Validation and Repeatability of Pediatric Refractive Error Profile 2 (PREP2)

THESIS

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Abstract

Many myopia control studies use refractive correction as a means to slow axial growth. The Pediatric Refractive Error Profile (PREP) is a survey used to measure quality of life of children wearing refractive correction and can be used in these studies. The PREP2 is an updated version of this survey. The purpose of this study is to compare the repeatability and validity of the PREP2 to the PREP.

This was done by having subjects take two administrations of the each survey, separated by a week. On the initial visit, the parents also completed a survey of how they believed their child felt about his or her vision correction. Each survey was scored and the repeatability was established using Student's t-test, 95% limits of agreement, Bland-Altman mean versus difference plots, and Pearson's Correlation Coefficient. The validity was established by comparing correlation to the parent survey with Pearson's Correlation Coefficient and comparing internal consistency within scales.

We examined 25 glasses wearers and 20 contact lens wearers between the ages of eight and 14. There was no significant bias between the two administrations of the PREP or PREP2 on any scale except on the PREP Academics scale for glasses wearers ($p=0.002$). The limits of agreement of glasses wearers for the PREP ranged from ±26.5 to ±57.7, contact lens wearers for the PREP ranged from ±16.1 to ±34.7, glasses wearers for the PREP2 ranged from ±20.0 to ±33.8, and contact lens wearers for the PREP2 ranged from ±15.2 to ±25.3. Using Pearson's Correlation Coefficient, all scales of the PREP and

PREP2 were statistically significant with the exception of Near Vision of PREP for spectacle wearers (p=0.166). The correlation to the parent's survey was statistically significant for Handling (p=<0.001) for the PREP and Overall Vision (p=<0.001), Appearance (p=0.001), and Activities (p=0.001) for the PREP2. The internal consistency was greater than 0.70 for Overall Vision, Appearance, Distance Vision, and Academics for the PREP and on all scales for the PREP2.

The PREP2 has higher repeatability and validity than the PREP and is a better survey for following quality of life changes over time. Further studies need to be conducted to eliminate questions from each scale, determine the scalability via Rasch analysis, and validate the PREP2 in subjects wearing orthokeratology lenses.

Dedication

This document is dedicated to my amazing family.

Acknowledgments

I would like to thank Dr. Jeff Walline for all your support and help. There were many times through this adventure that I considered giving up, but one quick conversation with you and I would be excited to continue working. Thank you for putting up with my short attention span and always keeping me on task. Without you, I would have never completed this.

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Chapter 1: Introduction

Myopia affects many people around the world and the prevalence has increased in recent years (Vitale et al., 2009). Myopia, in most cases, begins in children, with the average onset between seven and sixteen years (Kleinstein et al., 2012). For this reason, myopia control studies are designed around this age group. Many of these studies look at different types of spectacles or contact lenses. This vision correction may alter the child's quality of life. However, the only pediatric vision-specific quality of life survey available is the Pediatric Refractive Error Profile (PREP), which is not repeatable (Rah et al., 2010), therefore poor for following changes over time. The purpose of this study is to validate a new pediatric vision-specific survey, the PREP2.

1.1 Myopia Control

Myopia is often caused by excessive axial length, compared to the optics of the eye. This increased eye length can result in many ocular problems including retinal detachment and retinal degenerations (Saw et al., 2005). Since myopia has such a high prevalence in the general population (Kleinstein et al., 2012), myopia control is a topic of much research. As these studies are created, the researcher must not only look at if there is a slowing of myopia, but if there is enough slowing to make practitioners want to offer this to their patients. A clinically significant amount of slowing may be considered to be 25 to 50% over several years. There have been many studies looking at the effects of

different spectacle and contact lens designs on axial growth and refractive error progression.

Studies have looked at under-correcting myopia as a method to slow progression. However, under-correcting children's myopia to a visual acuity of 20/40 has been shown to increase the development of myopia instead of slow progression (Adler & Millodot, 2006; Chung et al., 2002).

Different spectacle lens designs have also been used to slow myopia progression. Flat top bifocals and progressive addition lenses (PALs) have been thought to decrease myopia progression by relieving the accommodative demand or accommodative error (lag) (Fulk et al., 2000). A study comparing myopia progression of subjects wearing flat top bifocals to those wearing single vision glasses was performed, and a 0.25D decrease in myopia progression for those wearing bifocals was found after two and a half years (Fulk et al., 2000). Two major studies using PALs found that PAL wear decreased myopia progression by less than 0.25D over the first year, but there was no decrease in progression in subsequent years (Edwards et al., 2002; Gwiazda et al., 2003). This decrease is not enough to prevent the retinal problems associated with high myopia.

