

# REFRACTIVE SURGERY IN CHILDREN

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# AESTHETIC SURGERY IN MINORS



- A 2017 study in the journal Facial Plastic Surgery Clinics of North America found that rhinoplasty procedures were more common in adolescents between the ages of 13 and 19 than in adults. Of the physicians surveyed, 68% reported an increase in underage rhinoplasty procedures over the past 5 years.

- A 2018 study in the journal Plastic and Reconstructive Surgery Global Open examined breast surgery in 12- to 19-year-old girls. The authors found that breast reductions were the most common procedure performed on minors (57% of cases), followed by breast corrections (24%) and breast augmentations (19%).

# REFRACTIVE SURGERY IN CHILDREN FOR NOW IS LIMITED TO TREATMENT OF REFRACTIVE AMBLYOPIA



### Effectiveness of Laser Refractive Surgery to Address Anisometropic Amblyogenic Refractive Error in Children

*A Report by the American Academy of Ophthalmology*

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**Purpose:** To review the published literature assessing the safety and effectiveness of laser refractive surgery to treat anisometropic amblyogenic refractive error in children aged  $\leq 18$  years.

**Methods:** A literature search of the PubMed database was conducted in October 2021 with no date limitations and restricted to publications in English. The search yielded 137 articles, 69 of which were reviewed in full text. Eleven articles met the criteria for inclusion and were assigned a level of evidence rating.

**Results:** The 11 included articles were all level III evidence and consisted of 1 case-control study and 10 case series. Six studies used laser-assisted in situ keratomileusis (LASIK), 1 used photorefractive keratectomy (PRK), 1 used refractive lenticule extraction/small incision lenticule extraction, and the rest used a combination of LASIK, PRK, laser epithelial keratomileusis (LASEK), or refractive lenticule extraction/small incision lenticule extraction. Five studies enrolled patients with anisometropic myopia, 2 studies enrolled patients with anisometropic hyperopia, and the remainder were mixed. Although all studies demonstrated an improvement in best-corrected visual acuity (BCVA), the magnitude of improvement varied widely. As study parameters varied, a successful outcome was defined as residual refractive error of 1 diopter (D) or less of the target refraction because this was the most commonly used metric. Successful outcomes ranged between 38% and 87%, with a mean follow-up ranging from 4 months to 7 years. Despite this wide range, all studies demonstrated an improvement in the magnitude of anisometropia. Regression in refractive error occurred more frequently and to a greater degree in myopic eyes and eyes with longer follow-up, and in younger patients. Although one study reported 2 free flaps, most studies reported no serious adverse events. The most common complications were corneal haze and striae.

**Conclusions:** Findings from included studies suggest that laser refractive surgery may address amblyogenic refractive error in children and that it appears to decrease anisometropia. However, the evidence for improvement in amblyopia is unclear and long-term safety data are lacking. Long-term data and well-designed clinical studies that use newer refractive technologies in standardized patient populations would help address the role of refractive surgery in children and its potential impact on amblyopia. *Ophthalmology* 2022;129:1323-1330 © 2022 by the American Academy of Ophthalmology

**Conclusions:** Findings from included studies suggest that laser refractive surgery may address amblyogenic refractive error in children and that it appears to decrease anisometropia. However, the evidence for improvement in amblyopia is unclear and long-term safety data are lacking. Long-term data and well-designed clinical studies that use newer refractive technologies in standardized patient populations would help address the role of refractive surgery in children and its potential impact on amblyopia. *Ophthalmology* 2022;129:1323-1330 © 2022 by the American Academy of Ophthalmology

# THE MYOPIA PANDEMIC WILL INCREASE PRESSURE ON REFRACTIVE SURGERY AND POSSIBLY LEAD TO A WEAKENING OF THE CURRENT AGE OF MAJORITY LIMIT

## Reducing the Global Burden of Myopia by Delaying the Onset of Myopia and Reducing Myopic Progression in Children

### The Academy's Task Force on Myopia

Bobek S. Modjtahedi, MD,<sup>1,2</sup> Richard L. Abbott, MD,<sup>3</sup> Donald S. Fong, MD,<sup>1,2</sup> Flora Lum, MD,<sup>4</sup> Donald Tan, MD,<sup>5</sup> on behalf of the Task Force on Myopia

In 2019, the American Academy of Ophthalmology (AAO) created the Task Force on Myopia in recognition of the substantial global increases in myopia prevalence and its associated complications. The Task Force, led by Richard L. Abbott, MD, and Donald Tan, MD, comprised recognized experts in myopia prevention and treatment, public health experts from around the world, and organization representatives from the American Academy of Family Physicians, American Academy of Optometry, and American Academy of Pediatrics. The Academy's Board of Trustees believes that myopia is a high-priority cause of visual impairment, warranting a timely evaluation and synthesis of the scientific literature and formulation of an action plan to address the issue from different perspectives. This includes education of physicians and other health care providers, patients and their families, schools, and local and national public health agencies; defining health policies to ameliorate patients' access to appropriate therapy and to promote effective public health interventions; and fostering promising avenues of research. *Ophthalmology* 2020;■:1–11 © 2020 by the American Academy of Ophthalmology

Supplemental material available at [www.aaojournal.org](http://www.aaojournal.org).

Myopia is a common ocular condition and an increasing cause of visual impairment globally. Myopia prevalence has been rising over the past several decades, especially in East Asia, with projections of even greater growth in the next 50 years. Holden et al<sup>1</sup> estimated that the number of myopic individuals (−0.50 diopter [D] or more myopia) and the prevalence of myopia would grow from 1406 million people (22.9% of the population; 95% confidence interval [CI], 932–1932 million [15.2%–31.5%]) in 2000 to 4758 million people (49.8% of the population; 95% CI, 3620–6056 million [43.4%–55.7%]) in 2050 (Fig 1). Similar growth was predicted for those with high myopia (≥−5.00 D or more myopia): from 163 million people (2.7% of the population; 95% CI, 86–387 million [1.4%–6.3%]) to 938 million people (9.8% of the population; 95% CI, 479–2104 million [5.7%–19.4%]).

Although the vision loss resulting from refractive error can usually be addressed with spectacles or contact lenses, the anatomic changes (i.e., longer ocular axial length) associated with myopia increase a patient's risk of uncorrectable visual impairment developing throughout life, especially with advanced age.<sup>2</sup> Higher degrees of myopia are associated with greater risks for complications and subsequent vision loss.<sup>2</sup> By 75 years of age, 3.8% of those with myopia (0.50 to −6.00 D myopia) and 39% of those with high myopia (−6.00 D or more myopia)

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#### THE LITERATURE

## THE MYOPIA PANDEMIC



Research into efforts to control this condition.

BY BOBEK S. MODJTAHEDI, MD, AND ARTHUR B. CUMMINGS, MD, CHB, FRC(SA), FRC(ED)OPHTH, FRC(SED)O

### REDUCING THE GLOBAL BURDEN OF MYOPIA BY DELAYING THE ONSET OF MYOPIA AND REDUCING MYOPIA PROGRESSION IN CHILDREN: THE ACADEMY'S TASK FORCE ON MYOPIA

Modjtahedi BS, Abbott RL, Fong DS, Lum F, Tan D. *Task Force on Myopia*<sup>1</sup>

Industry support: Some members of the task force reported receiving financial support from industry.

#### ABSTRACT SUMMARY

In 2019, the AAO assembled a task force of physicians and scientists from around the world to evaluate and synthesize the scientific literature on myopia. The established methods of myopia prevention and control were examined and evaluated for evidence of their safety and efficacy. Based on this information, the task force developed a global action plan to address this public health issue.<sup>1</sup>

The epidemiologic studies on myopia summarized by the task force indicate that the prevalence of myopia (≥ −0.50 D) will increase from 22.9% of the worldwide population in 2020 to 49.8% (41.6%–55.7%; 95% confidence interval) by 2050. Of the nearly 5 billion people with myopia in 2050, approximately 1 billion will have high myopia. Based on these statistics, Modjtahedi and colleagues describe a pandemic of myopia and call for global efforts comparable to those for the prevention and treatment of the COVID-19 pandemic.<sup>2–4</sup>

**RISK FACTORS.** Apart from a genetic predisposition if both parents have myopia, the most important risk factor for developing the condition

is extensive activity at close distance over time. The incidence of myopia therefore correlates with the educational level of the population. Children who grow up in an urban environment have a 2.6 times higher risk of developing myopia than those who grow up in a rural area. If both parents are highly myopic, a child's risk of experiencing rapid elongation of the eye is disproportionately higher. The earlier that children need refractive correction of myopia, the faster that myopia develops and the more pronounced it is. The problem of myopia is not limited to countries in Far East Asia. Although prevalence projections for 2050 were found to be lower in the United States, Australia, and Europe, the trend was similar.<sup>1,2</sup>

**Clinical significance.** It is well known that glaucoma and cataract positively correlate with myopia.<sup>10</sup> The Eye Disease Case-Control Study Group showed that, compared to nonmyopic eyes, eyes with a refractive error of <−3.00 to <−3.00 D and eyes with a refractive error greater than <−3.00 D had a fourfold and tenfold

higher risk, respectively, of idiopathic rhegmatogenous retinal detachment.<sup>10</sup> Terms such as *pathologic myopia*, *myopic degeneration*, *degenerative myopia*, and *myopic macular degeneration* describe conditions that affect chorioretinal atrophy, all basically caused by eyeball or axial length elongation. Pathologic myopia is a major cause of age-related blindness, especially in Asia. In China, 20% of cases of functional age-related blindness are currently attributed to myopia. In Europe, myopia is the most common (25%) cause of functional blindness in people less than 75 years of age. Overall, for all ages, the rate in Europe is 6.0% to 9.0%, making myopia the second most common cause of functional blindness.<sup>11</sup>

**Socioeconomic impact.** Globally, visual impairment from uncorrected myopia results in an estimated \$244 billion worth of lost productivity, and blindness from myopic macular degeneration results in \$6 billion worth of lost productivity.<sup>12</sup>

**Control strategies.** Therapeutic approaches to curbing myopia progression are many and include

### STUDY IN BRIEF

► An AAO task force evaluated the scientific literature on myopia and the established methods of its prevention and control in order to develop a global action plan to address this public health issue.

#### WHY IT MATTERS

The fight against the myopia pandemic will require decades of effort, and the onus is on adults to wage it at all levels of society.

