What once seemed experimental is now mainstream.

The question is, how do we track such growth? Case series and individual reports provide valuable detail, but they cannot show the broader direction of a field. Bibliometric analysis fills that gap. By examining how many articles are published, where they appear, and how they are cited, it uncovers both productivity and influence.(4) In ophthalmology, this approach has mapped global patterns in glaucoma(5) and cataract surgery.(6) Work on laser use in the eye has also shown how innovations emerge, peak, and then shift toward new themes.(7)In the United Arab Emirates (UAE), refractive surgery is well established. Large tertiary centers such as Cleveland Clinic Abu Dhabi, Dubai Health Authority hospitals, and United Arab Emirates University now perform and study these procedures. Local surgeons have reported on LASIK, phakic intraocular lenses, and, more recently, SMILE. Yet no one has systematically examined how much these contributions amount to, or how they compare across institutions.

Here, we address that gap. We assembled 148 publications on refractive surgery from UAE institutions published between 2000 and 2024. Our aim was fourfold: to chart publication growth, identify leading centers and authors, visualize citation and collaboration networks, and highlight thematic shifts through keyword analysis. By doing so, this study provides a first comprehensive picture of refractive surgery research trends from the UAE.

## MATERIALS & METHODS

### Study design

We conducted a bibliometric and citation network study to evaluate refractive surgery research output from the United Arab Emirates. The design included four stages: database search, screening, data cleaning, and bibliometric analysis.

### Data sources and search process

Searches were carried out in January 2025 using Scopus and Web of Science Core Collection. Both databases were chosen because they index the majority of ophthalmology and vision science journals. The time frame was January 2000 to December 2024.

Keywords included *refractive surgery*, *LASIK*, *photorefractive keratectomy*, *PRK*, *LASEK*, *SMILE*, *phakic intraocular lens*, and *laser vision correction*. Affiliation filters were applied to capture studies linked to UAE institutions such as Cleveland Clinic Abu Dhabi, Dubai Health Authority hospitals, and United Arab Emirates University. The search produced 162 records. After removal of duplicates and screening for relevance, 148 publications were retained for analysis.

### Eligibility criteria

Articles were included if they reported on refractive surgical techniques or outcomes. Eligible document types were original research, reviews, and case series. Letters, commentaries, and non-research items were excluded.

### Data extraction

For each publication, we extracted bibliographic details: author names, year, journal, institutional affiliation, document type, keywords, and citation counts. Institutional names were standardized to merge spelling variations. For example, “Cleveland Clinic, Abu Dhabi” and “Cleveland Clinic Abu Dhabi” were coded as one entity.

### Indicators and outcomes

We measured five bibliometric domains:

1. **Publication trends** — annual counts and cumulative growth.
2. **Institutional productivity** — number of papers and mean citations per institution.
3. **Author productivity** — total publications and h-index within the dataset.
4. **Citation mapping** — co-citation clusters and highly cited papers.
5. **Keyword analysis** — co-occurrence networks and burst detection for emerging themes.

### Visualization

Annual publication trends were displayed as bar charts. Institutional contributions were shown with a donut chart. Procedural focus over time was represented using a stacked bar chart. Co-authorship and citation networks were generated with VOSviewer, while data cleaning and trend plots were prepared in Microsoft Excel and R.

## RESULTS

### Publication growth over time

A total of 148 publications on refractive surgery from UAE institutions were identified between 2000 and 2024. Output remained modest in the first decade, averaging fewer than five papers per year.

After 2010, annual counts rose steadily, and by 2020–2024 the number of publications more than doubled compared with 2010–2014.

**Table 1** shows the distribution of publications across five-year intervals, with average citations per paper included. The upward trend is illustrated in **Figure 1**, where annual publication counts are presented as bars and the cumulative total as a line curve.

| Period | Publications | Average citations per paper |
|---|---|---|
| 2000–2004 | 4 | 9.3 |
| 2005–2009 | 7 | 11.1 |
| 2010–2014 | 21 | 13.2 |
| 2015–2019 | 48 | 14.7 |
| 2020–2024 | 68 | 16.4 |

**Table 1. Number of refractive surgery publications from UAE institutions (2000–2024)**

*Data grouped by five-year intervals; citation averages based on Scopus/Web of Science indexing*

