Functional Indications for Upper Eyelid Ptosis and Blepharoplasty Surgery

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Objective: To evaluate the functional indications and outcomes for blepharoplasty and blepharoptosis repair by assessing functional preoperative impairment and surgical results.

Methods: Literature searches of the PubMed and Cochrane Library databases were conducted on July 24, 2008, with no age or date restrictions, and they were limited to articles published in English. These searches retrieved 1147 citations; 87 studies were reviewed in full text, and 13 studies met inclusion criteria and were included in the evidence analysis.

Results: The 13 studies reported the functional effects or treatment results of simulated ptosis; several types of blepharoptosis repair, including conjunctiva-Müller's muscle resection, frontalis suspension, and external levator resection; and upper eyelid blepharoplasty.

Conclusions: Repair of blepharoptosis and upper eyelid dermatochalasis provides significant improvement in vision, peripheral vision, and quality of life activities. Preoperative indicators of improvement include margin reflex distance 1 (MRD_1) of 2 mm or less, superior visual field loss of at least 12 degrees or 24%, down-gaze ptosis impairing reading and other close-work activities, a chin-up backward head tilt due to visual axis obscuration, symptoms of discomfort or eye strain due to droopy lids, central visual interference due to upper eyelid position, and patient self-reported functional impairment.

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The American Academy of Ophthalmology prepares Ophthalmic Technology Assessments to evaluate new and existing procedures, drugs, and diagnostic and screening tests. The goal of an Ophthalmic Technology Assessment is to systematically review the available research for clinical efficacy, effectiveness, and safety. After appropriate review by members of the Ophthalmic Technology Assessment Committee, other Academy committees, relevant subspecialty societies, and legal counsel, assessments are submitted to the Academy's Board of Trustees for consideration as official Academy statements. The purpose of this assessment is to evaluate the functional indications for blepharoplasty and blepharoptosis repair by assessing functional preoperative impairment and surgical outcomes.

Background

Drooping upper eyelids are frequently a cause of visual symptoms and an indication for surgical intervention. The condition of drooping upper eyelids occurs as a result of a number of distinct diagnoses, which are treated by different operative procedures. Blepharoptosis (or ptosis) is a downward displacement of the upper eyelid margin. Ptosis results from myogenic, involutional, neurogenic, mechanical, traumatic, or developmental causes. Dermatochalasis refers to an excess of eyelid skin. The underlying muscle, connective tissue, and fat can also be excessive. Although dermatochalasis is most often an involutional problem, the excess eyelid skin may result from specific disorders, such as thyroid eye disease, floppy eyelid syndrome, blepharochalasis syndrome, trauma, or any condition that causes stretching of the upper eyelid skin.

The upper lid is divided into anterior and posterior lamellae for the purpose of surgical planning and reconstruction. The anterior lamella consists of skin and orbicularis oculi muscle. The posterior lamella incorporates conjunctiva, tarsus, Müller's muscle, and the levator muscle with its aponeurosis. The orbital septum and orbital fat are present between these lamellae superiorly.

Eyelid ptosis occurs when there is a deficiency in the structure or function of Müller's muscle or the levator muscle/aponeurosis complex in the posterior lamella. Surgical repair involves tightening or repositioning these structures or replacing their function with a suspension attached to an adjacent structure. Operations commonly used include conjunctiva-Müller's muscle resection, Fasanella-Servat procedure, internal and external levator

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resection, levator aponeurosis repair, frontalis muscle suspension, and Whitnall's ligament suspension. In all of these procedures, the goal is to improve the elevation of the lid margin, which rests in an abnormally low position. All ptosis repair procedures, whether performed through an anterior or posterior approach, address posterior lamellar pathology or insufficiency.

Blepharoplasty surgery and ptosis surgery are distinctly different. They are performed to correct anatomic defects in different upper eyelid lamellae. In some instances, they may both use an upper eyelid crease incision. Upper eyelid blepharoplasty is an anterior lamellar procedure with a cutaneous incision, removing excess skin superior to the upper eyelid crease. Depending on the anatomic variations of specific patients, orbicularis oculi muscle, orbital septum, or orbital fat may also be repositioned or removed.