Sankaridurg et al. examined three unique styles of lenses that had a small aperture centrally, offering focused light on the macula and a progressive decrease in minus power toward the periphery of the lens (Sankaridurg et al., 2010). Myopia progression of subjects wearing these new lenses was compared to subjects wearing single vision distance spectacles after a one year period (Sankaridurg et al., 2010). No difference in myopic progression was found between the different lens styles and the standard single

vision lenses. There was a significant slowing in a small subset of subjects consisting of children younger than 12 years with myopic parents using a lens that decreased the amount of aberrations in the horizontal meridian (Sankaridurg et al., 2010). None of these different spectacle lens styles proved a statistically significant slowing of myopia progression for the general myopic sample.

Pharmacologic agents have also been used to control myopia progression. Pirenzepine, a M1 muscarinic antagonist, has been shown to decrease myopia progression by 0.30 D per year (Siatkowski et al., 2004). This is believed to work by a non-toxic effect on sclera growth (Truong et al., 2002). However, pirenzepine is not widely available because it causes memory problems (Messer et al., 1987). Atropine, a non-selective muscarinic antagonist, has also been used. Several studies have shown that concentrations of atropine as low as 0.5% can decrease myopia progression by as much as 77% per year (Chua et al., 2006; Shih et al., 1999; Shih et al., 2001). Nevertheless, when the drops are discontinued, myopia progression continues at a rate greater than those who never used atropine (Tong et al., 2009). Atropine also causes photophobia, the inability to accommodate, and retina damage (Shih et al., 1999). Although these treatments do offer statistically significant slowing of progression, the side effects limit their use in a clinical setting. At this point, the best myopia control methods are contact lenses.

Gas permeable contact lenses have been examined as a means to slow axial growth. One such study looked at children, ages six to 12 years over a two year period (Katz et al., 2003). This study found that in comparison to subjects wearing single vision

spectacles, gas permeable contact lenses do not slow myopia progression (Katz et al., 2003). Another study performed by the Contact Lens and Myopia Progression (CLAMP) group examined children aged eight to 11 years over a three year period (Walline et al., 2004). According to CLAMP, gas permeable lenses do offer a statistically significant slowing of myopia progression, but the amount is not clinically meaningful because there is only a flattening of the cornea and no decrease in axial elongation (Walline et al., 2004).

Soft multifocal contact lenses have also been used in an attempt to slow myopia progression. A study by Anstice et al. used a simultaneous vision soft multifocal contact lens with a concentric ring design to provide +2.00 D of myopic defocus on the retina in one eye and a single vision lens in the fellow eye. After ten months, the test and control eye were switched for the remainder of the study. Their results showed a significant slowing of axial growth in the eye with the multifocal contact lens (Anstice & Phillips, 2011). However, when the lenses were switched to single vision distance, the eye increased its axial growth (Anstice & Phillips, 2011). Sankaridurg et al. also examined the changes in axial growth induced by multifocal contact lenses in children age seven to 14. They used a lens with a clear central area and progressive plus blur in the periphery of the lens. These results also demonstrated a decrease in axial growth and myopia progression over the 12 month period (Sankaridurg et al., 2011). Neither of these studies followed the children over a long period of time to see if there is a continued treatment effect beyond the first year.

Several recent studies have examined orthokeratology lenses and myopia control. Orthokeratology lenses are hypothesized to control myopia progression by creating a section of light in focus on the macula and focusing the rest of the light anterior to the peripheral retina (Walline et al., 2009). The Longitudinal Orthokeratology Research in Children study (LORIC) examined myopia progression of children from age seven to 12 years wearing orthokeratology over a two year period (Cho et al., 2004). Another study by Walline, Jones, and Sinnott examined children between eight and 11 years of age for two years (Walline et al., 2009). The Myopia Control with Orthokeratology Contact Lenses in Spain study (MCOS) measured changes in axial elongation over two years in children between ages eight and 11 years (Santodomingo-Rubido et al., 2009). The LORIC and MCOS studies compared the subjects to children wearing single vision distance spectacles (Cho et al., 2004; Santodomingo-Rubido et al., 2009). Walline, on the other hand, compared myopia progression to that of children wearing soft contact lenses (Walline et al., 2009). All three studies showed that orthokeratology lenses decrease axial elongation of the eye when compared to a control group (Cho et al., 2004; Santodomingo-Rubido et al., 2009, 2012; Walline et al., 2009). Recently, a randomized clinical trial was performed over a two year period and found a 43% decrease in myopia progression in children with low and moderate amounts of myopia by using orthokeratology lenses (Cho & Cheung, 2012). Research will continue to mount in this area as myopia control with orthokeratology lenses are tested on a wider population of subjects with larger amounts of myopia.