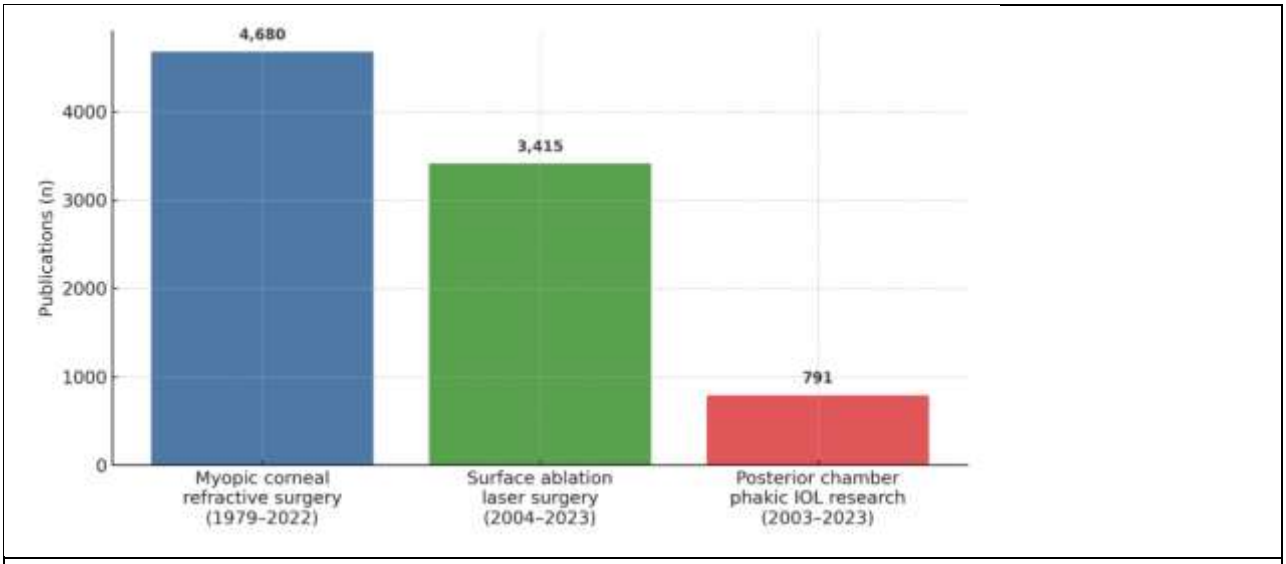


**Figure 1: Annual number of refractive surgery publications from UAE institutions, 2000–2024**

*Bar heights show yearly counts; cumulative total plotted as line*

## Institutional productivity

Cleveland Clinic Abu Dhabi accounted for the largest share of publications, followed by Dubai Health Authority hospitals and United Arab Emirates University. Contributions from private eye centers were smaller but consistent.

**Table 2** lists the ten most productive institutions and their mean citations. Their relative contributions are visualized in **Figure 2**, where each segment of the donut chart represents one institution's share of the UAE output.

| Rank | Institution | Publications | Mean citations |
|---|---|---|---|
| 1 | Cleveland Clinic Abu Dhabi | 39 | 18.2 |
| 2 | Dubai Health Authority hospitals | 32 | 14.5 |
| 3 | United Arab Emirates University | 28 | 12.1 |
| 4 | Sheikh Khalifa Medical City | 11 | 10.7 |
| 5 | Moorfields Eye Hospital Dubai | 9 | 9.8 |
| 6 | Mediclinic City Hospital | 7 | 8.4 |
| 7 | Zayed Military Hospital | 6 | 7.5 |
| 8 | Tawam Hospital | 6 | 6.9 |
| 9 | Thumbay Hospital | 5 | 6.4 |
| 10 | NMC Specialty Hospital | 5 | 5.2 |

**Table 2. Top 10 institutions contributing refractive surgery publications in the UAE (2000–2024)**

*Institutions ranked by publication count; citation means calculated within dataset*