Surgery to correct upper eyelid ptosis and dermatochalasis traditionally has been performed for functional indications. However, in patients desiring a change in appearance, surgery may be performed for cosmetic reasons. The scope of this assessment is limited to functional surgery; it does not discuss cosmetic surgery or compare the effectiveness of the many available surgical techniques. This assessment addresses indications for surgical correction of ptosis and dermatochalasis and the functional improvement that can be anticipated when lid structure and function are improved or restored.

Functional surgical indications currently in common use include impaired visual acuity, decreased peripheral vision, a compensatory chin-up backward head tilt, difficulty reading, dermatitis, eye strain and fatigue, and difficulty wearing a prosthesis in an anophthalmic socket. These indications are discussed by physicians and patients when functional surgical repair is contemplated. Third-party health care reimbursement agencies increasingly are becoming involved in this dialogue and the decision-making process. We have reviewed the available data to evaluate the impairments caused by upper eyelid ptosis and dermatochalasis so that patients, physicians, and other concerned parties can more objectively assess the indications for and benefits of surgical correction.

Resource Requirements

Blepharoplasty and blepharoptosis repair for functional indications in adults are generally performed as an outpatient procedure with local anesthesia. Sedation and anesthesia monitoring are appropriate for many patients. General anesthesia may be used when combined procedures are performed or patients are intolerant of "conscious" surgery.

Questions for Assessment

The objective of this review is to evaluate the functional indications and outcomes of blepharoplasty and blepharoptosis repair by answering the following questions:

(1) What are the functional indications for surgery?
(2) What are the results of surgery?
(3) Does surgery for ptosis or dermatochalasis improve visual function or quality of life?

Description of Evidence

The literature searches were performed in the PubMed and Cochrane Library databases on July 24, 2008, with no age or date restrictions, and they were limited to English language articles. The search retrieved 1147 unique citations using the following search strategy:

> (*Blepharoptosis*[mesh] OR *eyelid drooping*[All Fields] OR *palpebral ptosis*[All Fields] OR blepharoptosis[tiab] OR eyelids[mesh] OR eyelid diseases[mesh]) AND (*surgery*[Subheading] OR repair[tiab] OR correction[tiab] OR correct[tiab] OR surgery[tiab] OR *Blepharoplasty*[mesh] OR blepharoplasty[tiab]) AND (decision[tiab] OR need[tiab] OR prompt[tiab] OR prompting[tiab] OR prompted[tiab] OR indications[tiab] OR indication[tiab] OR symptom[tiab] OR sign[tiab]) AND *English*[Language] and (*Blepharoptosis*[mesh] OR *eyelid drooping* [All Fields] OR *palpebral ptosis*[All Fields] OR blepharoptosis[tiab]) AND (*surgery*[Subheading] OR repair [tiab] OR correction[tiab] OR correct[tiab] OR surgery [tiab] OR *Blepharoplasty*[mesh] OR blepharoplasty[tiab]) OR (*postoperative complications*[MeSH Terms] OR outcome[tiab] OR *treatment outcome*[MeSH Terms] OR *prognosis*[MeSH Terms] OR prognosis[tiab] OR result[tiab] OR resulted[tiab] OR effect[tiab] OR impact[tiab]) AND *English*[Language].

Two of the authors (K.V.C. and E.A.B.) screened the retrieved titles and abstracts against the inclusion criteria, and 1060 citations were excluded (Fig 1). The inclusion criteria were that the publication was an original report, that it was relevant to surgical treatment of ptosis or upper eyelid dermatochalasis, that it reported a primary outcome of functional improvement, and that it had a follow-up period of at least 6 weeks (if a surgical series). The 2 authors divided the remaining 87 articles and reviewed the full text to assess their inclusion according to the inclusion criteria. Seventy-four of these studies were excluded. All authors participated in data abstraction of the full text of the remaining 13 articles,[1–13] and each study was abstracted independently by 2 authors. These studies were all case series that provided level III evidence.