There is still a need for myopia control studies. Under-correction causes an increase in the progression of myopia and bifocal and defocus spectacle lenses do not change myopia progression. Gas permeable contact lenses decrease myopia progression by warping the cornea, but offer no decrease in axial growth. New contact lens designs do appear to offer some promise of myopia control. Soft multifocal contact lenses offer small amounts of slowing of axial growth over short periods. Orthokeratology lenses appear to be the most promising at slowing myopia progression, but need to be tested on subjects with higher amounts of myopia. Research will continue to develop in this area and as it does, the vision-specific quality of life while wearing these new refractive error correction devices should be monitored.

1.2 Quality of Life and Self Perception Surveys

There are many disease-specific quality of life surveys available. The Visual Function Index is one such survey. This survey is specifically designed to assess visual function of patients with cataracts and does not translate to quality of life changes from vision correction (Desai et al., 1996; Steinberg et al., 1994). Another survey is the Psychosocial Impact of Assistive Devices (PIAD). This survey can be used for many devices, including optical devices such as low vision tools, spectacles, and contact lenses (Day & Jutai, 1996). The PIAD does have high validity and reliability for comparing the psychosocial effect of contact lenses and glasses, but it is not vision-specific and is designed for use by adults (Day & Jutai, 1996).

One survey that is vision-specific is the National Eye Institute Visual Function Questionnaire (NEI VFQ). There are two forms of this survey, a 25 question form and a

51 question form (Mangione et al., 2001). The longer questionnaire offers higher validity and internal consistency (Mangione et al., 2001). Although this survey is statistically reliable, it poses two major problems for use with children. The NEI VFQ examines eleven scales including ocular pain, occupation, and driving (Cole et al., 2000; Mangione et al., 2001; Mangione et al., 1998). These scales do not translate to pediatric problems with vision correction. Also, there are no specific questions pertaining to vision correction (Mangione et al., 1998). In clinical trials, the NEI VFQ is sensitive to changes in quality of life from many ocular diseases, including glaucoma and macular degeneration (Mangione et al., 1998). However, it is not sensitive enough to predict changes in subjects whose only ocular problem is refractive error (Walline et al., 2000). For these reasons, the NEI VFQ is not a suitable survey to measure vision correction specific quality of life in children.

One survey designed to measure specific quality of life changes from refractive error correction is the National Eye Institute Refractive Error Quality of Life survey (NEI-RQL). This is a 42 questions survey that addresses 13 different scales associated with vision correction (Hays et al., 2003). These scales include: clarity of vision, expectations, near vision, far vision, diurnal fluctuations, glare, symptoms, dependency, suboptimal correction, worry, appearance, and satisfaction (McDonnell et al., 2003). These scales were determined using several small focus groups of people with refractive error (Berry et al., 2003). This survey has been shown to be useful in people who wear spectacles, contact lenses, or orthokeratology lenses (Berntsen et al., 2006). The questions within the NEI-RQL contain many adult specific topics including cooking,

fixing things around the house, reading medicine bottles, and driving (Hays et al., 2003). Therefore, the NEI-RQL would not be an ideal survey for examining refractive error correction of children.

Another survey is the Refractive Status and Vision Profile (RSVP). This survey was created with the intention of measuring "self-reported quality of life of refractive error" (Vitale et al., 2000). This survey examines eight scales: concern, glare, expectations, functioning, symptoms, optical problems, problems with vision correction, and driving (Kadkhoda et al., 2006; Nichols et al., 2003; Nichols et al., 2001; Schein, 2000; Vitale et al., 2000). These are not ideal scales for children, as driving is not a concern in pediatric patients. The RSVP offers high sensitivity in patients undergoing refractive surgery and predicting patient satisfaction with surgery outcomes (Kadkhoda et al., 2006; Nichols et al., 2001; Schein, 2000; Vitale et al., 2000), but this questionnaire is not sensitive enough to differentiate changes in contact lens wearers (Nichols et al., 2001). Since this survey addresses adult-specific areas and is not sensitive enough to monitor changes in contact lens wearers, the RSVP is also a poor survey to measure changes in opinion of refractive error in children.