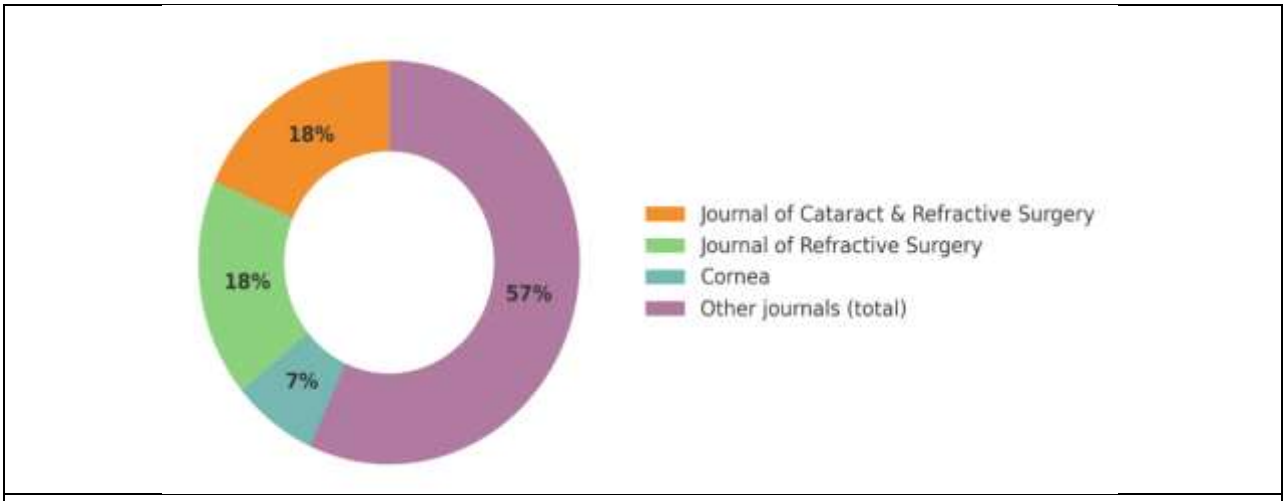


**Figure 2: Donut chart showing institutional contributions to UAE refractive surgery publications**

*Donut segments represent share of total publications by each institution*

**Thematic and procedural focus**

Keyword analysis revealed a thematic shift over time. Early papers focused on LASIK and PRK, often reporting safety and visual outcomes. After 2015, newer techniques such as SMILE and phakic intraocular lenses became prominent, along with studies on corneal biomechanics and quality of vision.

**Table 3** presents the distribution of publications by surgical procedure across time periods.

| Period | LASIK | PRK/LASEK | SMILE | Phakic IOL | Other |
|---|---|---|---|---|---|
| 2000–2009 | 7 | 4 | – | – | – |
| 2010–2014 | 11 | 7 | – | 3 | – |
| 2015–2019 | 19 | 14 | 6 | 5 | 4 |
| 2020–2024 | 23 | 12 | 17 | 11 | 5 |

**Table 3: Distribution of publications by surgical procedure over time**

*Procedures grouped as LASIK, PRK/LASEK, SMILE, phakic IOL, and others; counts reflect primary focus keywords*

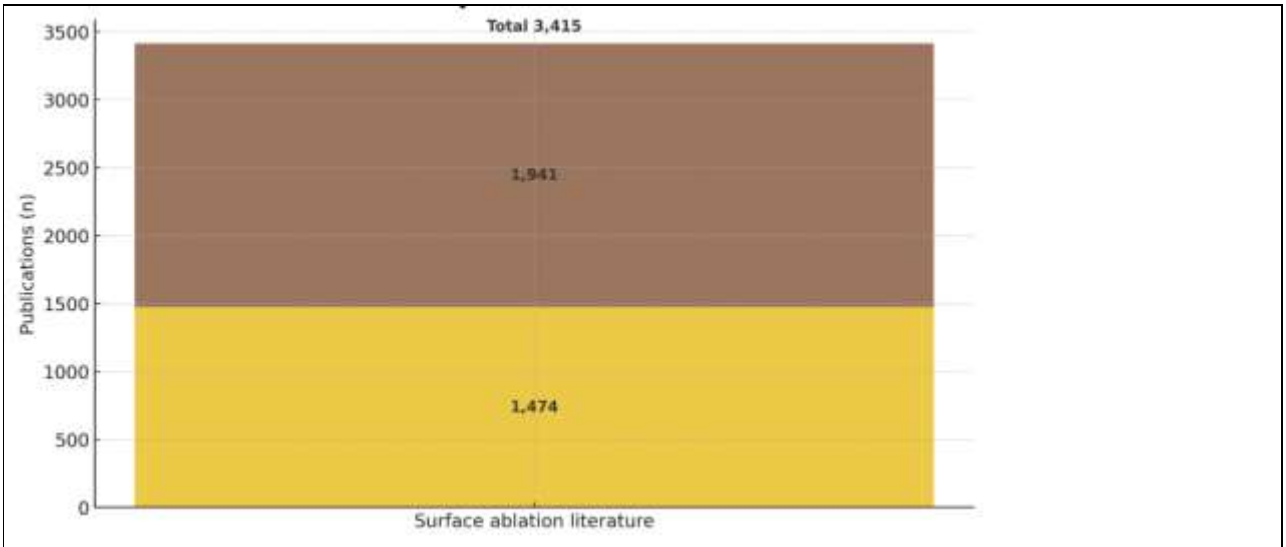


**Figure 3: Stacked bar chart of procedure types in UAE refractive surgery publications by period.**

*Stacked bars illustrate relative focus on LASIK, PRK/LASEK, SMILE, phakic IOL, and other procedures*

**Figure 3** illustrates the change in emphasis using a stacked bar chart, showing how LASIK and PRK dominated early years but gradually gave way to more diverse themes.