Published Results

The 13 articles identified by the literature searches are summarized in Table 1 (available online at http://aaojournal.org). They report the effects or treatment results of simulated ptosis, conjunctiva-Müller's muscle resection, frontalis suspension, external levator resection, and upper eyelid blepharoplasty.

The study by Meyer et al[11] shows that superior visual field impairment is proportional to the extent of simulated ptosis.[11]

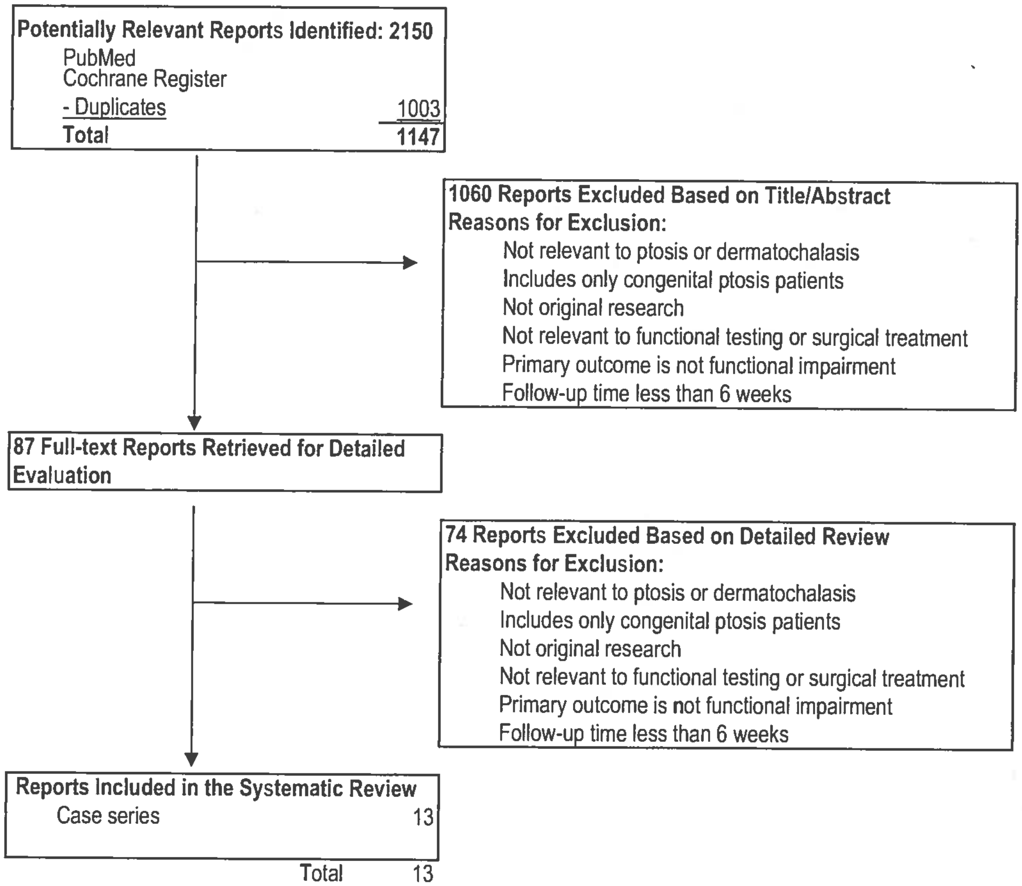

Figure 1. Reports evaluated for inclusion in the systematic review.

Two studies dealt with conjunctiva-Müller's muscle resection ptosis repair surgery. Brown and Putterman[5] documented that an average of 0.4 to 1.0 mm less upper eyelid margin elevation was achieved when a conjunctiva-Müller's muscle resection was combined with an upper eyelid blepharoplasty than when it was performed alone. The study by Perry et al[12] of conjunctiva-Müller's muscle resection combined with tarsectomy in more severe cases showed predictable results with or without concomitant blepharoplasty in a smaller study using their own algorithm. They did not find any worsening of dry eye symptoms.

