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Australia and New Zealand Horizon Scanning Network

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Horizon Scanning Technology Prioritising Summaries

AcrySof® ReSTOR® Multifocal Intraocular Lens

March 2006
(Updated May 2007)



ASERNIPs

**Australian
Safety
and Efficacy
Register
of New
Interventional
Procedures -
Surgical**



**Royal Australasian
College of Surgeons**

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The production of this Horizon scanning prioritising summary was overseen by the Health Policy Advisory Committee on Technology (HealthPACT), a sub-committee of the Medical Services Advisory Committee (MSAC). HealthPACT comprises representatives from health departments in all states and territories, the Australia and New Zealand governments; MSAC and ASERNIP-S. The Australian Health Ministers' Advisory Council (AHMAC) supports HealthPACT through funding.

This Horizon scanning prioritising summary was prepared by staff from the Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP-S).

Name of Technology:

AcrySof® ReSTOR® Multifocal Intraocular Lens (IOL) (Alcon, Inc., Fort Worth, TX, USA).

Purpose and Target Group:

The ReSTOR IOL is designed to treat aphakia, or absence of the natural lens of the eye, which usually results from surgical removal of a cataractous lens. ReSTOR lenses are indicated for adults with or without long-sightedness (presbyopia) who wish to reduce their dependence on glasses (Austin Eye Clinic 2006).

Stage of Development (in Australia):

- Experimental
- Investigational
- Nearly established
- Established
- Established but changed indication or modification of technique
- Should be taken out of use
- Not yet emerged in Australia

The AcrySof ReSTOR Multifocal IOL is registered in the Australian Register of Therapeutic Goods (ARTG number: 92318, Product ID: 162927).

International Utilisation:

COUNTRY	LEVEL OF USE		
	Trials underway	Limited use	Widely diffused
Europe		✓	
United States		✓	

Impact Summary:***Background***

Cataracts are cloudy areas of accumulated protein that form on the lens of the eye. They cause vision impairment by limiting the amount of light which is able to reach the retina (eMedicine.com 2005a). Symptoms of cataract formation typically include blurred and reduced vision, faded colour perception, glare, light sensitivity and impaired night vision (AIHW 2005b).

Advancing age is the leading risk factor for the development of cataracts, although factors such as smoking, diabetic complications, prolonged sunlight exposure, eye trauma or chronic inflammation, family history and congenital factors (such as infection in pregnant women),

arthritis, short-sightedness, certain blood pressure medications and prolonged steroid use are also thought to play a causative role (Better Health Channel 2002e; Viva! Communications 2005).

Medical and surgical treatments are the primary means of tackling the condition. Mild cataracts, where vision is not significantly impaired, either require no treatment or are managed conservatively by prescribing glasses (Leyland and Zinicola 2003). In severe cases, surgery to remove the cataractous lens may be required. In developed countries, an IOL is implanted at the time of cataract surgery to replace the natural lens and help regain some of the focussing ability of the eye (Better Health Channel 2002d; eMedicine.com 2005b).

Traditionally, IOL implants have been monofocal in design and only capable of restoring a patient's distance vision (Access Media Group 2005). As a result, recipients still required reading glasses to achieve good near vision. Multifocal IOLs were developed to overcome the restrictions of monofocal IOLs and restore near and distance vision in recipients (Access Media Group 2005).

Early generation multifocal IOLs, such as Crystalens® by Eyeonics, Inc. (Aliso Viejo, CA, USA), achieved near and distance vision by relying on the mechanical action of the ciliary muscle to adjust the lens by a process of accommodation, similar to the movement of natural lenses. This approach, however, requires a period of time for re-training and adjustment of the eye musculature and places added pressure on the ciliary muscle, which naturally deteriorates over time (The Medical Management Services Group 2005). ReSTOR lenses, on the other hand, do not rely on the ciliary muscle. Instead, they use adaption technology (a gradual layering of diffractive gradations radiating from the centre of the lens) to appropriately distribute light to the near and distant focal points of the retina without the need for any mechanical movement of the lens (The Medical Management Services Group 2005). The result is a simultaneous improvement in both near and distance vision that is not dependent on the mechanical movement of the eye musculature and a reduction in the dependence on glasses or contact lenses. Once the natural lens of the eye is removed, it cannot be replaced. However ReSTOR lenses can be removed, if need be, and replaced with monofocal, bifocal or other multifocal IOLs (Austin Eye Clinic 2006).