# REAL LIFE DATA

LITTLE IS KNOWN ABOUT THE PRACTICE OF REFRACTIVE SURGERY IN CHILDREN





REFRACTIVE SURGERY  
ALLIANCE SOCIETY

## Kermani Survey of Refractive Surgery in Children - 2023

Dear colleagues;

While refractive surgery continues to face resistance from a wide variety of interest groups around the world, development in our beautiful specialty is unstoppable. We are pushing open new doors, we are lifting boundaries that seemed immovable, and we have reached a momentum that in light of recent technological developments, far-reaching major changes are becoming apparent. Refractive surgery has long grown up and it is aware of its responsibilities.

I would like to ask for your participation in a survey about refractive surgery in children. The invitation to give a lecture on this topic at an international congress gave me the idea to do a survey. Because in fact we know very little about how the practice is managed. Of course, this is a controversial topic, but we have to face it and there must be no taboos. In the light of the pandemic of myopia rolling towards us, the pressure on refractive surgery to soften the boundaries of treatment in relation to age will become greater and greater.

In this survey, the aim is first to capture the status quo. This survey will take less than 10 minutes to complete. I will be happy to provide you with the results. I would like to thank the RSA and World College of Refractive Surgery & Visual Sciences very much for their great support in this matter.

Best regards,

Omid Kermani, MD

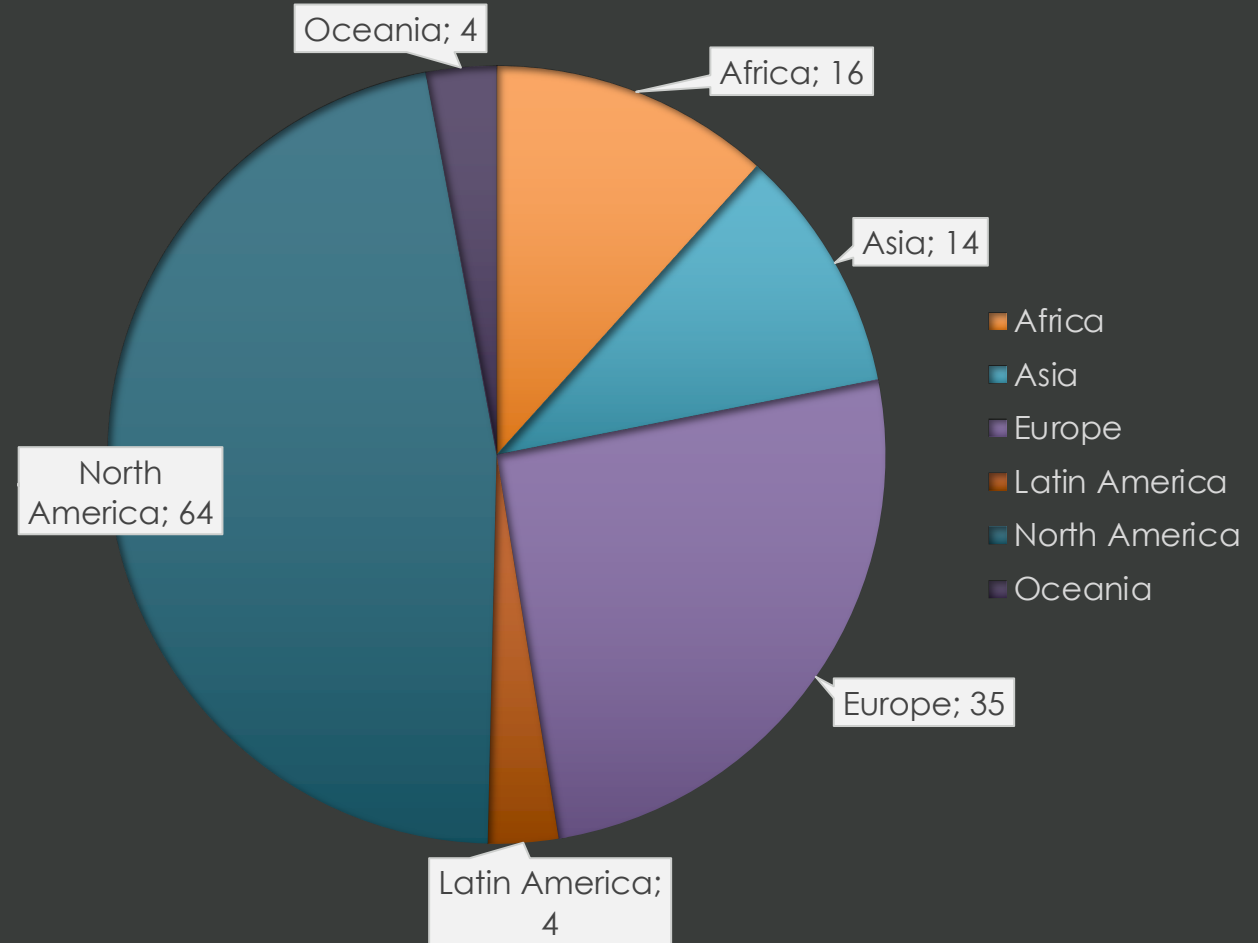
[Begin Survey](#)

Please do not forward this email as its survey link is unique to you.  
[Privacy](#) | [Unsubscribe](#)

# 10 QUESTIONS WITH MULTIPLE CHOICE ANSWERS

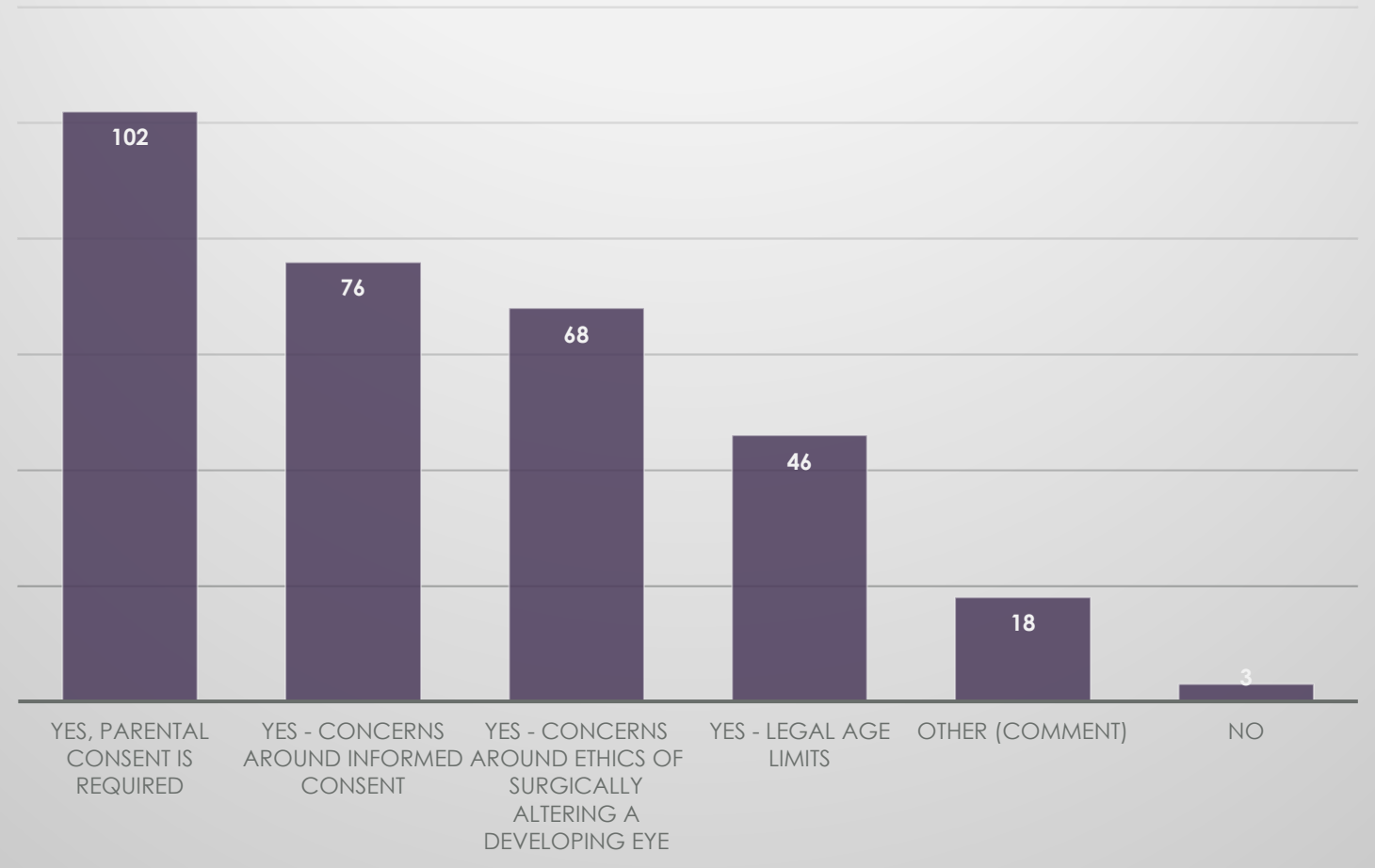
137 QUESTIONNAIRES WERE ALL ANSWERED  
BY MEMBERS OF RSA AND  
WCRS&VS

## Respondents by Region



ALL SURGEONS ARE  
AWARE AND AGREE IN  
ETHICAL AND LEGAL  
CONSIDERATIONS THAT  
COME WITH PERFORMING  
REFRACTIVE SURGERY ON  
CHILDREN