There are several pediatric quality of life and self perception surveys currently available. The Pictorial Scale of Perceived Competence and Social Acceptance for Young Children is a survey designed to measure cognitive ability, physical ability, peer acceptance, and maternal acceptance for children from preschool to second grade (Harter & Pike, 1984), an age group that is not primarily affected by myopia (Kleinstein et al., 2012). The Harter Self Perception Profile for Children measures self-perceptions about

scholastics, behaviors, athletics, appearance, and global self-worth (Granleese & Joseph, 1994). The Piers-Harris Self Concept Scale examines self-esteem in areas such as behavior, appearance, satisfaction, self-concepts, happiness, anxiety, academics, and popularity (Piers et al., 2002; Terry et al., 1997). The Perceived Competence Scale for Children looks at global self-worth (Harter & Pike, 1984). Although several of these surveys have been used to measure quality of life or self perception in pediatric patients with myopia (Dias et al., 2005; Terry et al., 1997), none of them are vision specific.

Two vision-specific quality of life surveys for pediatric patients, besides the Pediatric Refractive Error Profile, do exist. The Children's Visual Function Questionnaire examines general health, general vision, personality, competence, family impact, and treatment (Felius et al., 2004). This survey is designed for children younger than eight (Felius et al., 2004), earlier than the normal onset of myopia (Kleinstein et al., 2012). Also, this survey is taken by the parent or guardian (Felius et al., 2004), therefore a direct measure of the child's quality of life is not obtained. The second survey is the Spectacle Survey. This survey measures how much a child is bothered by wearing glasses (Walline et al., 2006), but it does not offer any measurements for establishing opinions of patients wearing contact lenses. Due to the limitations of these surveys, a pediatric vision-specific survey that can measure opinions for glasses and contact lenses is greatly needed.

1.3 Uses of the Pediatric Refractive Error Profile (PREP)

The Pediatric Refractive Error Profile (PREP) was designed to measure vision-specific quality of life in children wearing glasses or contact lenses. Several prominent pediatric studies used the PREP as part of their study design. The Adolescent and Child

Health Initiative to Encourage Vision Empowerment (ACHIEVE) study used both the PREP and the Spectacle Survey to determine how the subjects felt about their vision correction (Jones-Jordan et al., 2010; Rah et al., 2010; Walline et al., 2006). The ACHIEVE Study showed that pediatric contact lens wearers wore their vision correction slightly fewer hours per week than spectacle wearers, but the overall vision correction (contact lenses plus glasses) was similar between the two groups (Jones-Jordan et al., 2010). Based on the answers given on the PREP, the ACHIEVE group determined that the best contact lens wearers were those that were involved in activities or those that hated wearing their spectacles (Rah et al., 2010). The PREP also revealed that contact lenses improved the child's quality of life most in the scales of Appearance, Athletics, and Satisfaction (Rah et al., 2010).

The Contact Lenses in Pediatrics (CLIP) group also used the PREP to evaluate vision-specific quality of life. All CLIP subjects completed the PREP at each visit (Walline, Gaume, et al., 2007; Walline, Jones, et al., 2007). Based on the responses to the PREP, it was found that the quality of life of the subjects greatly improved after wearing contact lenses for a week or less and lasted for a minimum of three months (Walline, Gaume, et al., 2007). The PREP did not show a significant difference in the improvement in quality of life between children (eight to 12 years of age) and teens (13 to 17 years of age), indicating that children benefit from contact lens wear as much as teenagers (Walline, Gaume, et al., 2007). Specifically, the CLIP group found improvements in quality of life in the scales of Appearance, Satisfaction, and Activities when switching to contact lens wear (Walline, Gaume, et al., 2007).

Most recently, the PREP was used by Santodomingo-Rubido et al. for the Myopia Control with Orthokeratology Contact Lenses in Spain (MCOS) study (Santodomingo-Rubido et al., 2009). The MCOS study was a two year study on the effects of orthokeratology lenses on myopia progression (Santodomingo-Rubido et al., 2009, 2012). The PREP was administered at the 12- and 24-month visits. Two additional Handling questions were added to the survey for the MCOS study (Santodomingo-Rubido et al., 2009). The results of the quality of life changes throughout the study have yet to be published.

1.4 Pediatric Refractive Error Profile 2 (PREP2)

The Pediatric Refractive Error Profile determines vision-specific quality of life, but it does not offer high repeatability (Rah et al., 2010). The PREP does not have an equal number of positively and negatively worded questions within each scale, which may introduce bias into the data. It also does not have an equal number of questions in each scale; and the scale of Satisfaction has only one question. This is problematic because it causes poor internal consistency within each scale. Therefore, the PREP is not ideal to track quality of life changes over time. For those reasons, we created the PREP2.

The PREP2 is a 56 question vision-specific quality of life survey. It examines seven scales: Vision, Symptoms, Handling, Peer Perception, Activities, Appearance, and Overall. Each scale has eight questions, with an equal number positively and negatively worded. The purpose of this study is to establish the repeatability and validity of the PREP2 in comparison with the original PREP.