Clinical Need and Burden of Disease

In 2004 it was estimated that there was approximately 1.5 million Australians aged 55 or over living with untreated cataracts (AIHW 2005a). Advancing age accounts for significant increases in cataract prevalence, rising from about 2.5% in middle-aged cohorts to as much as 99% prevalence in those aged 90 years and over (AIHW 2005c; Better Health Channel 2002c). As a result, cataract surgery is one of the most commonly performed surgical procedures (Better Health Channel 2002a; Viva! Communications 2005). In 1999, as many as 120,000 cataract procedures were performed in Australia (Better Health Channel 2002b).

While the majority of patients with mild cataracts are not bothered by the need to wear glasses, some patients prefer the convenience of unaided near and distance vision (Leyland and Zinicola 2003). In addition, patients suffering from more severe cataracts may benefit substantially from a multifocal IOL implant.

Estimated Speed and Geographic and Practitioner Use Patterns of Diffusion in the Health System

The United States Food and Drug Administration (FDA) granted approval for the commercial distribution of the AcrySof ReSTOR Multifocal IOL on March 21, 2005. In Europe the ReSTOR lens has already received the Conformité Européenne (CE) Mark and has been commercially available since April 4, 2003 (Austin Eye Clinic 2006). Although the ReSTOR lens is currently available in Australia, the extent of its use is currently not known.

Existing Comparators

- ReZoom™ (Advanced Medical Optics, Inc., Santa Ana, CA, USA)
- Crystalens® (Eyeonics, Inc., Aliso Viejo, CA, USA)

Estimated Cost Impact

The fee for the implantation of ReSTOR lenses has been reported at US\$4600 per eye (inclusive of surgeon fee, ReSTOR lens, operating room fee and IOL adjustment) (Austin Eye Clinic 2006). Implantation of ReSTOR lenses is not regarded as a medical necessity, so most insurance companies do not cover the costs. In some cases the cataract surgery may be covered, but not the insertion of the lens (Austin Eye Clinic 2006). In Australia, the cost of implanting ReSTOR lenses in June 2004 was approximately AU\$3500, inclusive of some Medicare reimbursement (The Sydney Morning Herald 2005).

The Medicare Benefits Schedule item numbers, reimbursements and number of claims between July 2004 and June 2005 for treatments associated with the extraction of the natural lens, insertion and removal of artificial lens are outlined in Table 1.

Table 1 Year 2006 Medical Benefits Schedule of Fees for cataract surgery and lens replacement

Category	Item Number	Benefit	Number of Claims July 2004 to June 2005
Lens extraction and insertion of an artificial lens	42702	\$779.05	105,320
Insertion of an artificial lens into the posterior chamber	42703	\$495.10	101
Artificial lens removal and replacement with a lens inserted into the posterior chamber	42710	\$780.95	58

Efficacy and Safety Issues

List of Studies Found

Total number of studies	3
Non-randomised comparative studies	2
Case series studies	1

The studies included in this summary are highlighted in bold in the reference list. One of the non-randomised comparative studies consisted of unpublished data submitted to the FDA in 2004 by Alcon, Inc. as part of a Premarket Approval Application. Data from the case series study by Oliveira *et al.* (2005) were derived from the English abstract since the full text was published in Portuguese.

Visual Acuity

The data presented to the FDA were obtained from clinical trials conducted in Europe and the United States. Of the 802 participants, 760 were evaluated after one year. In these 760 patients, 566 received a ReSTOR implant in one eye (monocular) and 194 patients received a monocular monofocal lens implant (control group). Of these, 549 of the 566 monocular ReSTOR recipients received an implant in the second eye, while 181 of the 194 monocular monofocal lens recipients also had an implant placed in the second eye, resulting in 730 binocular implantations.

For monocular implantation, ReSTOR recipients exhibited significantly lower (P value not stated) uncorrected and best corrected distance acuity, compared to the control group. Six months after surgery, binocular ReSTOR lens recipients achieved similar distance vision acuity to patients who had monofocal lenses implanted in both eyes. However, no 12-month data were available for patients with binocular implants.

Photopic near visual acuity (uncorrected, distance corrected and best corrected) for monocular implants at 6 and 12 months post-surgery was better in ReSTOR lens recipients, compared to the control group. This was also true for binocular implants at 6 months post-implantation.

Intermediate photopic visual acuity data at 6 months post-implantation were only available for a subset of patients receiving binocular implants (n = 34 ReSTOR group; n = 27 control group). The uncorrected and distance corrected intermediate visual acuity was measured in ReSTOR and monofocal lens recipients. Overall, the percentage of recipients who achieved 20/40 vision at 50, 60 and 70 cm was greater in the ReSTOR patient group. More specifically, uncorrected visual acuity results revealed that at a distance of 50 cm significantly more (P < 0.05) ReSTOR recipients achieved 20/40 vision (or better) than monofocal lens recipients.