Frontalis suspension ptosis repair for patients with severe ptosis and poor levator function was reported in 2 studies. Ben Simon et al[3] found similar results were achieved from single-loop suspension compared with a double-triangle technique using a variety of suspension materials. Bernardini et al[4] found that a 1-mm silicone rod used to create a margin reflex distance 1 (MRD_1) of 1 to 2 mm provided satisfactory functional results with a small risk of corneal exposure problems.

Seven studies dealt with external levator resection surgery and its outcomes. Altieri et al[1] reported that 11 patients with ptosis persisting after anterior segment surgery had an 81.8% incidence of subjective impaired quality of life. They achieved improved lid position with external levator surgery.

Dryden and Kahanic[6] documented that 9 of 127 patients (7.1%) who underwent external levator surgery were symptomatic of functional difficulties caused by greater ptosis present in down gaze. In 6 of the 9 patients, the superior field of vision and MRD_1 were measured preoperatively in primary gaze and 20 degrees down gaze. They had an average of 12.5 degrees greater superior visual field impairment and 1.9 mm decreased MRD_1 in down gaze than in primary gaze before surgery. All patients with symptomatic down-gaze ptosis had an MRD_1 of 2 mm or less in down gaze. This corresponded to superior visual field impairment of 32 degrees or more (64% superior visual impairment).

Erb et al[7] found that in 9 of 54 patients (17%) who underwent a unilateral external levator ptosis repair, the unoperated lid dropped 1 mm or more after surgery. This could not be predicted by preoperative studies, and 3 of the patients (5.6%) underwent subsequent surgery for contralateral ptosis. Frueh et al[10] showed that small incision external levator surgery outcomes were as good as or better than the outcomes in cases in which a full eyelid crease incision was performed. Shore et al[13] demonstrated that early postoperative external levator adjustments within 1 week of surgery were advantageous over waiting to perform later reoperations. The early reoperation reduced the time to final desired result, improved the ease with which the reoperation was performed, and provided potential cost savings.

Three of the studies dealt with upper eyelid blepharoplasty surgery outcomes. Brown and Putterman[5] found a diminished effect of conjunctiva-Müller's muscle resection ptosis repair when performed concomitantly with upper eyelid blepharoplasty. This was not documented in the smaller number of combined conjunctiva-Müller's muscle resection/blepharoplasty procedures reported by Perry et al.[12] Fagien[8] found that 6 of 28 eyebrows (21.4%) descended 2 mm or more after upper eyelid blepharoplasty. The patients in this study were still satisfied with their outcome.

The final 2 reports dealing with external levator surgery were prospective studies of the effect of unilateral and bilateral surgery on subjective visual function and quality of life outcome measures.

A prospective study of the effect of unilateral and bilateral ptosis surgery on subjective visual function and quality of life outcome measures was performed by Battu et al.[2] They adapted previously validated questionnaires pertaining to vision-related activities, symptoms, and well-being. Fifty consecutive adults ranging in age from 22 to 93 years (mean, 65 years) completed the questionnaires before ptosis surgery and 6 to 8 weeks after surgery. All of the patients had ptosis severe enough to cause visual field limitation, with MRD_1 of 2 mm or less. All patients achieved improved eyelid position after surgery. Statistically significant symptomatic improvement was achieved in patients who had unilateral and bilateral ptosis surgery for the categories identified as eye or eyelid appearance, must raise eyebrows to see, eyelids block vision, and superior visual field blocked. Significant symptomatic improvement was also achieved in patients who had bilateral ptosis surgery for the categories identified as vision and need to keep the head in a chin-up backward head tilt position. Surgical repair of both unilateral and bilateral ptosis led to statistically significant improvement in the performance categories of fine manual work, hanging or reaching for objects above eye level, reading, watching television, reading road signs or seeing stop lights above while driving, reading signs at the side of the road while driving, and working on a computer or typewriter. Patients who underwent bilateral ptosis repair also noted a significant improvement in performing housework or kitchen chores. Other symptoms and activities showed improvement after surgery but did not reach a level of statistical significance. There were no symptoms or activities that showed a mean worsening after ptosis surgery.