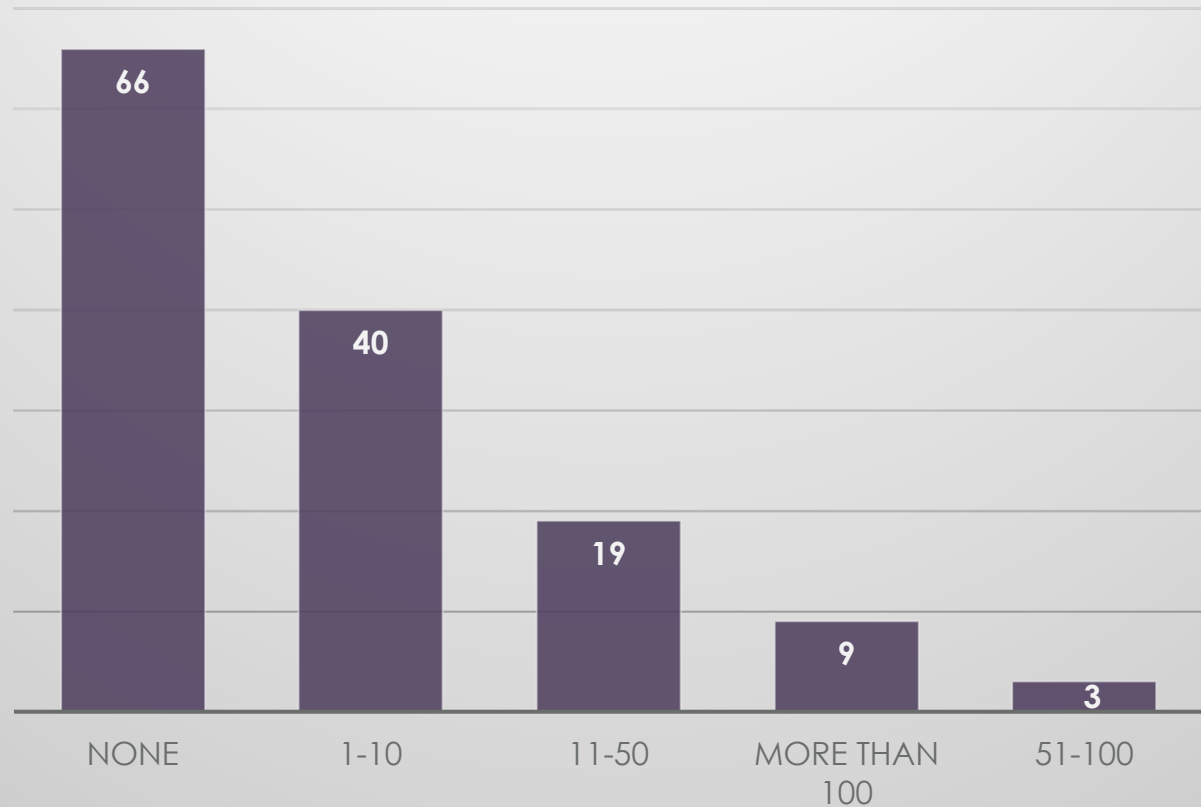
## Ethical or Legal Considerations for Pediatric Refractive Surgery (count of responses)



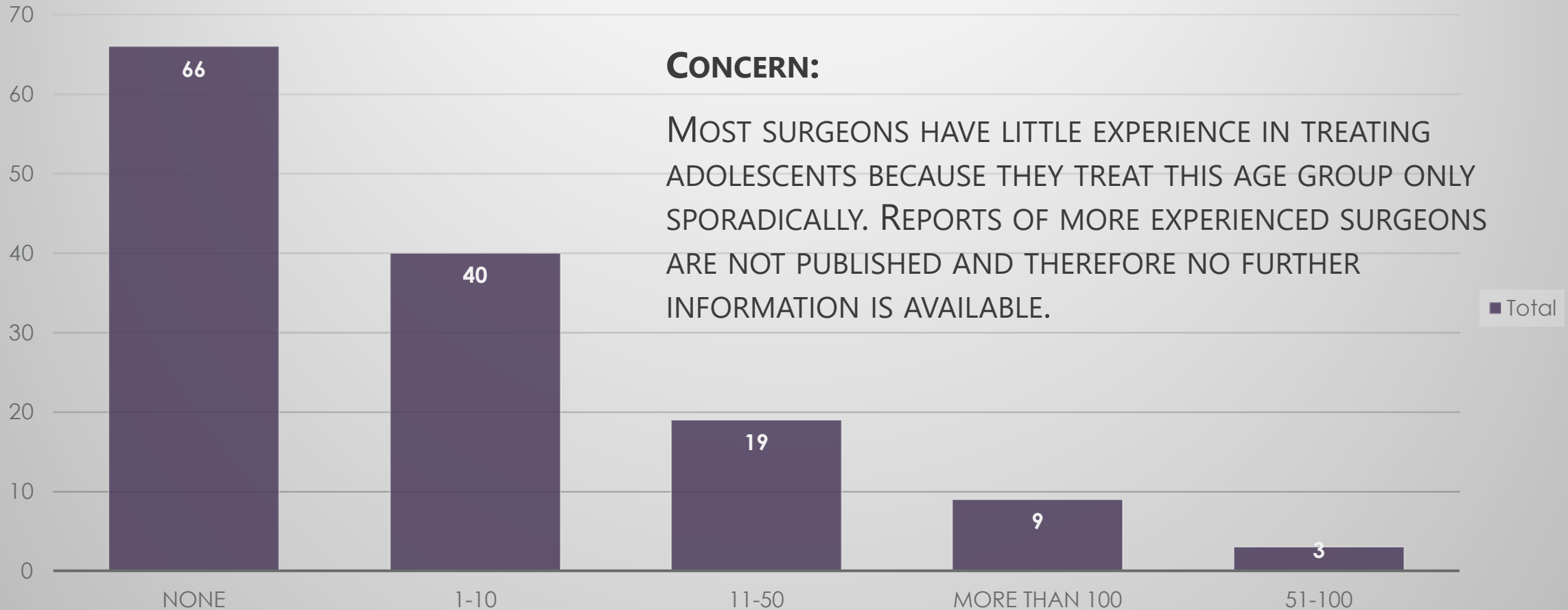


THE ANSWERS INDICATE THAT THE SURVEY IS NOT REPRESENTATIVE. NEVERTHELESS, THERE ARE 1,000 TO 2,000 CASES THAT HAVE NEVER BEEN SURVEYED BEFORE. THIS GIVES THE SURVEY A REMARKABLE RELEVANCE.

## Count of How many refractive surgeries have you performed in children under the age of 18?



## Count of How many refractive surgeries have you performed in children under the age of 18?



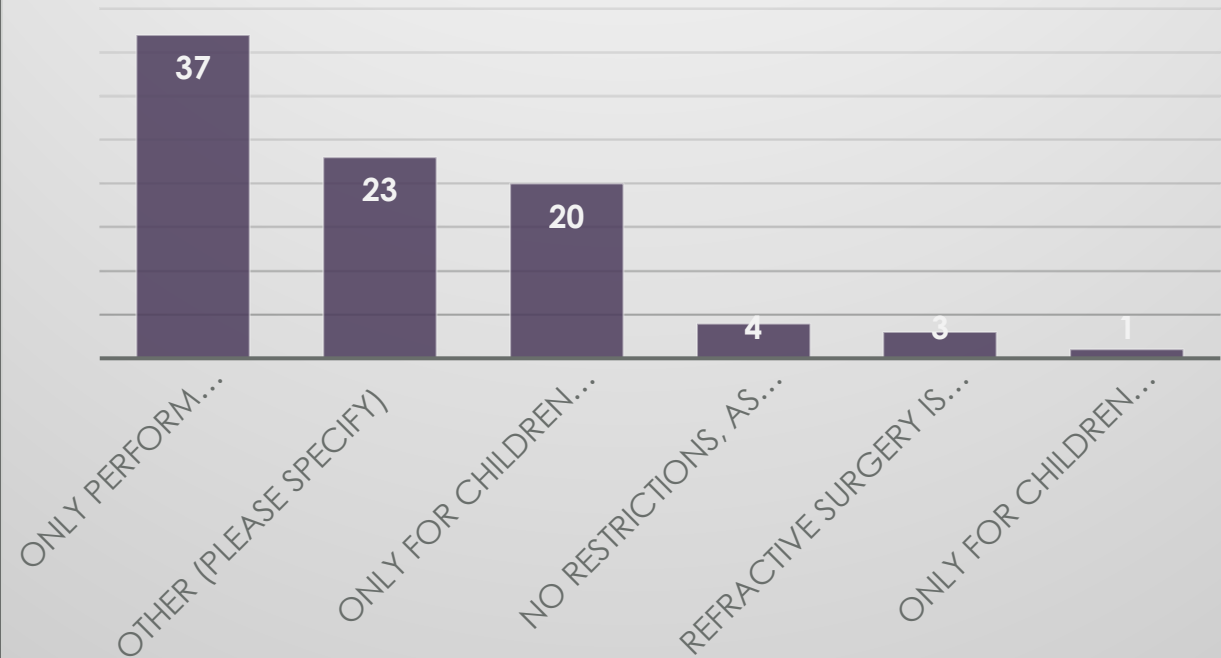
### CONCERN:

MOST SURGEONS HAVE LITTLE EXPERIENCE IN TREATING ADOLESCENTS BECAUSE THEY TREAT THIS AGE GROUP ONLY SPORADICALLY. REPORTS OF MORE EXPERIENCED SURGEONS ARE NOT PUBLISHED AND THEREFORE NO FURTHER INFORMATION IS AVAILABLE.

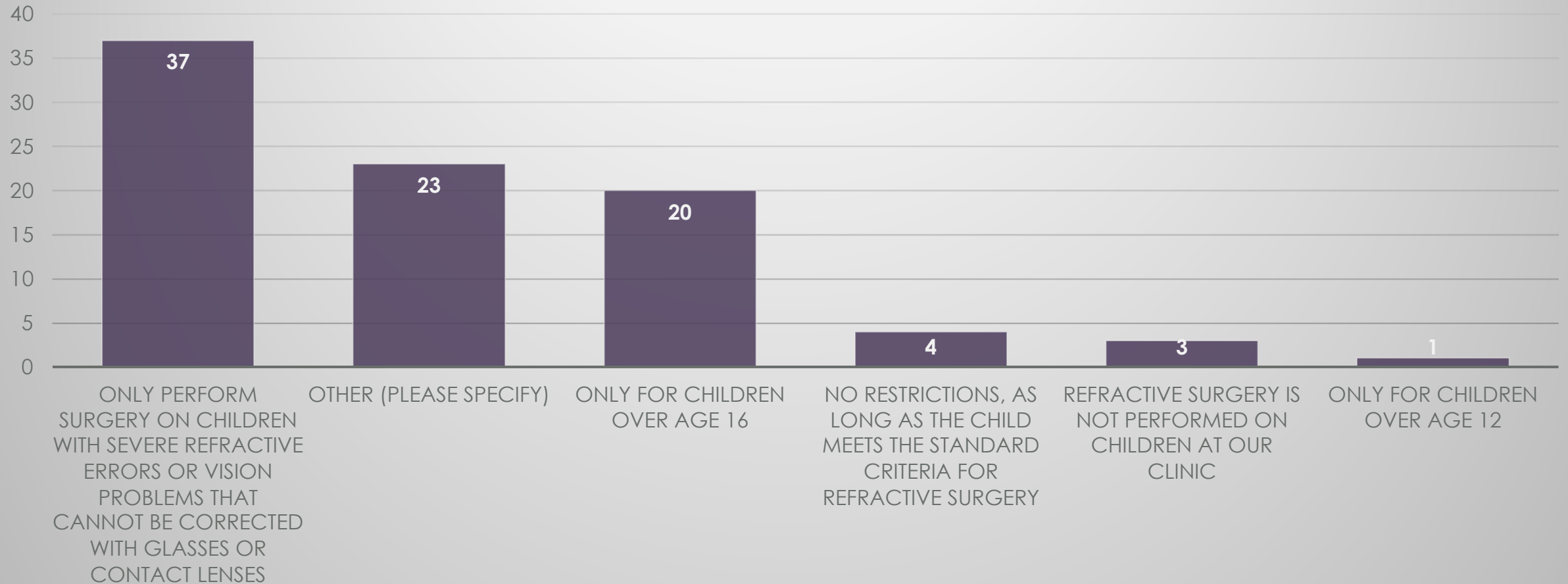
QUESTIONS ONLY ANSWERED BY THOSE WHO PERFORM RS ON CHILDREN (N=71)

**THE SURGEONS ARE IN CONSENSUS,** THAT ONLY PRONOUNCED VISUAL DEFECTS AND SIGNIFICANT VISUAL DISTURBANCES OR OTHER MEDICALLY RELEVANT INDICATIONS ARE PRESENT.