Contrast Acuity

The FDA trial showed that ReSTOR recipients had contrast acuity that was clinically equivalent to the control group under various lighting conditions. The limited data available in the abstract of Oliveira *et al.* (2005) stated that patients with binocular ReSTOR implants achieved contrast sensitivity and stereopsis results congruent with those of phakic and pseudophakic patients.

Frequency of Spectacle Wear

Data regarding the effect of ReSTOR lenses on the frequency of spectacle wear in patients with binocular implants revealed that over 90% of patients no longer required spectacles for distance vision, compared to 62% of monofocal control lens recipients. The difference in spectacle requirement for near vision was even more dramatic. Over 80% of ReSTOR recipients no longer used spectacles for near vision as opposed to only 7.7% in the control group.

Visual Quality and Disturbances

Visual disturbance results from the FDA trial demonstrated that patients with monocular ReSTOR implants experienced night vision problems, including glare, flare and presence of halos, more often (P < 0.05) than patients with the monofocal control lens implant. However, the degree of visual disturbance was similar between the groups for binocular implants.

A prospective non-randomised comparative study of four different types of IOL implants (including ReSTOR) measured differences in visual quality (Rocha *et al.* 2005). The study revealed that ReSTOR lens recipients experienced significantly (P < 0.05) less spherical, mean total and mean high order aberrations than patients receiving the monofocal IOLs.

Safety Issues and Contraindications

Data from clinical trials show that insertion of ReSTOR lenses poses no safety concerns for recipients. Patients involved in clinical trials presented to the FDA reported no occurrences of any persistent adverse events associated with the implantation of ReSTOR lenses. There are no known contraindications for ReSTOR lenses.

2007 update

The reading ability obtained using three different multifocal IOLs were investigated by Hutz et al. (2006) in a randomised study. Sixty cataract patients (120 eyes) were randomised to receive different IOLs: SA40N IOL (AMO) (Group 1, n = 20), Tecnis ZM001 IOL (AMO) (Group 2, n = 20) and AcrySof ReSTOR IOL (Alcon) (Group 3, n = 20). Six-week postoperative results showed that no significant difference in pupil size was observed between groups under low-light or bright-light conditions. The study also demonstrated that Tecnis ZM001 IOL recipients generally experienced better near visual acuity and reading speed than patients in the two other groups under low light conditions. However, under bright-light conditions ReSTOR lens recipients performed significantly better than the other two groups.

Souza et al. (2006) reported the results from a comparative study in which patients received binocular implantation of ReSTOR IOLs (n = 25) or standard monofocal IOLs (n = 15) following cataract surgery. Patients were followed-up until 120 to 180 days postoperatively. Results showed that monocular distance uncorrected and best-corrected visual acuity did not significantly differ between the two groups. However, mean monocular and binocular uncorrected and distance corrected near visual acuities were significantly better in ReSTOR recipients than monofocal IOL recipients ($p < 0.001$). In terms of coma, spherical, high-order and total aberrations, only spherical aberrations were significantly lower in ReSTOR recipients ($p < 0.001$). ReSTOR recipients also experienced lower photopic contrast sensitivity ($p < 0.001$). There were no statistically significant differences between groups in terms of reading speed or stereopsis. In terms of quality of life, both groups were comparable regarding satisfaction performing distance activities without glasses in different lighting conditions, but significantly differed for near activities where ReSTOR recipients performed better ($p < 0.001$).

Alfonso et al. (2007) conducted a study of 670 eyes in 355 patients to reveal any correlations between pupil size and visual acuity and contrast sensitivity following implantation of the ReSTOR IOLs. The study reported that larger pupils were significantly correlated to better best-corrected distance visual acuity ($r = 0.297$; $p = 1.36 \times 10^{-8}$) and worse best distance-corrected near visual acuity ($r = 0.276$, $p = 1.02 \times 10^{-7}$). Additionally, distance contrast sensitivity was found to be better in patients with larger pupils at all spatial frequencies in bright-light and dim-light conditions ($p < 0.01$).

Results from a multicenter European trial of 127 patients with cataractous eyes showed that at six weeks postoperatively high spectacle independence was achieved with 88.0% and 84.6% of ReSTOR patients for distance and near vision respectively (Kohnen et al. 2006). However glare and halos were reported as severe in 8.5% of patients and as moderate in 4.2% of patients. After monocular implantation, 92% of patients indicated they would choose to have the same lens implanted again, while after binocular implantation 95.7% of patients indicated likewise.