A subsequent functional outcome study of ptosis surgery was reported by Federici et al[9] using the same questionnaires before and after surgery as Battu et al.[2] In a larger cohort of 100 patients, ranging in age from 22 to 93 years (mean, 65.8 years), there was also a statistically significant improvement in ache around eyes, self-image, tearing, redness, burning, dryness, economic status, and general well-being in addition to the improved symptom categories in the previous study. Additional activity categories that showed statistically significant improvement were performing one's occupation, playing a sport, and walking without assistance. The patients' self-reported preoperative functional impairment was more strongly associated with their degree of functional improvement after surgery than were their preoperative eyelid measurements or visual field tests.

Discussion

Level III evidence case studies establish visual field impairment caused by ptosis in primary gaze and down gaze as a functional indication for surgical repair.[6,11] Various procedures have been used to safely achieve correction of ptosis and dermatochalasis.[1–10,12,13] Two of the case series were prospective studies that clearly documented improvement in visual function and quality of life as a result of ptosis surgery.[2,9]

Additional peer-reviewed research studies have been published that did not meet selection criteria but provide additional clarification for this discussion.

In addition to the study of simulated ptosis by Meyer et al,[11] 3 more studies[14–16] reported quantitative data on the effect of ptosis on the superior peripheral field of vision. Margin reflex distance 1[17,18] is the distance from the upper eyelid margin to the central corneal light reflex, which approximates the center of the pupil and the visual axis. The MRD_1 was found to be the measurement that was most predictive of field loss.[14] Each study used different perimetric techniques. Three investigators used Goldmann kinetic perimetry (Haag-Streit AG, Köniz, Switzerland) with different test-object sizes.[11,14,16] Two used suprathreshold static superior field tests with the Humphrey Field Analyzer (Carl Zeiss Meditec, Inc., Dublin, CA).[15,16] One of these used a 36-test point pattern,[15] and the other used 114 points.[16] Despite these testing variations, the results show similar relationships between ptosis and superior visual field loss (Fig 2). The unobstructed normal superior field measures approximately 50 degrees.[19] Visual field impairment can occur when the MRD_1 is less than 4 mm.[14,16] With an MRD_1 of 2 mm, the superior visual field impairment is in the range of 24% to 30%.[11,14–16] This corresponds to 12 to 15 degrees of superior visual field loss.

Meyer et al[20] demonstrated that more severe ptosis with an MRD_1 of approximately 0 mm impairs the horizontal and inferior visual field axes, in addition to impairing the superior visual field. This was evaluated using a custom static full-threshold perimeter test strategy. Contraction of the entire peripheral field of vision was noted. There was also decreased sensitivity over all of the remaining superior hemifield.

Visual impairment in down gaze due to ptosis was first reported by Waller et al[21] and subsequently addressed in 5 peer-reviewed publications.[6,22–25] Patipa's[24] prospective study demonstrated that superior visual field impairment with ptosis is present in 40 degrees downward reading gaze and in primary gaze. After ptosis surgery, the superior field of vision improved in both primary gaze and reading gaze. In addition, patients reported qualitative improvement in vision for reading, reading comfort and endurance, and vision for other tasks performed in reading gaze in the early period after surgery.

Wojno[25] reported 4 patients who exhibited little or no ptosis in primary gaze but had "significant and symptomatic