### What are your policies on performing refractive surgery on children? Do you have any specific criteria or restrictions? (count)



## What are your policies on performing refractive surgery on children? Do you have any specific criteria or restrictions? (count)



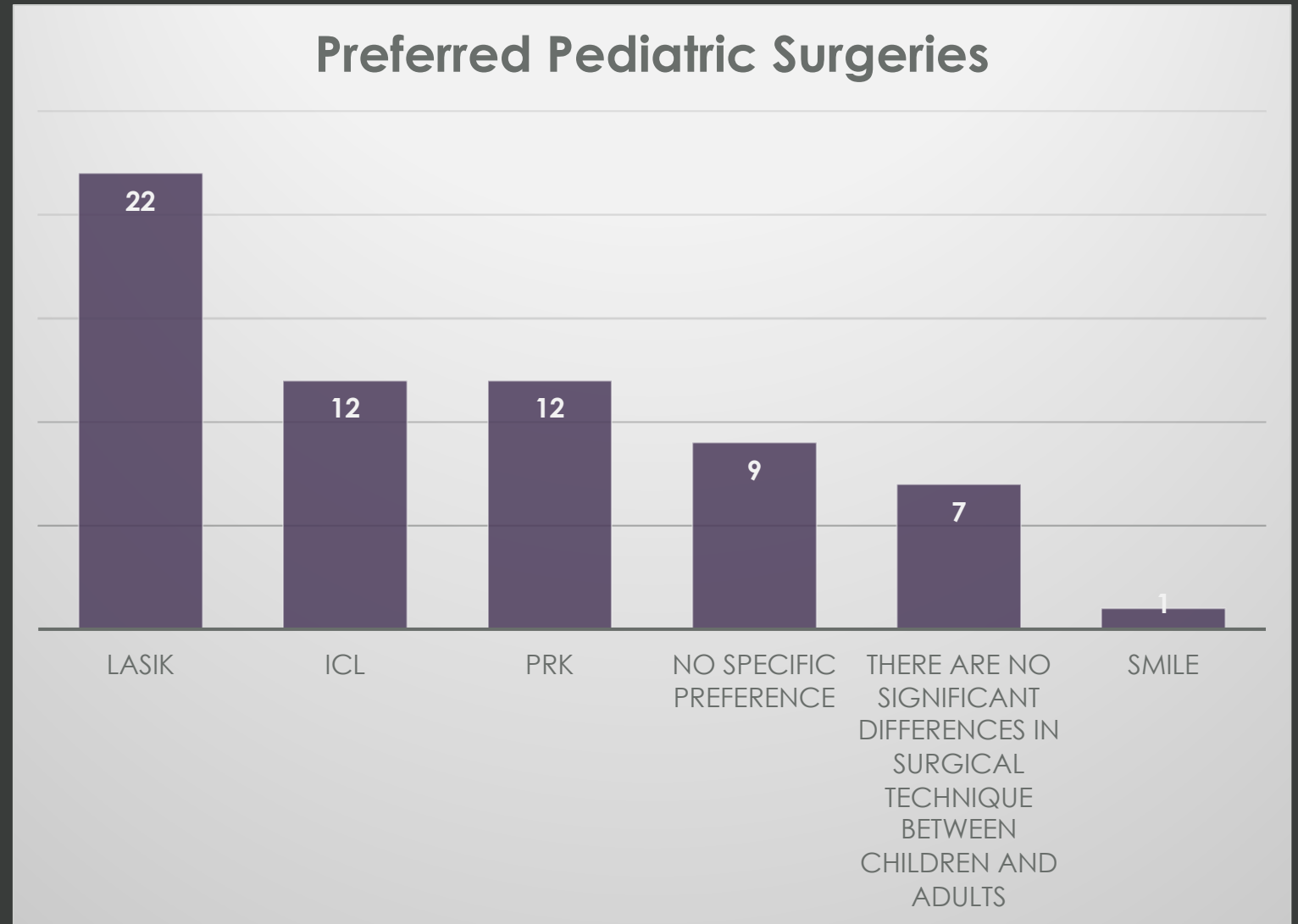
## SURPRISE !

### ICL ?

IT'S RESONABLE IN HIGH MYOPES AND WHEN LVC IS NOT RECOMMENDED.

### LASIK ?

DOES PATIENT COMFORT TAKE PRECEDENCE OVER SAFETY HERE ? A NUMBER OF QUESTIONS COULD BE ASKED.



## Preferred Pediatric Surgeries

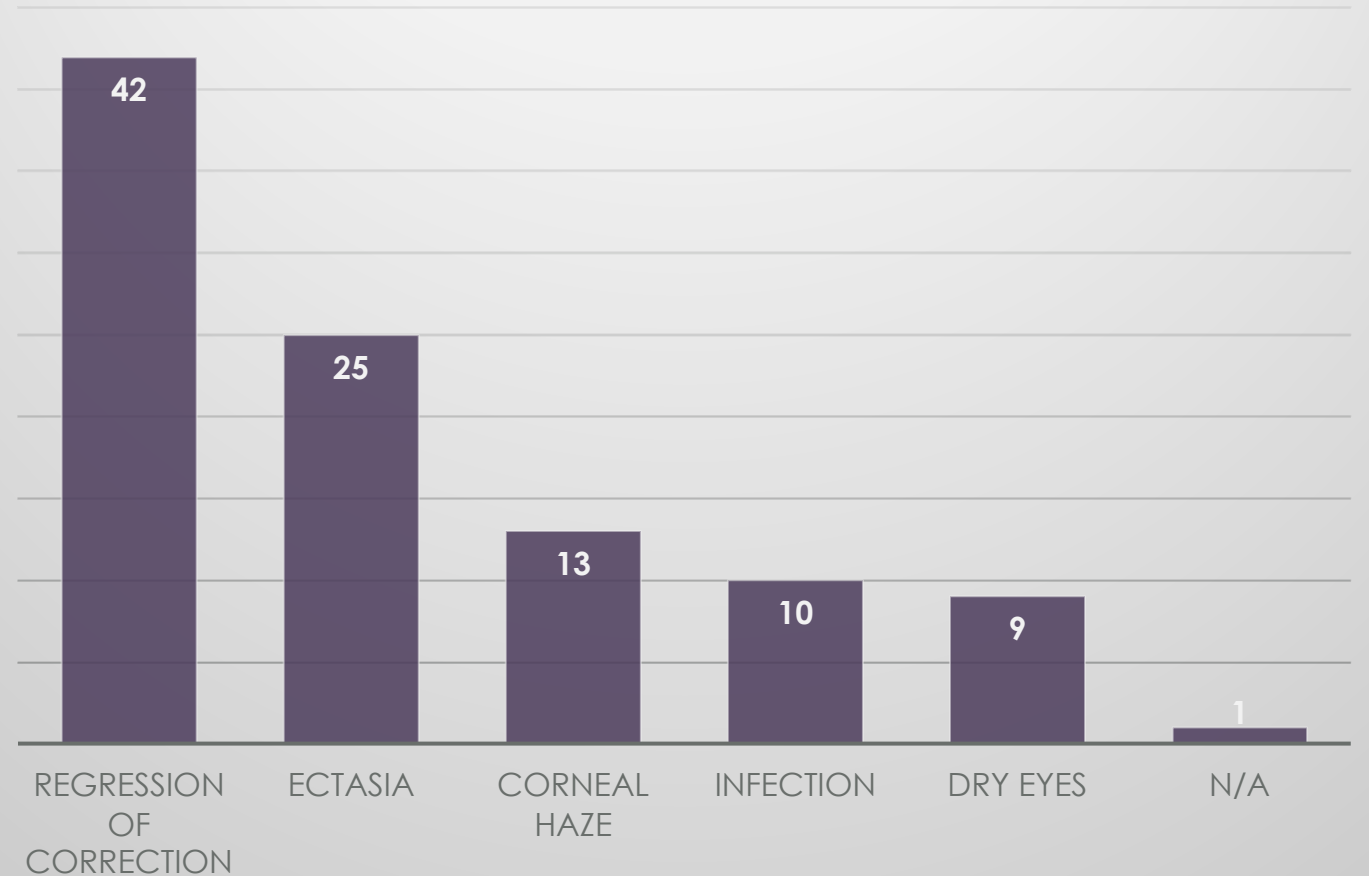


## REGRESSION:

IS REGRESSION A CONSEQUENCE OF REORGANIZATION OF TISSUE OR A CONSEQUENCE OF AXIAL LENGTH INCREASE ?

IF WE HAD AN UNTREATED COMPARISON GROUP, WE WOULD BE ABLE TO DETERMINE WHETHER THE INCREASE IN AXIAL LENGTH IS LESS, EQUALLY OR MORE PRONOUNCED. THIS IS A QUESTION THAT WILL PLAY A ROLE IN MYOPIA CONTROL IN THE FUTURE.

