COMPARING THE LONG-TERM COSTS ASSOCIATED WITH INTRAOCULAR LENS SELECTION AND ND:YAG LASER CAPSULOTOMY POST-CATARACT SURGERY: A COST-CONSEQUENCE ANALYSIS FROM A BELGIAN HEALTHCARE SYSTEM PERSPECTIVE

PMD7

Okke-Jaap Bosgra[1], Rafael Busutil[2], Ruth Mentens[1], Caridad Perez Vives, Derek O'Boyle[4]1

Affiliations: 1. Alcon Nederland BV, Gorinchem 2. Alcon Healthcare, S.A, Barcelona; 3. Alcon Management SA, Cointrin, Switzerland ; 4. Alcon Laboratories Ireland Ltd., Cork, Ireland

BACKGROUND AND OBJECTIVE

- Cataract surgery is the most frequently performed surgical procedure in Belgium[1] with crude rate of 11.8 per 1000 population performed in 2016[1]
- Posterior Capsular Opacification (PCO) is the most frequent complication of cataract surgery[2], the first year incidence rates have been reported to vary from 11% to 43% and from 23% to 38% within 2–4 years post-cataract surgery[5-7]
- PCO affecting patient's visual acuity is treated by neodymium-doped yttrium aluminium garnet laser (Nd:YAG) capsulotomy which is generally considered safe, but is associated with complications such as retinal detachment (RD), glaucoma, cystoid macular edema (CME), intraocular lens (IOL) pitting, iritis, and uveitis[8-13]
- The aim of this analysis was to estimate the cost impact of Nd:YAG procedures due to AcrySof vs. other single-piece acrylic IOLs, reflecting the Belgian setting.

METHODS

- A cost consequence model was developed in Microsoft Excel to estimate the healthcare resource utilization and cost impact of Nd:YAG capsulotomy due to different single-piece acrylic IOLs – AcrySof, AMO Tecnis, B&L Akreos, Lenstec Softec and Rayner C-/Super-flex, on the Belgian national healthcare system
- The model was developed using the cost-consequence analytical approach outlined in the medical technologies evaluation programme methods guidance from National Institute for Health and Care Excellence, UK[14]

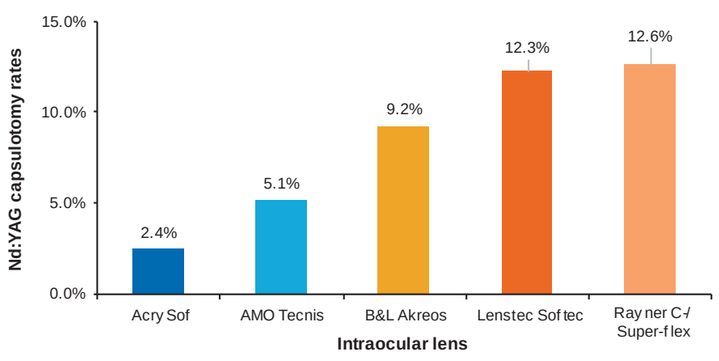
Patient population

- The current economic evaluation assessed the patients post-cataract surgery
- The data for estimated annual number of cataract surgeries for Belgium was derived using 2016 cataract surgery incidence/100,000 individuals and the general population estimates from Eurostat[1]

Model inputs

- Three-year incidence rates of Nd:YAG capsulotomy post-cataract surgery with single piece AcrySof IOLs and non-AcrySof IOLs were derived from the post-hoc analysis of the data available from a real world evidence study[15] (**Figure 1**)

Figure 1. Cumulative Nd:YAG capsulotomy incidence for single-piece acrylic IOLs at 3 years post cataract surgery

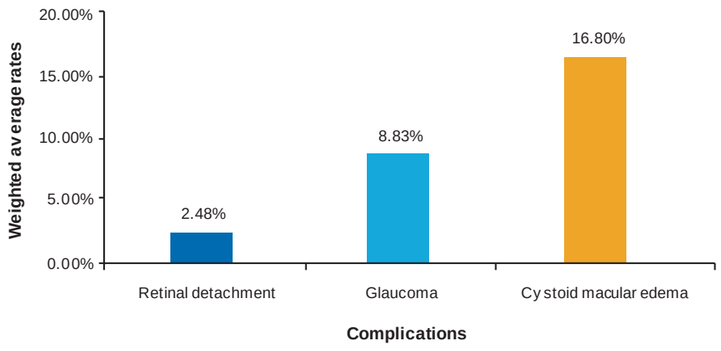


IOL = intraocular lens, Nd:YAG = neodymium-doped yttrium aluminium garnet laser

Source: Three-year incidence of Nd:YAG capsulotomy post-cataract surgery with AcrySof IOLs and non-AcrySof IOLs were derived from a real world evidence study[14]

- Three-year post-Nd:YAG capsulotomy incidence of RD, glaucoma, and CME, were estimated using weighted average of published rates from studies retrieved through a systematic literature search[16] (**Figure 2**)