Results from a large 112 patient (224 eyes) case series study which divided eyes

into myopic or hyperopic demonstrated that at six months postoperatively all patients achieved uncorrected distance visual acuity of 20/25 or better (Fernandez-Vega et al. 2007). Both safety and efficacy indexes were similar in both groups at distance but were larger for hyperopic patients at near distance.

Further evidence of the ability of the ReSTOR IOLs to improve vision has been documented by smaller studies. For example Rekas and Zelichowska (2006) reported a case series study in which 10 patients (20 eyes) experienced restoration of good visual acuity with the ReSTOR IOLs independent of distance without the occurrence of major adverse events. Similar results were also reported by Blaylock et al. (2006) in another case series of 20 patients (37 eyes) who concluded that ReSTOR IOL implantation is able to offer good visual acuity at distance and near distance.

2007 Recommendation

The existing evidence base for the ReSTOR lens supports its ability to improve vision. The randomised controlled trial by Hutz et al. (2006) revealed that in bright-light conditions, the ReSTOR lens appears to be superior to the SA40N and the Tecnis ZM001; while Souza et al. (2006) reports that the ReSTOR has substantial advantages to monofocal IOLs. Overall, ReSTOR lenses appear to be relatively safe and effective in correcting vision with a high rate of patient satisfaction. However, there is insufficient evidence to produce a horizon scanning report.

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| <input type="checkbox"/> Horizon Scanning Report | <input type="checkbox"/> Full Health Technology Assessment |
| <input checked="" type="checkbox"/> Monitor | <input type="checkbox"/> Archive |

References

Alfonso J, Fernandez-Vega L, Begoña Baamonde M, Montes-Mico R. Correlation of pupil size with visual acuity and contrast sensitivity after implantation of an apodized diffractive intraocular lens. *Journal of Cataract and Refractive Surgery* 2007; 33(3): 430-438.

Blaylock J, Si Z, Vickers C. Visual and refractive status at different focal distances after implantation of the ReSTOR multifocal intraocular lens. *Journal of Cataract and Refractive Surgery* 2006; 32(9): 1464-1473.

Fernandez-Vega L, Alfonso J, Rodriguez P, Montes-Mico R. Clear lens extraction with multifocal apodized diffractive intraocular lens implantation. *Ophthalmology* 2007 [Epub ahead of print].

Hutz W, Berthold Eckhardt H, Rohrig B, Grolmus R. Reading ability with 3 multifocal intraocular lens models. *Journal of Cataract and Refractive Surgery* 2006; 32(12): 2015-2021.

Kohnen T, Allen D, Boureau C, Dublineau P, Hartmann C, Mehdorn E, Rozot P, Tassinari G. European multicenter study of the AcrySof ReSTOR apodized diffractive intraocular lens. *Ophthalmology* 2006; 113(4): 578-584.e1.

Rekas M and Zelichowska B. Multifocal diffractive intraocular lenses in cataract surgery – preliminary report. *Klinika Oczna* 2006; 108(4-6): 186-190.

Rekas M and Zelichowska B. Multifocal diffractive intraocular lenses in cataract surgery – preliminary report. *Klinika Oczna* 2006; 108(4-6): 186-190.

Souza C, Muccioli C, Soriano E, Chalita M, Oliveira F, Freitas L, Meire L, Tamaki C, Belfort R. Visual performance of AcrySof ReSTOR apodized diffractive IOL: A prospective comparative trial. *American Journal of Ophthalmology* 2006; 141(5): 827-832.

Ethical Issues

No issues were identified from the retrieved literature.

Cultural or Religious Considerations

No issues were identified from the retrieved literature.

Other Issues

Although no contraindications were identified in the literature retrieved, the manufacturer has outlined warnings and precautions for the use of the lenses in the Brief Product Statement. In addition, patient selection has been identified as a key factor influencing the degree of success, suggesting that this product may not be suitable for all patients.

Recommendation:

No published studies comparing ReSTOR lenses and other multifocal IOLs were located. The largest data set available on the ReSTOR lens comes from unpublished data submitted to the FDA. The limited evidence indicates that the ReSTOR IOL improves distance and near vision acuity and reduces dependency on spectacles for near and distance vision, compared to monofocal lens implants. Based on the information available, it is recommended the following be conducted:

- | | |
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| <input type="checkbox"/> Horizon Scanning Report | <input type="checkbox"/> Full Health Technology Assessment |
| <input checked="" type="checkbox"/> Monitor | <input type="checkbox"/> Archive |

Note: At the time of writing there are no cost-effectiveness data regarding the ReSTOR lenses. ReSTOR lenses are significantly more expensive compared to other lenses and unless the additional cost is justified it is difficult to recommend the use of this lens above other alternatives.