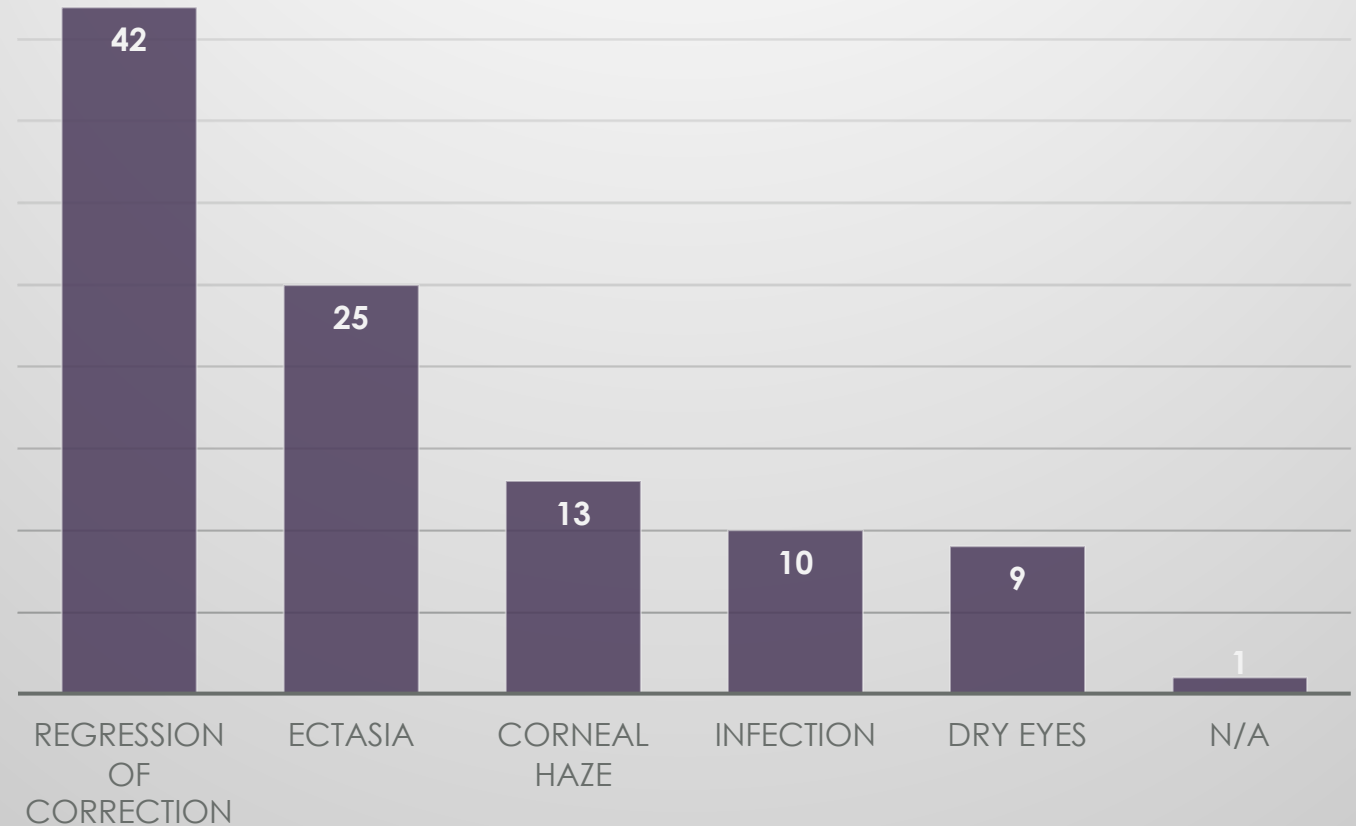
## Potential risks and complications of pediatric surgery (count of responses)



## ECTASIA:

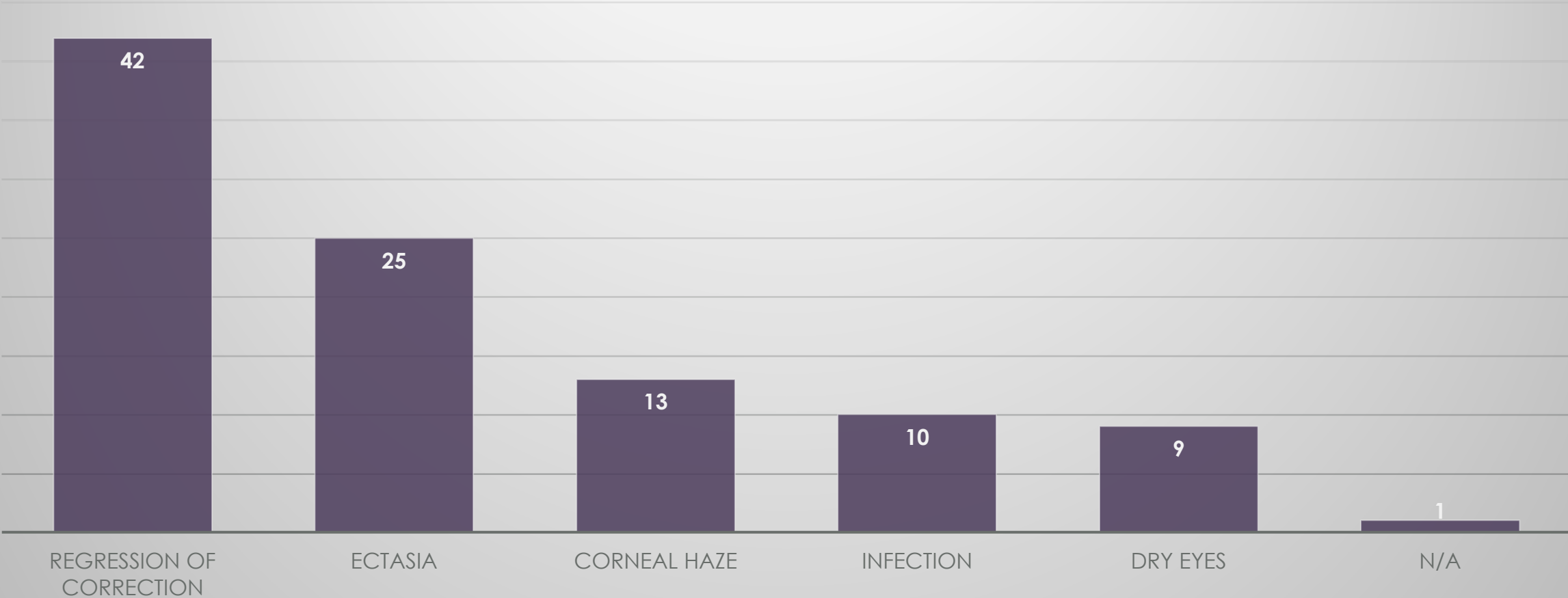
WHAT IS THE WEIGHTING OF THE CORNEAL AGE IN THE MULTIMODAL INTERACTION OF ALL DIAGNOSTIC PARAMETERS ?