Figure 2. Estimated rates of complications at 3 years post Nd:YAG capsulotomy



Nd:YAG = neodymium-doped yttrium aluminium garnet laser

Source: Three-year post- Nd:YAG capsulotomy incidence of retinal Detachment, glaucoma, and cystoid macular edema were estimated using weighted average of published rates from studies retrieved through a systematic literature search[16]

- Considering payers' perspective, direct treatment costs were considered including Nd:YAG capsulotomy costs and costs of treating complications due to Nd:YAG capsulotomy, i.e. RD, glaucoma, and CME
- National average of published Nd:YAG capsulotomy and vitrectomy Healthcare Resource Groups (HRG) tariffs were used, while average medical treatment costs for glaucoma and CME were sourced from literature (**Table 1**)
- For analysis, a 3-year time horizon was considered, the time period post-cataract surgery over which Nd:YAG capsulotomy rates and its complications were assessed

Table 1. Model inputs

Parameters	Year	Estimate
Number of cataract procedures[1]	2016	133,789
Costs		
Nd:YAG capsulotomy[17]	2018–19	€188.15
Retinal detachment[18]	2018–19	€762.63
Glaucoma[18]	2018–19	€ 381.31
Cystoid macular edema[18]	2018–19	€85.99
Associated follow-up visit[18]	2018–19	€7.48

Assumptions

- IOL acquisition costs were considered equivalent as IOLs are reimbursed under fixed cataract HRGs. This is aligned with the approach used in earlier published studies[21,22]

Model outputs

- In terms of health system benefits, following model outputs were analysed - reduction in incidence of Nd:YAG capsulotomy and its subsequent complications with the use of AcrySof over comparator IOLs for Belgium
- Total cost savings were assessed with respect to reduction in Nd:YAG capsulotomy and its complications between single-piece acrylic monofocal AcrySof and comparator IOLs
- Since weighted average of published rates were used to estimate probabilities of complications, 95% confidence intervals available for the estimated probabilities of Nd:YAG capsulotomy procedure rates were used to calculate the lower and upper values of different complications

Sensitivity analysis

- The lower and upper values for Nd:YAG capsulotomy rates were derived from the available confidence interval values and for complications (RD, glaucoma, and CME), the lower and upper values were derived using the Nd:YAG capsulotomy rates
- Furthermore, the ±10% variation in costs were applied to the lower and upper values for all the events to derive the minimum and maximum cost difference between comparators in order to test the robustness of results

RESULTS

Health system benefits

- In hypothetical scenarios considered in the model, if the Belgian national cohort of cataract surgery eligible patients in a given year were to be implanted with any of the five single-piece acrylic IOLs, in 3 years post cataract surgery, the AcrySof IOL would have the lowest incidence of Nd:YAG laser capsulotomy and its complications, and the highest would be with Rayner C-/Super-flex (**Table 2**)

Table 2. Reduction in the number of events of Nd:YAG capsulotomy and its complications with the use of AcrySof over the comparator IOLs in Belgium

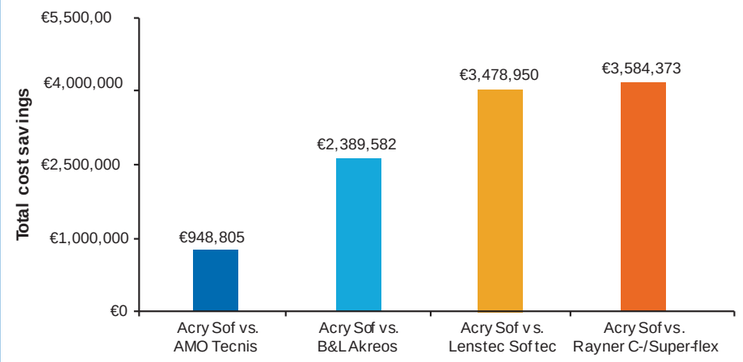
Comparisons	Baseline	Lower Value	Upper Value
Reduction in the number of Nd:YAG capsulotomy			
AcrySof vs. AMO Tecnis	–3,612	–2,943	-4,549
AcrySof vs. B&L Akreos	–9,098	–8,027	-10,302
AcrySof vs. Lenstec Softec	–13,245	–11,907	-14,717
AcrySof vs. Rayner C-/Super-flex	–13,646	–12,041	-15,386
Reduction in the number of RD events			
AcrySof vs. AMO Tecnis	–90	–73	-113
AcrySof vs. B&L Akreos	–226	–199	-255
AcrySof vs. Lenstec Softec	–328	–295	–365
AcrySof vs. Rayner C-/Super-flex	–338	–299	–382
Reduction in the number of glaucoma events			
AcrySof vs. AMO Tecnis	–309	–260	–402
AcrySof vs. B&L Akreos	–803	–709	–910
AcrySof vs. Lenstec Softec	–1,170	–1051	–1299
AcrySof vs. Rayner C-/Super-flex	–1,205	–1063	–1359
Reduction in the number of CME events			
AcrySof vs. AMO Tecnis	–607	–494	–764
AcrySof vs. B&L Akreos	–1,528	–1349	–1731
AcrySof vs. Lenstec Softec	–1,205	–2000	–2472
AcrySof vs. Rayner C-/Super-flex	–2,293	–2023	–2585