Chapter 2: Methods

Forty-five children and their guardians participated in our study. Twenty-five of the participants wore spectacles and twenty wore contact lenses. Subjects participated in a set of surveys administered twice, separated by one week. The guardians were given a survey only during the initial appointment.

2.1 IRB Approval

All procedures were approved by The Ohio State University Biomedical Institutional Review Board and followed the Declaration of Helsinki. All subjects and their guardians were given a verbal explanation of the experiment. The guardians provided written consent and the subjects provided written assent. The guardians also signed a HIPAA privacy policy. The guardian was given a copy of all three pieces of documentation.

2.2 Selection Criteria

Children between the ages of eight and 14 years were eligible to participate in the study. This age group was established because children less than eight years of age may not be able to understand the options on the test. Children over the age of 14 years do not participate in myopia control trials because their myopia may no longer be progressing (Cho et al., 2004; Walline et al., 2004). Depending on their primary type of refractive correction, the subjects were placed in either the spectacles group or the contact lenses group. The primary type of vision correction was defined as what the child identified as

wearing most often. The subject must have been wearing that type of vision correction as their primary correction for at least one week prior to entering the study.

2.3 Data Collection Methods

Subjects were recruited from the Ohio State University College of Optometry Binocular Vision and Pediatric and Contact Lens Services, as well as from subjects who participated in the ACHIEVE Study (Jones-Jordan et al., 2010; Rah et al., 2010; Walline et al., 2006).

During the initial visit, subjects completed the original Pediatric Refractive Error Profile (PREP) survey based on what type of correction he or she primarily wore. The only difference between the Spectacle and Contact Lens forms is the word "glasses" is replaced with the word "contact lenses". Subjects also completed the Pediatric Refractive Error Profile 2 (PREP2). The PREP2 is the same for either type of vision correction, so both contact lens wearers and spectacle lens wearers were given the same copy. A copy of the PREP for glasses, PREP for contact lenses and PREP2 can be found in Appendices A, B and C, respectively. For those subjects who were unable to read the survey, either because of literacy rate or cycloplegia, the surveys were read aloud the subjects. The subjects' guardian completed the Parent Form about how he or she believed the child felt about his or her vision correction, by rating each scale on a one to ten scale, where one is completely disagree and ten is completely agree. A copy of the parent survey can be found in Appendix D.

The subject's monocular and binocular logMAR visual acuity was recorded using a high contrast Bailey-Lovie chart while wearing his or her habitual vision correction.

Subjects began reading every letter on every line until they missed three letters on a single line. The test was stopped after attempting to read all letters in the line. The visual acuity score was then calculated by adding together the total number of letters the patient read correctly. The subjects were tested at a distance of four meters. The power of the habitual correction of the spectacles was recorded using the Nikon EL-7S lensometer (Tokyo, Japan). The power of the habitual correction of the contact lenses was recorded based on the subject's previous medical chart.

Non-cycloplegic manifest refraction was performed on the subjects. For those subjects who were given a cycloplegic agent in the clinic before participating in the study, the non-cycloplegic refraction from the clinical exam was recorded for the subject. The new refractive correction was placed in a trial frame, and monocular and binocular visual acuity was again tested using the previously listed procedure.

Before the subject left the initial visit, the guardian was given a self-addressed, stamped envelope to mail back completed surveys. The guardian was also given a parking pass and the subject was given $10 compensation for their time.

After 1 week, the subject's guardian was emailed a copy of the PREP in the appropriate form (spectacles or contact lenses) and a copy of the PREP2. The guardian was directed not to help the subject fill out the form. Furthermore, the guardian was told if the child could not read, the guardian could read the form to the subject, but could not explain any words or add any examples not listed on the form. The guardian was then instructed to mail the two completed surveys back in the pre-stamped envelope received

during the initial visit. If the set of surveys were not returned within a week of the initial email, a reminder email was sent.

For guardians who did not have access to email and/or a printer, a second copy of the PREP and PREP2 was given at the initial visit. The guardian's phone number was collected and the guardian was told not to give the subject the surveys until he or she received a call instructing them to do so. If the surveys were not returned within one week of the initial phone call, a reminder phone call was given.