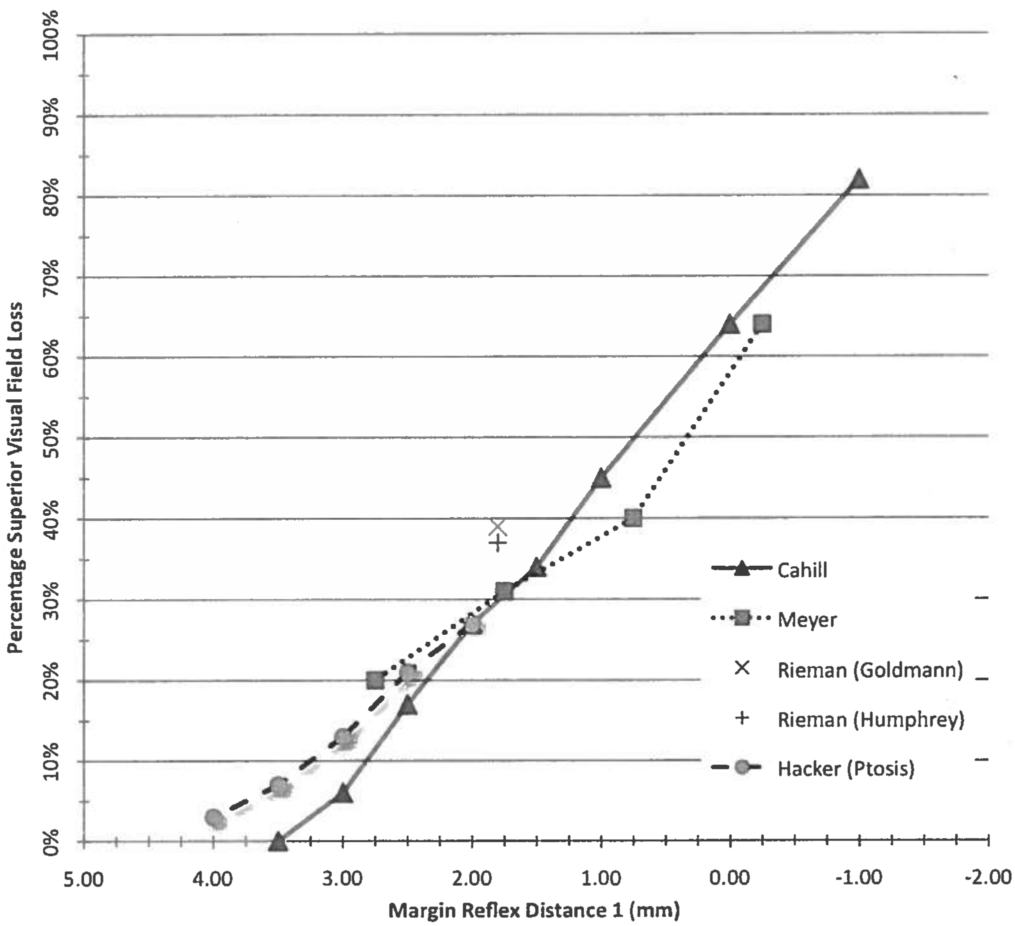

Figure 2. Superior visual field loss as a function of margin reflex distance 1 (MRD_1). The percentage of superior visual field loss is inversely related to MRD_1. The results of 4 investigations are similar despite differing perimetric techniques.

obstruction of the visual axis in down gaze" of 35 to 40 degrees. Minimal surgical aponeurotic advancement improved elevation of the eyelids in down gaze with little or no lid position change in primary gaze. Stoller and Meyer[26] reported that normal control patients have an MRD_1 that averages 1 mm less in down gaze than in primary gaze. The range of MRD_1 change was from 3 mm lower to 1 mm higher in down gaze. This substantiates Wojno's observations, including the functional benefit of ptosis surgery in patients with symptomatic ptosis only in down gaze.

Meyer and Rheeman[22] demonstrated that the MRD_1 in down gaze decreased an average of 0.8 mm compared with the MRD_1 in primary gaze in patients with acquired ptosis. Seventy-eight percent of the patients exhibited a decreased MRD_1, 2% had an increase, and 20% had no change in MRD_1 in down gaze compared with primary gaze. This was in contradistinction to patients with congenital myogenic ptosis, who characteristically show a lid lag with an increased MRD_1 in down gaze.

Olsen and Putterman[23] documented that 43% of 88 eyelids with adult-onset acquired ptosis had a vertical palpebral fissure height of 0 in 45 degrees down gaze. Thirty percent of the patients had subjective symptoms of inability to read or work in the down-gaze position for long periods of time, brow ache, fatigue, or having to manually elevate their eyelids to see in the down-gaze position. In the 34 patients who elected to have ptosis surgery, the mean MRD_1 in primary gaze was increased from a preoperative value of −0.1 to 3.3 mm after surgery. The vertical palpebral fissure height in down gaze increased from a preoperative average of 0.7 to 3.4 mm. Of the 14 operated patients with subjective preoperative functional impairment in down gaze, all obtained symptomatic relief through ptosis surgery. Decreased use of the frontalis muscle and brow after surgery was documented. The patients reported relief of their brow ache, fatigue, and inability to read or work in the down-gaze position.

