

# Cost-Effectiveness Comparison Between Monofocal and Multifocal Intraocular Lens Implantation for Cataract Patients in Taiwan

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## ABSTRACT

**Purpose:** Our aim was to conduct a cost-effectiveness analysis (CEA) of monofocal and multifocal intraocular lenses (IOLs) for cataract patients in Taiwan.

**Methods:** This prospective nonrandomized study was designed to evaluate the effectiveness of monofocal and multifocal IOLs by means of visual performance, visual quality, vision-related quality of life, and spectacle-independence rates. The direct costs were calculated using the payment points of the fee schedule for medical services multiplied by the treatment items. The concept of incremental cost effectiveness ratios was used to evaluate the costs of different types of IOLs in cataract surgery and postoperative outcomes in patients.

**Findings:** A total of 61 patients from the monofocal IOL group (n = 21), multifocal IOL group 1 (n = 22), and multifocal IOL group 2 (n = 18) who completed the study were included in the analysis. No significant differences were observed in mean ages or patient to eye ratio. Significant differences in effectiveness after the implantations of monofocal and multifocal IOLs were observed for spectacle-free rate and monocular contrast sensitivity under glare conditions only. The incremental cost-effectiveness ratios of monofocal versus multifocal IOLs indicated that it cost an additional \$57 to \$58 (US dollars) to increase each 1% of the spectacle-independence rate.

**Implications:** This study's results indicated that multifocal IOLs provided better effectiveness on vision-related indicators like the incremental cost effectiveness ratios of postoperative spectacle-independence rate and binocular best-corrected visual acuity measurements at near vision. Our findings suggest that

multifocal IOLs can be highly cost effective for patients who prefer to be spectacle free, so it is important to ensure that patients have realistic expectations when making choices between monofocal and multifocal IOLs. (*Clin Ther.* 2014;36:1422–1430) © 2014 Elsevier HS Journals, Inc. All rights reserved.

**Key words:** cataract, CEA, cost-effectiveness analysis, ICER, incremental cost effectiveness ratio, intraocular lens, IOL, visual performance.

## INTRODUCTION

Cataract surgery is one of the most effective health care interventions and produces great health gains for a substantial number of patients at relatively low cost.<sup>1–5</sup> Conventional monofocal artificial intraocular lenses (IOLs) are used to replace the original lens after cataract surgery and remain the standard cost situated in the reimbursement systems of many countries. However, after implantation, most patients need spectacles for at least near vision. Multifocal IOLs were developed by applying the principle of simultaneous vision to provide improvements on visual-function restoration for near and distance vision and to free patients from spectacles for presbyopia after cataract surgery.<sup>6–8</sup> Differences in visual performance achieved with multifocal IOLs depend on the optical principle and IOL designs.

Many studies have been conducted to evaluate the effects of implementation of various IOLs on visual

Accepted for publication July 21, 2014.

<http://dx.doi.org/10.1016/j.clinthera.2014.07.009>

0149-2918/\$ - see front matter

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performance and quality of life (QOL) in cataract patients.<sup>7,9-11</sup> Javitt et al<sup>12</sup> compared the differences in visual performance, patient satisfaction, and QOL between cataract patients after cataract surgery and implantation of multifocal or monofocal IOLs in a multicenter randomized clinical trial. The results indicated that the patients receiving multifocal IOLs achieved a best-corrected visual acuity (BCVA), had less restrictions of visual performance, spectacle independence, and increased QOL.<sup>12</sup> In 2007, Zeng et al<sup>13</sup> conducted a study comparing the differences in aberration and contrast sensitivity (CS) in 124 patients after cataract surgery and implantation of aspheric, multifocal, or monofocal IOLs and showed that multifocal IOLs improved near vision, led to increased high-order aberrations, and reduced CS. The results suggested that aspheric IOLs were more effective in decreasing aberrations and improving CS.<sup>13</sup> In addition, Tzelikis et al<sup>14</sup> explored the outcomes of aberration and CS in 25 cataract patients implanted with aspherical or spherical IOLs after binocular cataract surgery in 2008. The effectiveness of different IOLs implanted in patients receiving the same IOLs in both eyes was evaluated and compared. Apart from lowered high-order aberration and spherical aberration observed in the patients receiving aspherical IOLs, improved CS was also noted in patients reporting glare and halo.<sup>14</sup>

Orme et al<sup>15</sup> evaluated the cost effectiveness of different approaches using AMO Array multifocal and monofocal IOLs for patients undergoing bilateral cataract surgery in 2002. Their findings revealed that the medical cost was higher in cataract patients receiving AMO Array multifocal IOLs compared with monofocal IOLs. However, patient satisfaction with the implantation of AMO Array multifocal IOLs was higher, as a consequence of the patients experiencing an improved visual performance, such as night vision. In addition, multifocal IOLs were a small additional medical cost when compared with monofocal IOLs.<sup>15</sup> Multifocal IOLs were also found to result in better uncorrected near visual acuity than monofocal IOLs and, in recent studies, were reported to provide good uncorrected distance visual acuity in most cases.<sup>16,17</sup>

According to the literature described here, the effects of implantation of different IOLs on visual performance and QOL have been investigated extensively. Because patients bear the additional costs, it is important to assess the value of multifocal IOLs from

their perspective. However, only a few studies have reported on the costs associated with spectacles after cataract surgery.<sup>15,18-21</sup> A cost-effectiveness analysis (CEA) is considered an important tool in rationalizing health care spending. The CEAs of cataract surgery were mostly expressed as the cost per disability-adjusted life-years or quality-adjusted life-years gained.<sup>1-5</sup> However, there was wide variability among the different studies conducted in various countries, due to differences in reimbursement systems, models used, and costs included. The difference in cost effectiveness attributed to the associated costs of various IOL implants has not been explored in Taiwan. Therefore, the aim of the present study was to conduct an analysis of the costs of bilateral implantation of different IOL models (2 multifocal and 1 monofocal), surgical procedure, and postoperative visual performance and QOL to achieve the goal of maximum effectiveness at the lowest cost.

## METHODS

This observational study included patients scheduled for routine cataract surgery in the Department of Ophthalmology, Taipei City Hospital, Heping Fuyoy Branch between August 1, 2009, and July 31, 2011. The study protocol was approved by the Institutional Review Board of Taipei City Hospital and was conducted in compliance with the Declaration of Helsinki. Ninety patients aged 50 to 80 years with bilateral cataracts and without concurrent retinopathy, glaucoma, optic neuropathy, uveitis, or history of intraocular surgery (such as refractive surgery) were enrolled. They were categorized into 3 groups (1 monofocal and 2 multifocal groups) in accordance with the types of IOLs chosen. Patients with visually significant coexisting ocular pathologies or who were unwilling to respond to the questionnaires were excluded. Only patients who completed the study were taken into account in the analysis.

### Parameters of Effectiveness and Costs

The patients enrolled in the monofocal group received the Acrysof SA60AT lens (Alcon Laboratories, Inc., Ft Worth, TX) and 2 multifocal groups received either the Tecnis ZM900 (AMO) or AcrySof ReSTOR IQ lens (Alcon Laboratories, Inc.). Visual performance and several vision-related QOL indexes were the parameters of effectiveness used in this study. Visual and patient-reported outcomes at 1 month

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