2.4 Scoring the PREP and PREP2

Both the PREP and the PREP2 had the same response options for each statement: "strongly agree," "agree," "neutral," "disagree," and "strongly disagree." On the PREP, 13 of the 26 questions were positively worded. Those positively worded questions were questions 1, 2, 6, 8, 9, 10, 12, 13, 14, 15, 17, 20, and 24. For these questions, strongly agree was scored as five and strongly disagree was scored as one. The questions not listed above were negatively worded and therefore their adjusted score resulted in strongly agree being given a score of one and strongly disagree given a score of five. Each score was then converted to a 0-100 point scale by subtracting one from the score and multiplying by 25, where a score of 100 represents great quality of life and a score of 0 represents very poor quality of life. The scoring system can be seen in Table 1.

Answer	Positively Worded Raw Score (Scale Score)	Negatively Worded Adjusted Raw Score (Scale Score)
Strongly Agree	5 (100)	1 (0)
Agree	4 (75)	2 (25)
Neutral	3 (50)	3 (50)
Disagree	2 (25)	4 (75)
Strongly Disagree	1 (0)	5 (100)

Table 1. Scores assigned to different answers on both the PREP and PREP2.

On the PREP2, the even number questions were positively worded and the odd number questions were negatively worded. The positively and negatively worded questions were scored and scaled the same as the original PREP.

For the PREP, the 26 questions were split into 11 scales (Table 2), ten individual scales and an Overall Average of all scales.

Satisfaction	I like to wear my glasses/contact lenses.
Handling+	It is easy to clean and take care of my glasses/contact lenses. It is easy to put on and take off my glasses/contact lenses. My glasses/contact lenses get lost or broken easily.* My glasses/contact lenses fall off my face.*
Overall Vision+	When I wear my glasses/contact lenses I have problems seeing clearly.* When I wear my glasses/contact lenses my vision is very clear. When I wear my glasses/contact lenses my vision is blurry.*
Peer Perception+	When I wear my glasses/contact lenses my friends make fun of me.* When I wear my glasses/contact lenses my friends want to wear glasses too. When I wear my glasses/contact lenses my friends like the way I look.
Symptoms+	When I wear my glasses/contact lenses my eyes hurt.* When I wear my glasses/contact lenses my nose, ears, or head hurts.* When I wear my glasses/contact lenses my eyes itch, burn, or feel dry.* When I wear my glasses/contact lenses my eyes feel good.
Near Vision	When I wear my glasses/contact lenses I have no problems seeing the computer or video games. When I wear my glasses/contact lenses I have problems reading.*
Appearance+	When I wear my glasses/contact lenses I like how I look. I don't like how I look with glasses/contact lenses.* If I wore contact lenses/glasses I would look better.*
Distance Vision	When I wear my glasses/contact lenses I am able to see clearly far away. When I wear my glasses/contact lenses I have problems seeing at the movies or when I look far away.*
Academics	When I wear my glasses/contact lenses I do better at school. When I wear my glasses/contact lenses I do better on tests.
Activities+	I never have problem wearing my glasses/contact lenses when I play outdoor. I am bothered by my glasses/contact lenses when I play sports, dance or do other activities.*

Table 2. PREP questions based on scale. To the left of the "/" is what appears on the PREP glasses and to the right of the "/" is what appears on the PREP contact lenses. *Indicates negatively worded questions. +Indicates scales which appear on both the PREP and the PREP2.

Fifty-six questions were evenly split into seven scales for the PREP2 (Table 3). The score for each scale was then calculated by averaging the scaled score for each of the questions in that scale.

Handling	When I play outdoors, I never have a problem with my vision correction. My vision correction sometimes breaks or falls off while I am wearing it.* When I am active, my vision correction never falls off. My vision correction is sometimes hard to put on or take off.* My vision correction never gets lost or broken. Sometimes it is hard to clean my vision correction.* It is easy to put on or take off my vision correction. I don't like cleaning my vision correction.*
Overall Vision	My vision if very clear when I look far away (movies or board at school). When I look far away, my vision is not as clear as I would like it to be.* My vision is very clear when I look at something close (books or cell phones). When I read, my vision is not as clear as I would like it to be.* My vision is always excellent. Sometimes my vision is not clear.* I can always see better than my friends. My friends usually see better than me.*
Peer Perception	My friends make fun of me because of my vision correction.* My friends want the same kind of vision correction that I have. My friends don't like how I look when I wear my vision correction.* My friends only say good things about my vision correction. My friends sometimes say things that are not nice about my vision correction.* My friends never mention my vision correction. My friends sometimes laugh about my vision correction.* When I wear my vision correction, my friends like the way I look.
Symptoms	My eyes are sometimes uncomfortable.* My eyes are always comfortable. My eyes sometimes itch, burn, or feel dry.* My eyes never feel irritated. I am sometimes uncomfortable when I wear my vision correction.* My eyes always feel great. Sometimes I don't like how my eyes feel.* Wearing my vision correction is always comfortable.
Appearance	I am happy with the way that I look. I do not like how I look when I war my vision correction.* My vision correction makes me look cool. I think that I could be better looking.*

Continued

Table 3. PREP2 questions based on scale. *Indicates negatively worded questions.