In addition to the studies of functional outcome and quality of life improvement resulting from ptosis surgery by Battu et al[2] and Federici et al[9] already summarized, quality of life studies in large populations substantiate the significant association between visual field impairment and difficulty with driving activities, sense of dependency, mental health, subjective distance vision, and peripheral vision.[27] Each 10% loss in visual field corresponds with an 8% higher risk of falls in adults aged more than 65 years.[28] Loss of peripheral vision was more highly associated with falls than visual acuity, contrast sensitivity, stereo acuity, and central

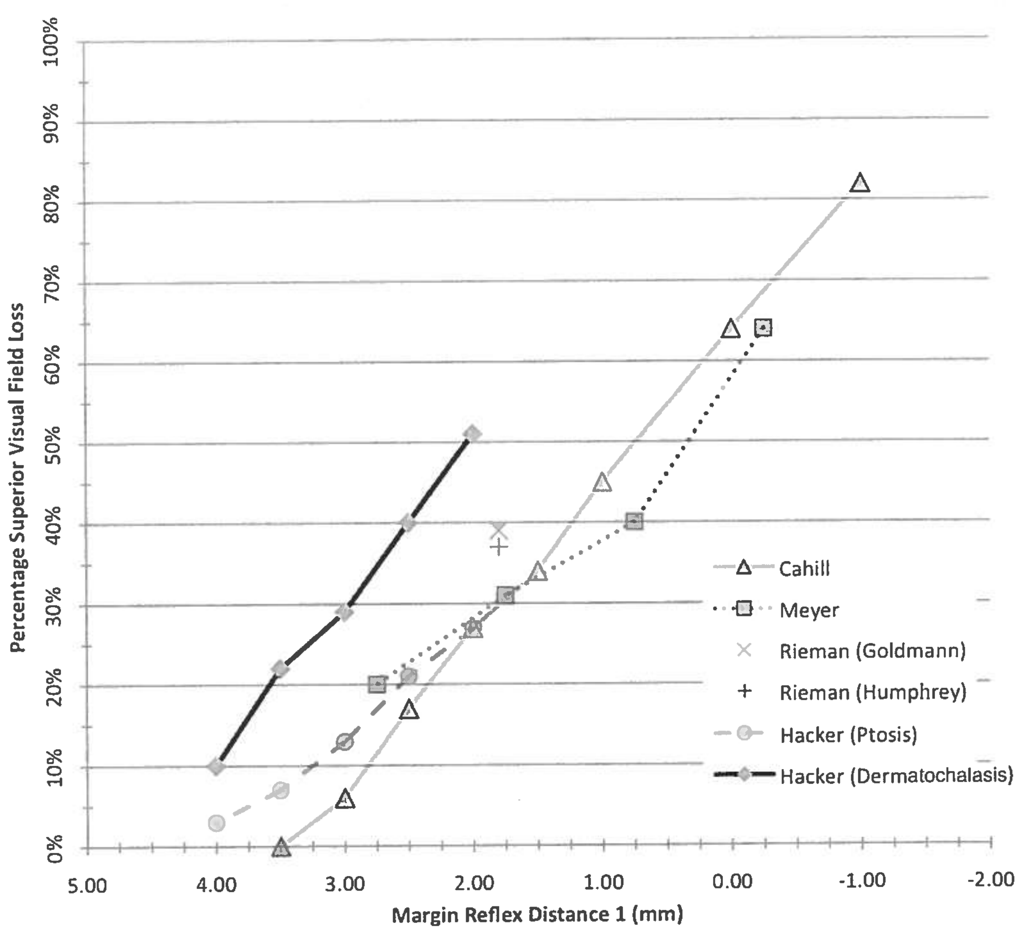

Figure 3. Superior visual field loss due to dermatochalasis. The percentage of superior visual field loss caused by dermatochalasis (*bold line*) is greater than what is caused by ptosis alone (*shaded plots*).