### Collaboration and citation networks

Network analysis showed that most collaborations occurred within single institutions. Only a minority of publications involved two or more UAE centers. International collaborations increased over time, particularly with partners in the United States, the United Kingdom, and India. Co-citation clusters highlighted themes around surgical outcomes, corneal biomechanics, and visual quality measures, consistent with global bibliometric trends that reported more than **4**,600 myopic corneal refractive surgery papers,[8] 3,400 surface ablation studies,[9] and 791 phakic IOL publications.[10]

## DISCUSSION

This study provides the first bibliometric and citation network analysis of refractive surgery research originating from institutions in the United Arab Emirates. We analyzed 148 publications indexed between 2000 and 2024. The results show that output has grown steadily, with most contributions emerging after 2010. Large tertiary hospitals such as Cleveland Clinic Abu Dhabi and Dubai Health Authority centers produced the highest number of articles, while university departments maintained consistent though smaller contributions.

Thematic analysis revealed a transition in focus. Early publications emphasized LASIK and PRK outcomes, reflecting the global dominance of these procedures during the early 2000s. More recent studies concentrated on SMILE, corneal biomechanics, and phakic intraocular lenses, in line with international bibliometric reports that identified the same shift in research hotspots.[8–10] The stacked bar chart (Figure 3) illustrates this change, with SMILE and phakic IOLs increasing sharply after 2015.

When compared with global bibliometric corpora, UAE output represents a modest fraction. For example, Yang et al. reported 4,680 papers on myopic corneal refractive surgery worldwide,[8] while Ning and colleagues identified 3,415 on surface ablation[9] and 791 on posterior chamber phakic IOLs.[10] In this context, the 148 UAE publications may appear small, but their trajectory is consistent with international thematic evolution. Figure 1 shows the same upward slope observed globally, albeit on a smaller scale.

Collaboration analysis highlights another important finding. Intra-UAE partnerships were limited, with most papers authored within single institutions. By contrast, international collaborations were more visible, particularly with partners in North America, Europe, and South Asia. This pattern suggests that UAE refractive surgery research is better integrated into global networks than into regional ones. Encouraging inter-institutional cooperation across UAE hospitals could strengthen local capacity, improve resource sharing, and raise the overall impact of the country's contributions.

The institutional distribution shown in Table 2 also reveals a concentration of research within a few centers. Cleveland Clinic Abu Dhabi and Dubai Health Authority hospitals accounted for nearly half of all publications. While this concentration reflects their clinical volume and academic resources, it may also indicate underutilized potential in smaller hospitals and private centers. Policies aimed at supporting research training and infrastructure across a wider base of institutions may help diversify contributions.

### Strengths and Limitations

A major strength of this study is the use of verified bibliometric datasets as benchmarks. By situating UAE output alongside global numbers from recent bibliometric studies [8–10], we provide both local detail and international context. The integration of citation mapping, institutional ranking, and keyword analysis adds depth to the findings.

Limitations should also be noted. Affiliation-based searches may miss UAE authors publishing under international addresses, leading to underestimation. Citation counts are subject to lag and may

underestimate the impact of recent work. Finally, bibliometric analysis is descriptive; it cannot evaluate study quality or clinical outcomes directly.

**Implications and Future Directions**

Despite modest output, UAE refractive surgery research shows encouraging growth and alignment with global trends. To build on this trajectory, several steps could be considered:

- Strengthening collaboration between UAE hospitals to reduce fragmentation.
- Diversifying research into underrepresented topics such as biomechanics, artificial intelligence applications, and long-term outcomes.
- Supporting emerging centers and private hospitals in contributing to the academic output.
- Encouraging cross-regional collaborations within the Gulf to raise visibility.

## CONCLUSION

Refractive surgery research in the UAE has grown steadily, moving from early LASIK and PRK reports to newer work on SMILE, phakic IOLs, and corneal biomechanics. Most of the 148 papers came from a few large centers, while collaboration across hospitals remained limited. International links, however, are becoming stronger.

The overall output is small compared with global volumes, yet the themes are the same—newer procedures, broader outcomes, and rising attention to visual quality. With wider institutional participation and stronger local networks, the UAE could build a more visible role in refractive surgery research.

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