### Potential risks and complications of pediatric surgery (count of responses)



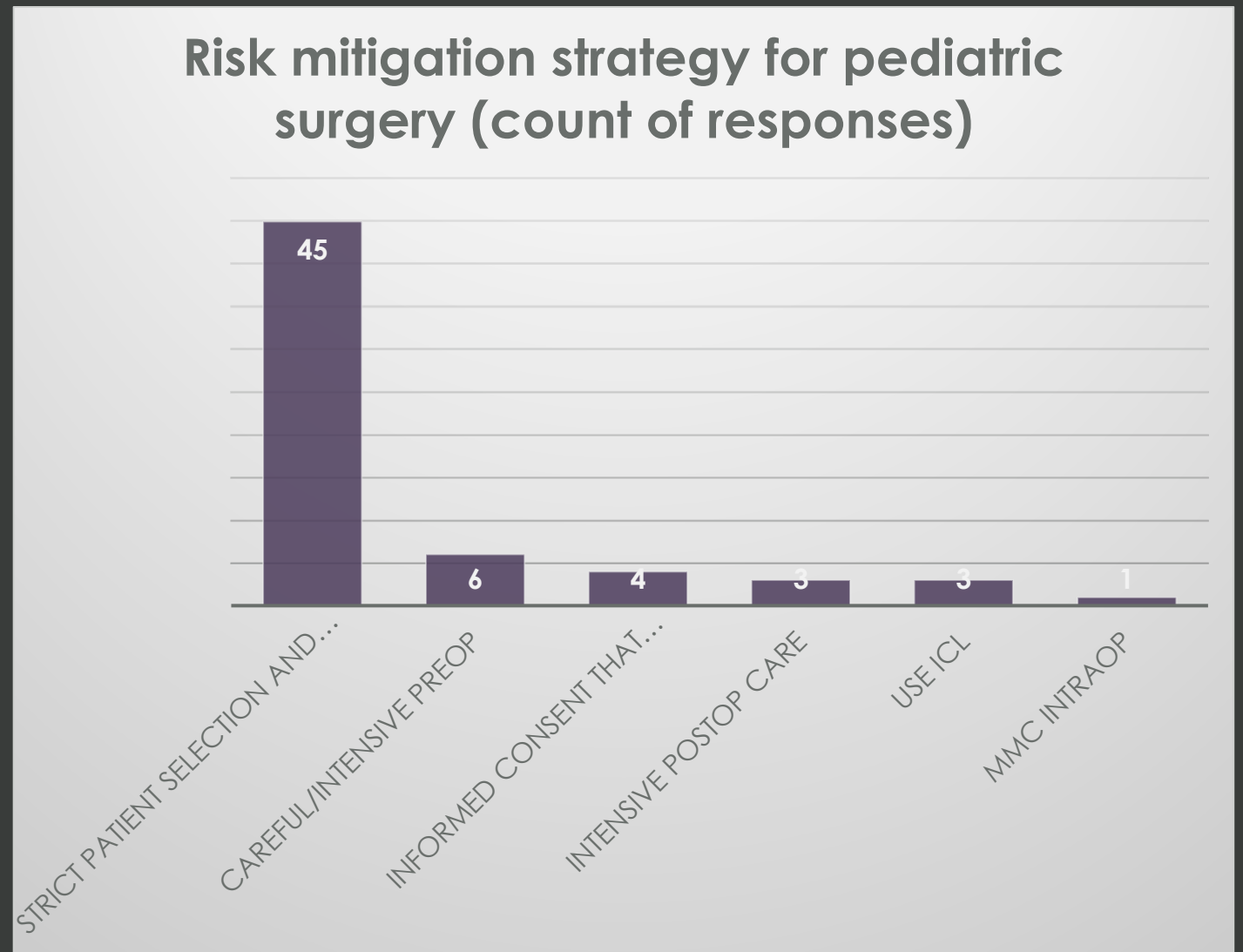


# Potential risks and complications of pediatric surgery (count of responses)

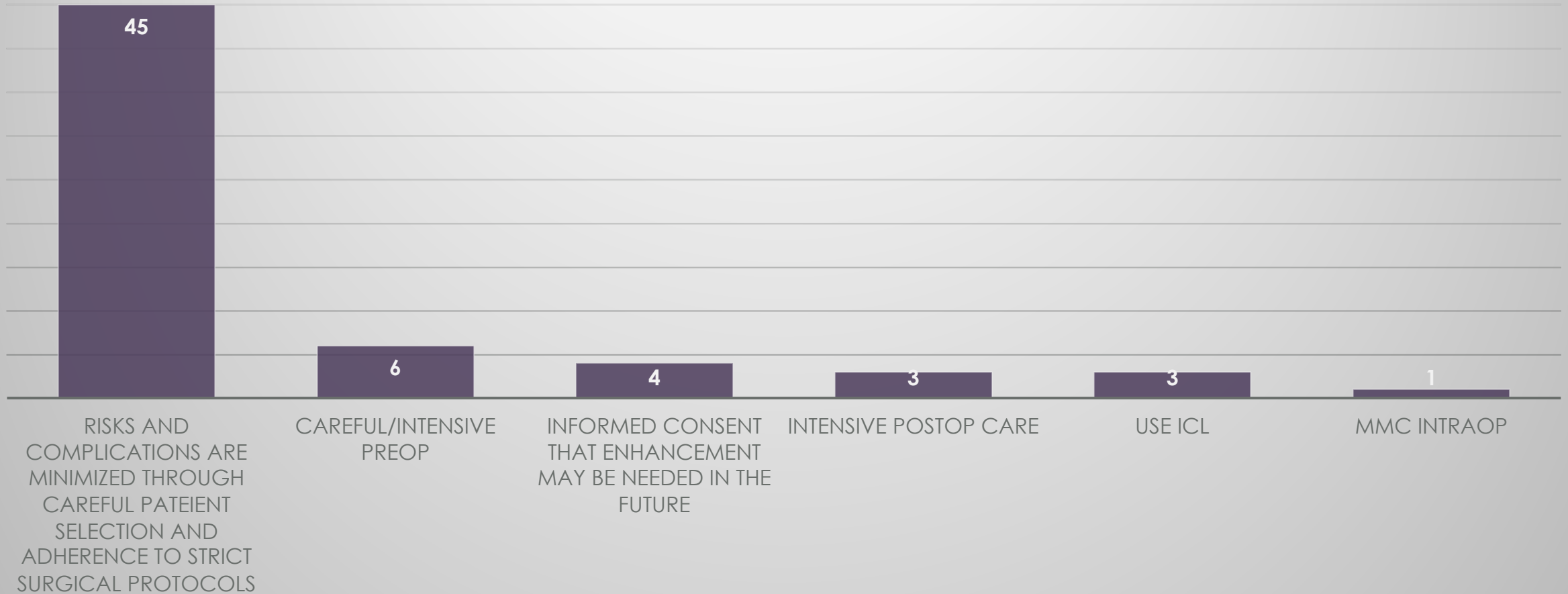


## SPECIFIC RISKS

How do you minimize these risks ?



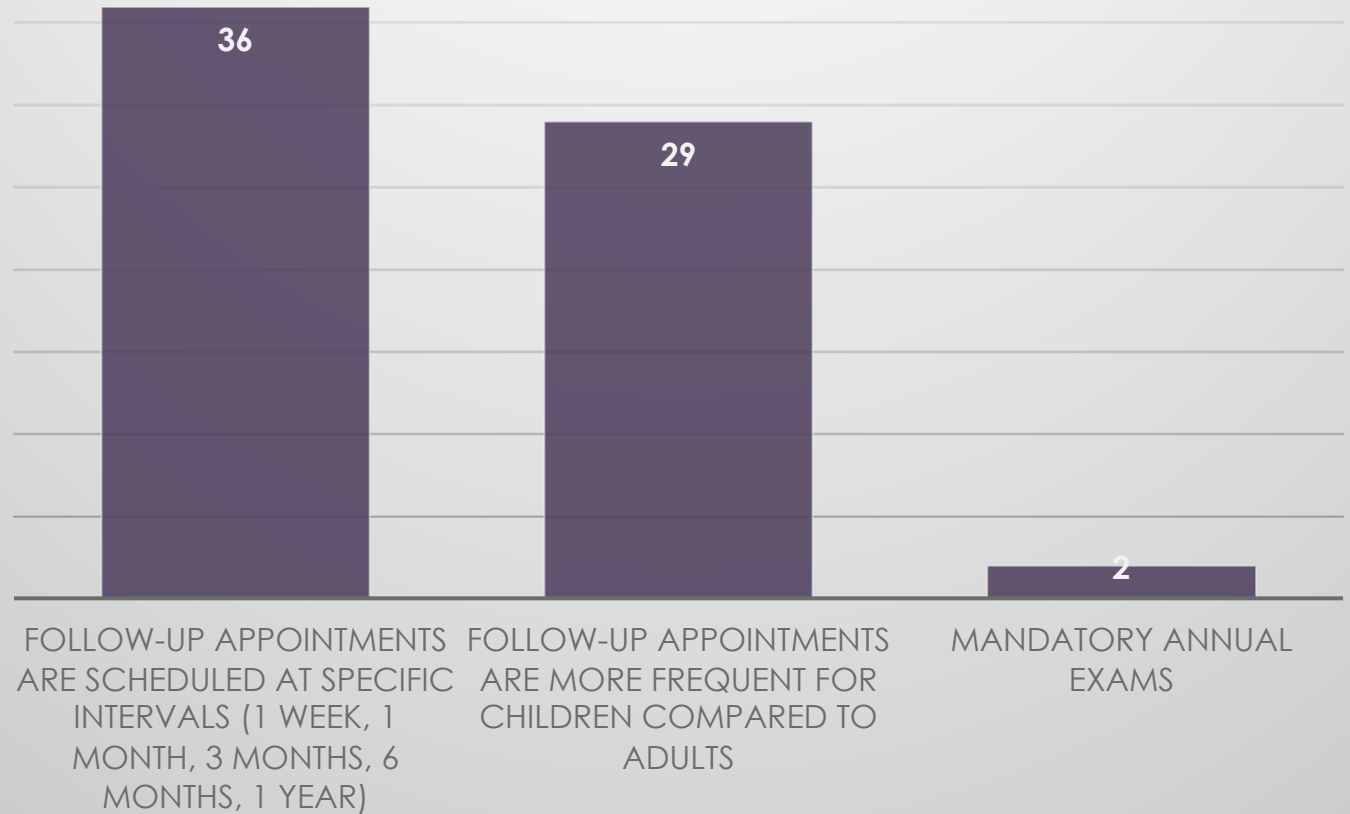
## Risk mitigation strategy for pediatric surgery (count of responses)



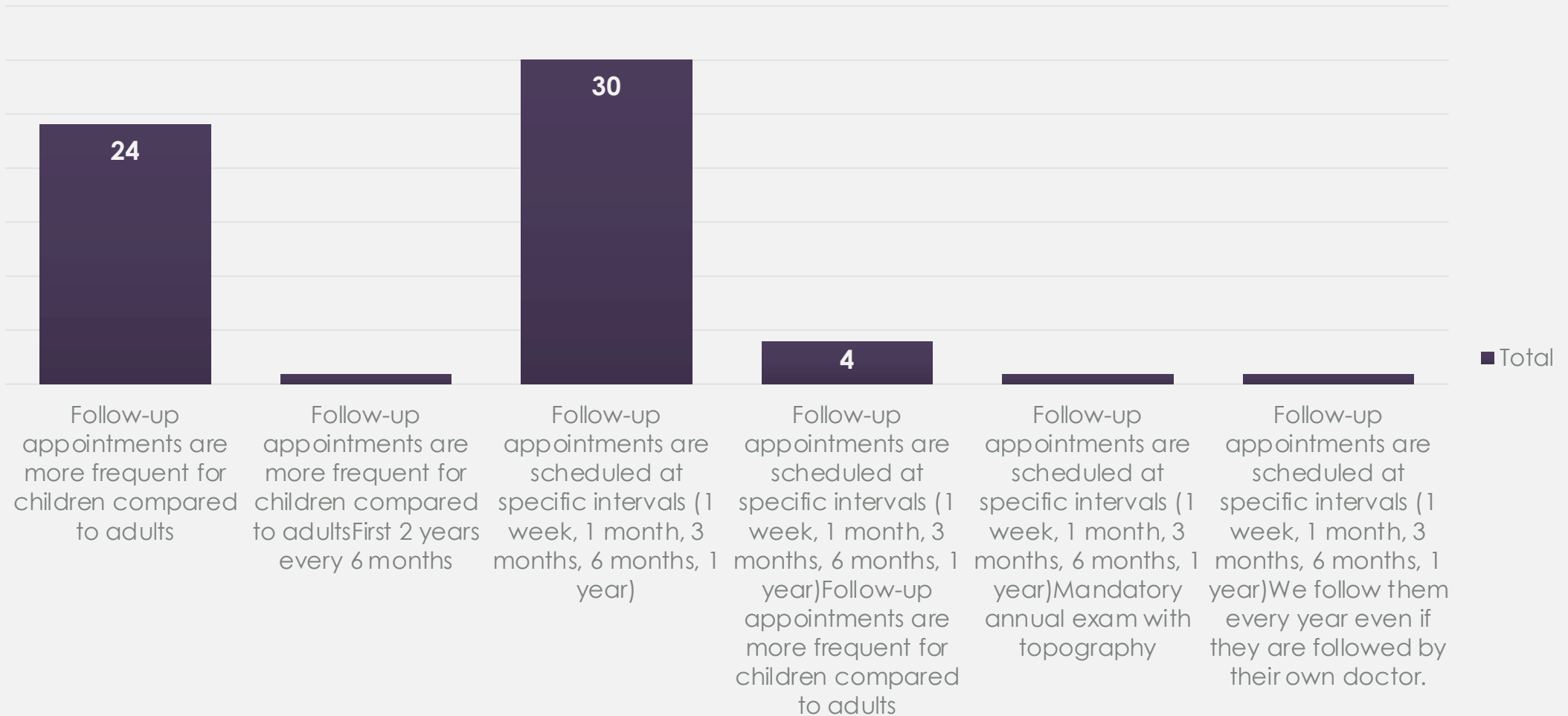
## FOLLOW-UP

WHAT IS THE FOLLOW-UP PROTOCOL FOR CHILDREN WHO HAVE UNDERGONE REFRACTIVE SURGERY? HOW FREQUENTLY DO YOU MONITOR THEM POST-SURGERY?