CME = cystoid macular edema, IOL = intraocular lens, Nd:YAG = neodymium-doped yttrium aluminium garnet laser, RD = retinal detachment

Cost results

- The total national healthcare costs of Nd:YAG capsulotomy procedure and its complications associated with each IOL considered in the analysis were - AcrySof: €843,382; AMO Tecnis: €1.79 million; B&L Akreos: €3.23 million; Lenstec Softec: €4.32 million and Rayner C-/Super-flex: €4.42 million
- Total estimated cost savings with the use of single-piece monofocal AcrySof IOL for the budget owner in Belgium ranged from €948,894 (vs. AMO Tecnis IOL) to €3.58 million (vs. Rayner C-/Super-flex IOL) (**Figure 3**)

Figure 3. Total cost savings for budget owners with the use of AcrySof over other IOLs in Belgium



Sensitivity analysis

- Cost savings for the budget owner were most affected by Nd:YAG capsulotomy rates
- The results for sensitivity analysis are presented in **Table 3**

Table 3. Sensitivity analysis results for total costs savings with ±10% variation in the costs of Nd:YAG capsulotomy, retinal detachment, glaucoma and cystoid macular edema

Comparisons	Lowest estimate (all costs decreased by 10%)	Highest estimate (all costs increased by 10%)
AcrySof vs. AMO Tecnis	€695,790	€1,314,270
AcrySof vs. B&L Akreos	€1,897,609	€2,976,435
AcrySof vs. Lenstec Softec	€2,814,787	€4,252,051
AcrySof vs. Rayner C-/Super-flex	€2,846,414	€4,445,326

Limitations

- Data for annualized cataract surgeries in Belgium was available up to year 2016 only
- Furthermore, the usual demerits of using retrospective data cannot be overlooked including susceptibility to confounding, issues like missing data and lack of validation

CONCLUSIONS

- In this analysis, we estimated the cost impact of Nd:YAG laser capsulotomy and its complications due to the use of five single-piece monofocal acrylic IOLs from the perspective of the Belgian national healthcare system. Our findings indicate that performing cataract surgery with AcrySof IOLs could substantially offset the treatment burden of Nd:YAG capsulotomy procedures and subsequent complications in 3 years post-cataract surgery period when compared with other single-piece monofocal acrylic IOLs resulting in cost savings of €948,894 million to €3.58 million. Results highlight that the appropriate choice of IOL for cataract surgery, as a direct consequence of lower ND:YAG capsulotomy rates and associated complications – may translate into significant savings for the Belgian national healthcare system

References

1. Eurostat. Surgical operations and procedures performed in hospitals by ICD-9-CM, (2017)
2. Wang W. et al. Investigative Ophthalmology & Visual Science, 57(14), 5872–5881 (2017)
3. RCOphth. The Way Forward: Options to help meet demand for the current and future care of patients with eye disease. The Royal College of Ophthalmologists (2015)
4. Sinha R. et al. Indian J Ophthalmol, 61(7): 371–376 (2013)
5. Maedel S. et al. Cochrane Database Syst Rev., (1), (2017)
6. Auffarth G.U. et al. Ophthalmic Epidemiol., 11(4), 319–329, (2004)
7. Fong C.S. et al. Am J Ophthalmol., 157(1), 171–179, (2014)
8. Karahan E. et al. Med Hypothesis Discov Innov Ophthalmol., 3(2),45–50 (2014)
9. Lundstrom M. et al. Journal of cataract and refractive surgery, 38(6), 1086–1093 (2012)
10. Bhargava R. et al. International journal of ophthalmology, 8(3), 590–596 (2015)
11. Ozyol E. et al. Graefes Arch Clin Exp Ophthalmol., 252(1), 71–75 (2014)
12. Sheard R.M. et al. Journal of cataract and refractive surgery, 29(5), 930–934 (2003)
13. Ge J. et al. Archives of Ophthalmology, 118(10), 1334–1337 (2000)
14. NICE. Medical technologies evaluation programme methods guide. Process and methods [PMG33], (2017)
15. Dhariwal, M et al. Clinical ophthalmology (Auckland, NZ), 13, 169.)
16. OBoyle D. et al. Post-Nd:YAG laser complications in cataract patients treated for posterior capsular opacification: a systematic literature review, Poster presented to ISPOR 2018
17. Alcon research: data on file (2018-2019)
18. Rijksinstituut voor Ziekte en Invaliditeitsverzekering (RIZIV). Nomenclatuur tariff part 9 issue 20190201 (2019)
19. Pineda R. et. al. Arch Ophthalmol., 128(7), 834–840 (2010)
20. Laurendeau C. et. al. J Med Econ., 12(3), 230–237 (2009)

Disclosure

OJB, RB, RM, CPV & DOB are employees of Alcon

Poster presented at the ISPOR Europe meeting, 2-6 November 2019 in Copenhagen, Denmark