References:

- Access Media Group. Cataract News. Access Media Group. Last updated 2005.
http://www.allaboutvision.com/conditions/cataracts_news.htm [Accessed January 2006].
- AIHW. Vision problems in older Australians. Australian Institute of Health and Welfare. Last updated July 2005b.
<http://www.aihw.gov.au/publications/aus/bulletin27/bulletin27.pdf>
- AIHW. Vision problems in older Australians. Australian Institute of Health and Welfare. Last updated July 2005a.
<http://www.aihw.gov.au/publications/aus/bulletin27/bulletin27.pdf>
- AIHW. Vision problems in older Australians. Australian Institute of Health and Welfare. Last updated July 2005c.
<http://www.aihw.gov.au/publications/aus/bulletin27/bulletin27.pdf>
- Austin Eye Clinic. Crystalens, ReSTOR lens & other surgical options to correct presbyopia. Austin Eye Clinic. Last updated 2006. <http://www.austin-eye.com/restor.htm> [Accessed January 2006].
- Better Health Channel. Cataracts explained. Better Health Channel. Last updated November 2002c.
http://www.betterhealth.vic.gov.au/bhvc2/bhcarticles.nsf/pages/Cataracts_explain_ed [Accessed January 2006c].
- Better Health Channel. Cataracts explained. Better Health Channel. Last updated November 2002d.
http://www.betterhealth.vic.gov.au/bhvc2/bhcarticles.nsf/pages/Cataracts_explain_ed [Accessed January 2006d].
- Better Health Channel. Cataracts explained. Better Health Channel. Last updated November 2002b.
http://www.betterhealth.vic.gov.au/bhvc2/bhcarticles.nsf/pages/Cataracts_explain_ed [Accessed January 2006b].
- Better Health Channel. Cataracts explained. Better Health Channel. Last updated November 2002a.
http://www.betterhealth.vic.gov.au/bhvc2/bhcarticles.nsf/pages/Cataracts_explain_ed [Accessed January 2006a].
- Better Health Channel. Cataracts explained. Better Health Channel. Last updated November 2002e.
http://www.betterhealth.vic.gov.au/bhvc2/bhcarticles.nsf/pages/Cataracts_explain_ed [Accessed January 2006e].
- eMedicine.com. Cataracts. eMedicine.com, Inc. Last updated January 2005a.
<http://www.emedicinehealth.com/articles/1439-1.asp> [Accessed January 2006a].
- eMedicine.com. Cataracts. eMedicine.com, Inc. Last updated January 2005b.
<http://www.emedicinehealth.com/articles/1439-1.asp> [Accessed January 2006b].

- Leyland M and Zinicola E. Multifocal versus monofocal intraocular lenses after cataract extraction. *The Cochrane Database of Systematic Reviews* 2003;
- Rocha KM, Chalita MR, Souza CEB, Soriano ES, Freital LL, Muccioli C, Belfort R. Postoperative wavefront analysis and contrast sensitivity of a multifocal apodized diffractive IOL (ReSTOR) and three monofocal IOLs. *Journal of Refractive Surgery* 2005; **21**(6)
- The Medical Management Services Group. ReSTOR, Crystalens & ReZoom lens replacement surgery. The Medical Management Services Group, L.L.C. Last updated 2005. <http://www.seewithlasik.com/docs/crystalens-restor-lens.shtml> [Accessed January 2006].
- The Sydney Morning Herald. Lens removes cataracts and glasses. The Sydney Morning Herald. Last updated December 2005. [Accessed January 2006].
- Viva! Communications. VNR Media alert: Revolutionary all-in-one lens set to restore full range of vision for people living with cataracts. Viva! Communications. Last updated 2005. <http://www.vivacommunications.com.au/cataracts/> [Accessed January 2006].

Search Criteria:

A search of MEDLINE, PubMed, *The Cochrane Library*, the Current Controlled Trials metaRegister, the UK National Research Register, the International Network of Agencies for Health Technology Assessment, relevant online journals and the Internet was conducted in January 2006.

Search terms used were:

'ReSTOR', 'intraocular lens', 'multifocal apodized diffractive IOL', 'multifocal posterior chamber intraocular lens', 'hydrophobic intraocular lens', and 'Acrysof ReSTOR.'

This Horizon Scanning Prioritising Summary was prepared by Mr. Luis Zamora from the NET-S Project, ASERNIP-S for the Health Policy Advisory Committee on Technology (Health PACT), on behalf of the Medical Services Advisory Committee (MSAC) and the Australian Health Ministers' Advisory Council (AHMAC).