### Typical follow-up considerations for pediatric patients



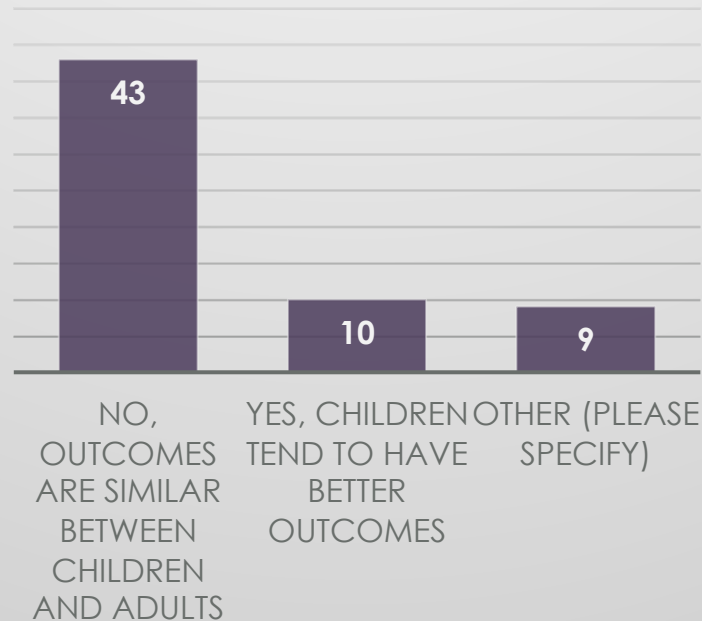
## Typical follow-up protocol for pediatric patients



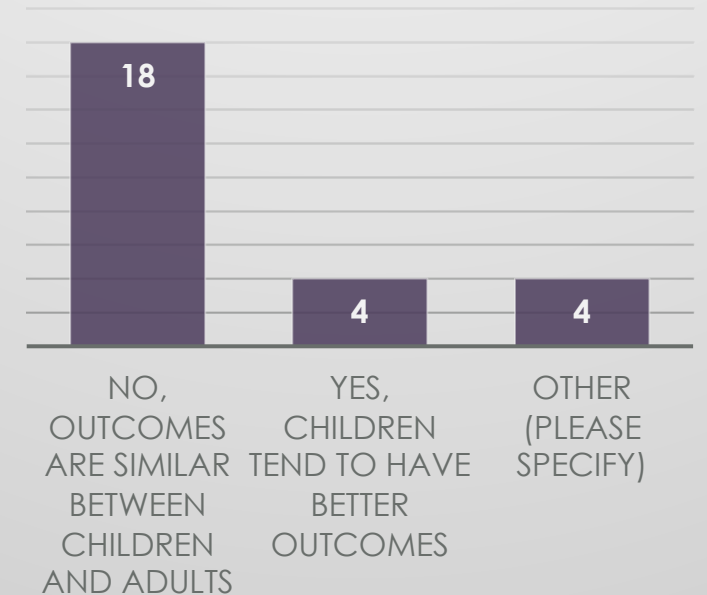
OUTCOMES ARE SIMILAR OR BETTER IN COMPARISON TO ADULTS.

IT WAS NOTED THAT THERE IS BETTER NEUROADAPTION AND LESS DRY EYE ISSUES IN YOUNG PATIENTS.

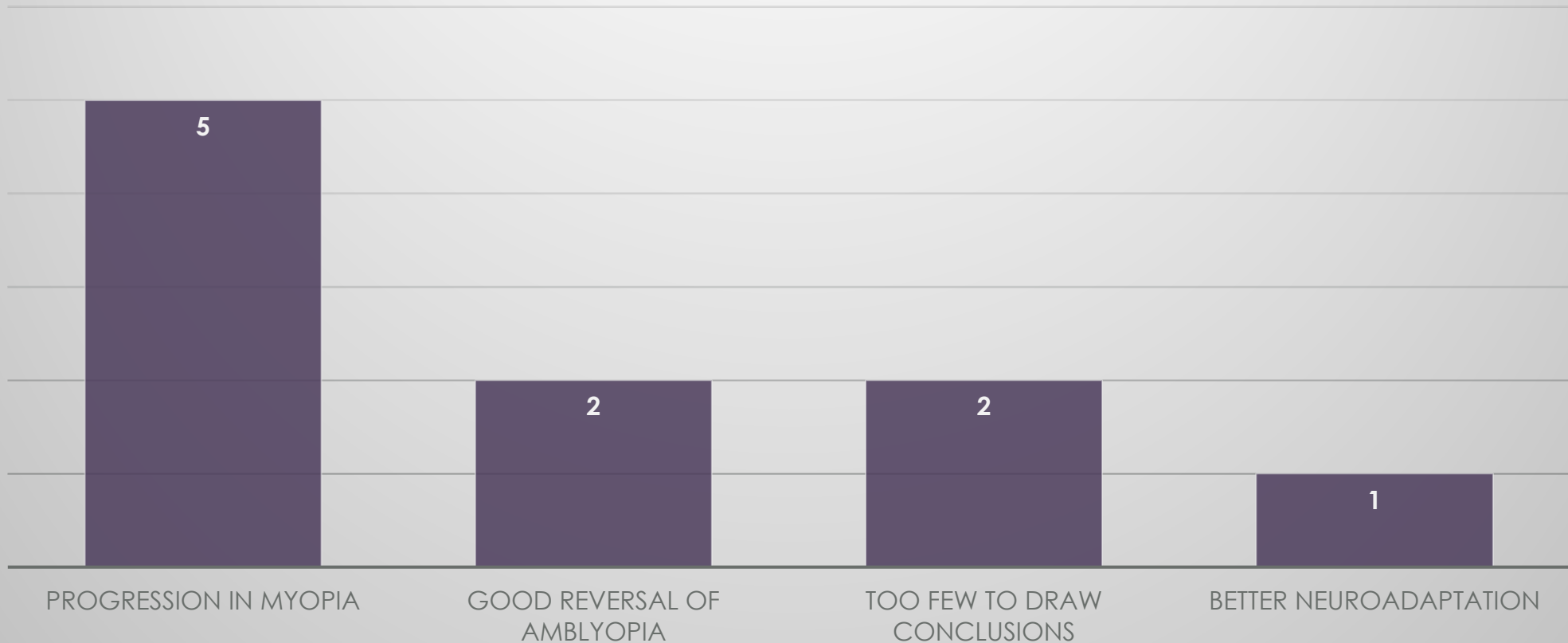
Have you noticed any differences in the outcome of refractive surgery between children and adults? (All Respondents)



Have you noticed any differences in the outcome of refractive surgery between children and adults? (only those with more than 10 pediatric surgical encounters, n=26)



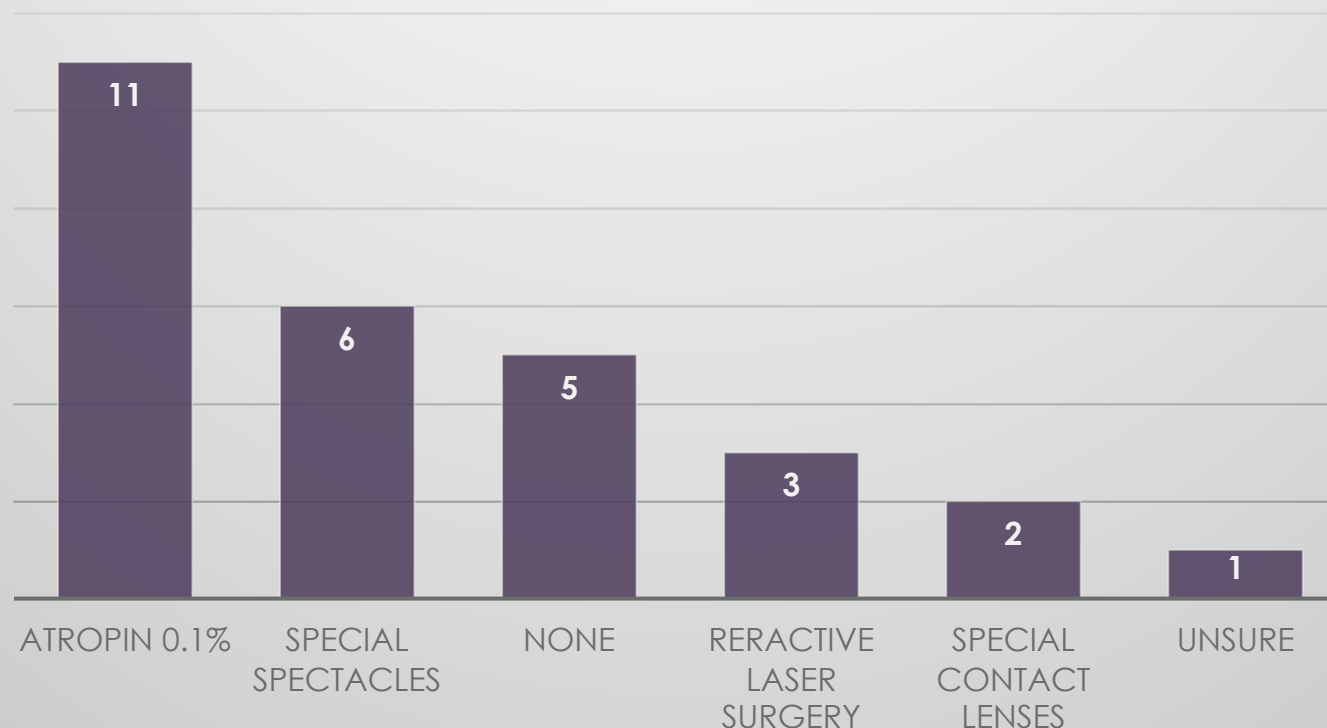
## Differences in outcome of refractive surgery between children and adults: Other responses