visual field loss. Superior visual field loss was just as important as inferior field loss. These findings are similar to the results of studies of patients with visual field loss due to glaucoma.[29]

Fewer studies have been performed measuring the impairment caused by dermatochalasis than have been performed studying the effects of ptosis. Hacker and Hollsten[15] documented the visual field impairment caused by dermatochalasis in 33 eyes of 17 patients who underwent upper eyelid blepharoplasty surgery. They noted the MRD_1 of the eyelids with dermatochalasis, but they did not quantify the severity of the dermatochalasis. There was significant superior visual field impairment exceeding the impairment that would result solely from the patients' MRD_1 (Fig 3). Superior visual field loss of 25% or more occurred in some patients with no eyelid margin ptosis. Two phenomena were proposed as causes for this. First, the fold of dermatochalasis can extend down farther inferiorly than the lid margin. Second, the dermatochalasis projects farther anteriorly than the margin, increasing the effect of hooding and obstruction of the superior visual field. Blepharoplasty surgery improved the superior field of vision but did not eliminate the visual field impairment because of concomitant ptosis in the patients with low MRD_1 values. For example, patients with an MRD_1 value of 2 mm and dermatochalasis had approximately 50% loss of superior visual field. After blepharoplasty surgery, they still had approximately 25% superior visual field loss from their remaining eyelid margin ptosis.

Temporal visual field loss has not been widely discussed with upper eyelid disorders, but it frequently accompanies the superior visual field loss caused by ptosis[14,20] and dermatochalasis, as reported in several studies noted earlier. This contributes to the disability documented in population studies of quality of life impairment due to visual field loss and in the American Medical Association Disability Standards.[27–30] Many states have a temporal visual field requirement for maintaining a driver's license, typically 50 degrees or more.[31] Requirements for a commercial driver's license are usually more stringent, with 70 degrees of temporal visual field often being necessary.[32]

In conclusion, the reviewed literature provides data indicating that ptosis and dermatochalasis independently impair visual field and patient well-being. These effects increase with more severe upper eyelid malposition. Although individuals may experience different symptoms with similar stages of impairment, the literature supports the following guidelines for indicating when surgical intervention is expected to provide functionally significant improvement.

Ptosis and upper eyelid blepharoplasty surgery were found to be functionally beneficial for each of these quantitative findings:

- MRD_1 of ≤2 mm measured in primary gaze[3,10,12]
- Superior visual field loss of 12 degrees or 24%[3,10,12]
- Down-gaze ptosis impairing reading documented by MRD_1 of ≤2 mm[7] measured in down gaze

Ptosis and upper eyelid blepharoplasty were also found to be functionally beneficial for the following qualitative findings:

- Self-reported functional impairment from upper eyelid droop[3]
- Chin-up backward head tilt induced by visual field impairment caused by lids[3,10]
- Interference with occupational duties and safety resulting from visual impairment caused by the upper lids[3,10]
- Symptoms of discomfort, eye strain, or visual interference due to the upper eyelid position[3,10]

The reviewed literature did not provide strong data on the following functional indications for ptosis and blepharoplasty surgery:

- Dermatitis
- Difficulty wearing a prosthesis in an anophthalmic socket
- Temporal visual field impairment preventing a driver from meeting licensing standards

Ptosis and dermatochalasis can occur concomitantly. Each has its own functional indications for repair, and different surgical procedures are required to correct them.

Future Research

The following are considerations for future research:

- Prospective comparative studies of visual field function before and after surgery.
- A review of whether or not third-party insurers are following the recommendations of this Ophthalmic Technology Assessment.
- Outcome analysis of the impact of surgery on functional abilities. Validated measures of reading speed that are used in neurocognitive psychology studies could be used to look at reading ability before and after upper eyelid surgery.
- Multi-institutional studies. Because the largest number of patients in the studies identified by our computer search was 177, these studies would provide larger sample sizes that would allow for better assessment of the outcome of upper eyelid surgery and quality of life improvement.
- Inclusion of functional outcomes and quality of life measures in the abstract of studies to facilitate retrieval by other investigators.

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