Table 3 continued

	When I wear my vision correction, I like how I look. When I look in the mirror, I do not like how I look.* Nobody notices when I wear my vision correction. Wearing my vision correction makes me look worse.*
Activities	When I play sports or other activities, I sometimes don't wear vision correction because it bothers me.* When I play outdoors, I never have a problem with my vision correction. When I play outside, my vision correction sometimes bothers me.* I am never bothered by my vision correction when I am active (sports, dance, etc.). I am worse at sports because my vision correction bothers me.* I never have any problems when I wear my vision correction while I play sports or do other activities. I could be better at sports if I didn't have to wear vision correction.* I can play outside without ever thinking about my vision correction.
Overall	I love my vision correction. I don't like my vision correction very much.* I never have problems with my vision correction I wish I had a different kind of vision correction.* I like to wear my vision correction. In general, wearing my vision correction bothers me.* I don't even notice my vision correction. I hate wearing vision correction.*

Each scale on the PREP2 had a corresponding question on the parent survey (Table 4). For each question on the parent survey, the guardian was asked to rate on a scale from one to ten, where one is equal to likes and ten is equal to dislikes, based on how the guardian believed his or her child to feel.

Handling	How does your child feel about handling his or her vision correction (put on/off, clean, fear of break, etc.)
Vision	How does your child fee about his or her vision?
Peer Perception	How does your child feel about friends' impressions of himself or herself due to vision correction?
Symptoms	How does your child feel about his or her eye comfort?
Appearance	How does your child feel about his or her appearance?
Activities	How does your child feel about participating in activities while wearing vision correction?
Overall	Overall, how does your child feel about his or her vision correction?

Table 4. Parent Form questions based on scale.

2.5 Statistical Methods

All data were dual entered into a Microsoft Excel spreadsheet 2007 (Microsoft, Inc., Redmond, WA.). All discrepancies between the dual entered data spreadsheets were corrected after consultation with the source document.

Survey scores were calculated using a scoring spreadsheet in Microsoft Excel where formulas automatically generated reverse scoring in negatively worded questions and scaled scores, as well as an average score for each scale.

All other data were analyzed using SPSS, version 19 (IBM, Chicago, IL.). All figures were made using Microsoft Excel 2007. A detailed description of the statistical methods to determine repeatability and validity are described below.

2.6 Repeatability

To examine the repeatability of the surveys, the answers to the initial administration of the survey were compared to the second administration of the survey, approximately one week later.

First, we determined whether there was a bias between the first and second administration of the PREP by comparing the mean scores of each administration using the Student's t-test. The same process was applied to the answers of the two administrations of the PREP2. P-values greater than 0.005 for the PREP and 0.007 for the PREP2 after Bonferroni adjustments were considered to show the two administrations of the survey did not give a statistically different result.

The 95% limits of agreement of the difference between the values obtained on two separate occasions were calculated. A Bland-Altman mean versus difference plot was created for each scale of the PREP and PREP2 (Bland & Altman, 1986).

The correlation of each administration of the survey was compared using Pearson's Correlation Coefficient. This coefficient was chosen because of the expected linearity of the two scores; if one score is higher it would be expected that the second time the survey was taken the survey would yield a similar higher score.

2.7 Validity

The validity of the PREP and PREP2 was established by comparing the correlation of each scale to that of the corresponding question in the parent survey. Since there is not gold standard for how the subjects felt in which to compare these data, the parent survey was used as a way to artificially create this standard. This was done using Pearson's Correlation Coefficient. A p-value less than or equal to 0.01 was considered to be significant. Subject responses were then plotted on scatter plots in comparison with guardian responses for visual inspection.

The internal consistency of each scale with two or more questions was calculated using Cronbach's alpha. A value of 0.70 or greater was considered to be significant. This was performed for both the PREP and PREP2.