# MYOPIA CONTROL

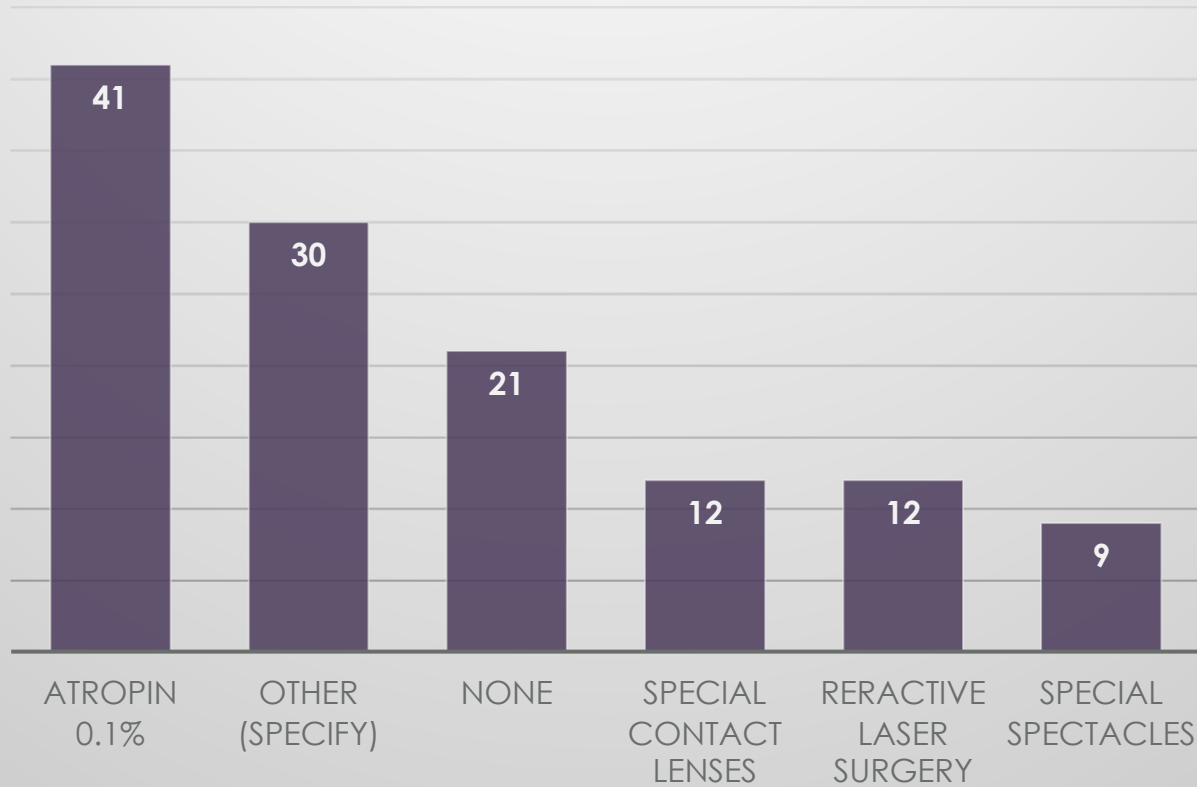
WHAT KIND OF INTERVENTION HAS THE GREATEST POTENTIAL TO CONTROL PROGRESSIVE MYOPIA IN TEENAGERS?

In your experience, what kind of intervention has the greatest potential to control progressive myopia in teenagers? (only those with more than 10 pediatric surgical encounters, n=27)





In your experience, what kind of intervention has the greatest potential to control progressive myopia in teenagers?  
(ALL RESPONDENTS)



Effective Myopia Control Responses - Other (Specify)

Note: Some responses not related to treatments and excluded from this summary breakout.



CONTROL  
MYOPIA  
TODAY

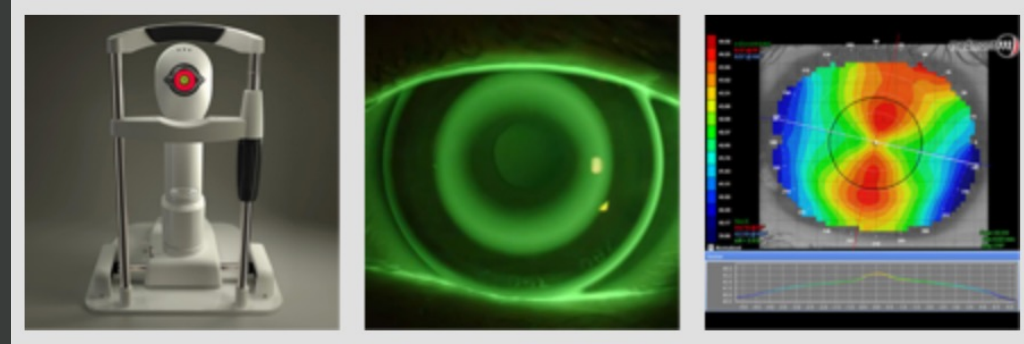


OR  
RISK POOR  
VISION  
TOMORROW

Source: The Asienparent

# MYOPIA CONTROL IN CHILDREN

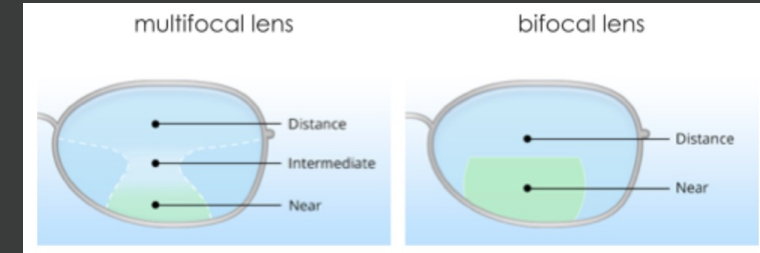
## ORTHOKERATOLOGY



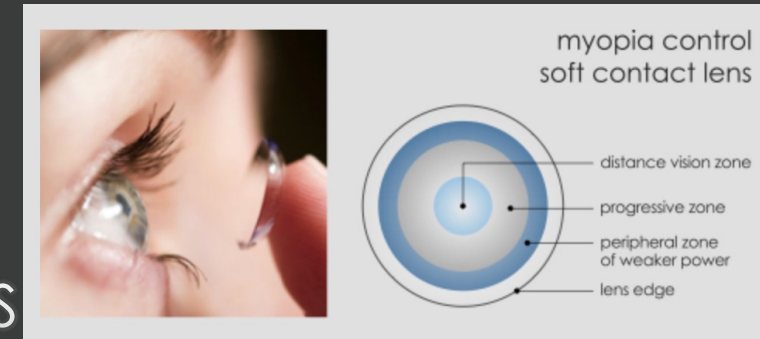
## BUSINESS MODEL:

- THE MYOPIA CLINIC<sup>®</sup>
- [EYECARECONCEPTS.COM.AU](http://EYECARECONCEPTS.COM.AU)

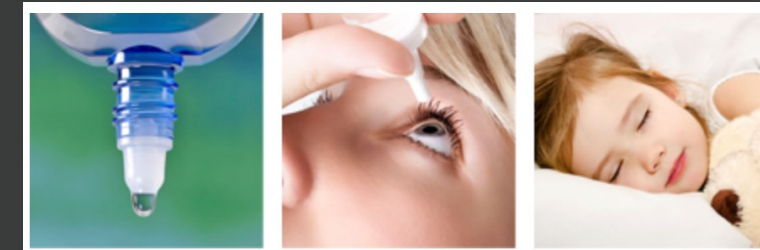
## ASPHERICAL GLASSES



## ASPHERICAL CONTACT LENSES



## ATROPINE EYEDROPS









Environmental Changes

## QUINTESSENCE:

THERE IS CURRENTLY NO SCIENTIFIC BASIS TO CARRY OUT TREATMENTS ON MINORS. HOWEVER, IT WOULD BE DESIRABLE TO WORK ON THE RESULTS OF THE TREATMENT OF YOUNG ADULTS. THE DEDUCTIVE INSIGHTS GAINED CAN HELP TO SECURE THE TREATMENT OF MINORS IN INDIVIDUAL CASES.

### Laser-assisted in situ keratomileusis long term outcomes in late adolescence

[Jorge L Alió del Barrio](#)  , [Mario Canto-Cerdán](#), [L...](#), and [Jorge L Alió](#)   [View all authors and affiliations](#)

[Volume 31, Issue 5](#) | <https://doi.org/10.1177/1120672120969039>

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#### Abstract

##### Purpose:

Evaluate the long term outcomes of myopic-LASIK in a late adolescent population (age  $\geq 17$  and  $< 20$  at the time of surgery).

##### Methods:

Monocentric retrospective case series study. Eyes with at least 3 years of follow-up time were included. Primary outcome measures were long term efficacy, safety and stability of the refractive error. Secondary outcome measure was the evaluation of the relation between the postoperative spherical aberration and the long term stability of the refractive error.

##### Results:

Forty-seven eyes of 25 patients were included. Mean follow-up was  $9.23 \pm 3.16$  years. Mean age at the time of surgery was  $18.74 \pm 0.44$  years. With time, postoperative UDVA showed a mild but significant deterioration of 1–2 Snellen lines ( $p = 0.012$ ), in connection with a mild but significant myopization of the SE (mean increase of  $-0.43$  D;  $p < 0.001$ ), sphere (mean increase of  $-0.29$  D;  $p = 0.004$ ) and cylinder (mean increase of  $-0.16$  D;  $p = 0.013$ ). CDVA remained stable over time ( $p > 0.05$ ). Efficacy index decreased from 1.01 to 0.87 in the long term (77% UDVA  $\geq 20/32$ ). Safety remained at 1.06. 66% and 74% of eyes presented a SE within  $\pm 0.50$  D and  $\pm 1.00$  D respectively. SE changed over 0.50D in 33% of eyes. No correlation could be detected between the SE and the postoperative spherical aberration. No cases of corneal ectasia were detected.

##### Conclusions:

Myopic-LASIK in late adolescence is safe and effective, but a mild myopic progression occurs. Despite presence of refractive stability is preferable, if necessary, myopic LASIK provides relatively good outcomes in the long term in this young population.

**Alió del Barrio JL, et al.**

European Journal of Ophthalmology. 2021;31(5):2307-2312.

# ACKNOWLEDGMENT



## REFRACTIVE SURGERY ALLIANCE SOCIETY

The Refractive Surgery Alliance is a professional organization and does not provide medical services or advice. Information here is obtained from a variety of sources and is provided for informational services, only.

[www.refractivealliance.com](http://www.refractivealliance.com)



The World College of Refractive Surgery & Visual Sciences (WCRS) is the only global organization that provides certification and accreditation in Refractive Surgery and recognizes an international set-standard curriculum that is critical for both quality and qualifications for refractive surgeons.

<https://www.wcrsvs.org>