Chapter 3: Results

3.1 Demographics

Seventy subjects took the initial set of surveys; 26 were contact lens wearers and 44 were spectacle wearers. Of those, 45 completed the study; 20 (77% of the contact lens wearers) were contact lens wearers and 25 (57% of the spectacle wearers) were spectacle wearers. The better retention rate in the contact lens wearers is most likely because many of the contact lens wearers were recruited from other studies and accustomed to have following ups, as opposed to glasses wearers which were all from the optometry clinic. Females made up 12 of the 20 contact lens wearers who completed the study (60%). Twelve (48%) of the spectacle wearers who completed the study were female. This is comparable to the percentage of each gender that began the study. Of those who completed both sets of surveys, mean age of contact lens wearers was 12.6±1.0 and the mean age of spectacle wearers was 10.6±1.8. Of the 20 contact lenses wearers who completed the study, one (5%) was Asian, four (20%) were African American, 12 (60%) were White, and three (15%) reported more than one race. One (5%) of the contact lens wearers was Hispanic or Latino. Of the 25 spectacle wearers, three (12%) were Asian, eight (32%) were African American, 13 (52%) were White, and one (4%) reported more than one race (Table 5). There was not a statistically significant difference between those who began the study and those who completed it in terms of ethnicity (χ^2, p=0.842) or age (Student's t-test, p=0.63). The spectacle wearers who completed the survey were

compared to the contact lens wearers who completed the survey, and there was not a statistically significant difference in race (χ^2, p=0.088), but the contact lens wearers were significantly older (Student's t-test, p=0.004).

In most cases, the second set of surveys was completed one to two weeks after the initial administration, although several subjects did return the surveys more than a month after the initial administration. Therefore, when the surveys were returned was not recorded. The exact number of days was not calculated because there was no way to determine how long after receiving the surveys the parent administered them, how long the parent waited to mail the survey after administering it, or how long the mail took to be received.

	Subjects Who Began the Study (n=70)	Subjects Who Completed the Study (n=45)	Contact Lens Wearers (n=20)	Spectacle Wearers (n=25)
Age	11.4±1.8	11.5±1.8	12.6±1.0	10.6±1.8
Gender (% Female)	54	53	60	48
Refractive Error Spherical Equivalent (D)	-2.03D	-2.64D	-3.17D	-2.22D
Best Corrected Visual Acuity at 4m	52	52	55	50
Ethnicity (% Hispanic/Latino)	3	2	5	0
Race (%)				
American Indian/ Alaska Native	0	0	0	0
Asian	6	9	5	12
Pacific Islander/Hawaiian	0	0	0	0
African American	26	27	20	32
White	57	56	60	52
More than one	11	9	15	4
Unknown/Unreported	0	0	0	0

Table 5. Demographics of those subjects that completed the study compared to all subjects that began the study.

3.2 Repeatability of the PREP and PREP2

For the original PREP, none of the scales yielded significantly different scores between the first and second administration for spectacle wearers except for the Academics scale (Students t-test, $p<0.005$, Table 6). Overall Average was the only scale with limits of agreement less than ±20 on the PREP for Glasses.

Spectacle Wearers	Mean Difference	95% Limits of Agreement	P-value
Overall Vision	-1.33	-35.58, +32.91	0.71
Near Vision	-3.50	-61.18, +54.18	0.56
Far Vision	7.00	-36.64, +50.64	0.13
Symptoms	5.74	-24.90, +36.38	0.08
Appearance	-2.83	-29.37, +23.72	0.31
Satisfaction	1.00	-37.69, +39.69	0.80
Activities	5.00	-43.49, +53.49	0.32
Academics	11.50	-20.07, +43.07	0.002
Handling	1.49	-34.80, +37.78	0.69
Peer Perception	2.00	-25.22, +29.22	0.48
Overall Average	2.60	-15.35, +20.56	0.17

Table 6. Mean difference and 95% limits of agreement for the first and second administration of the PREP for Glasses. After Bonferroni adjustment for multiple comparisons, the p-value must be less than 0.005 to be considered statistically significant.

Since the glasses wearers were significantly younger than the contact lens wearers, the groups were split into two age groups, age eight to 11 and age 12 to 14 (Table 7). For all scales, except Activities, the older group of glasses wearers had smaller 95% limits of agreement on the PREP compared to the younger group. In the younger age group, only the Overall Average had limits of agreement less than ±20. For the older

group, the Symptoms, Satisfaction, and Overall Average had limits of agreement less than ±20.

Spectacle Wearers	Age 8-11 (n=16)		Age 12-14 (n=9)	
	Mean Difference	95% Limits of Agreement	Mean Difference	95% Limits of Agreement
Overall Vision	-1.0	±39.5	-1.9	±24.2
Near Vision	5.5	±55.8	-19.4	±49.2
Far Vision	9.4	±45.2	2.8	±42.0
Symptoms	7.7	±37.5	2.3	±9.9
Appearance	-2.3	±27.7	-3.7	±26.0
Satisfaction	0	±47.3	2.8	±16.3
Activities	7.0	±48.2	1.4	±51.2
Academics	14.1	±35.6	6.9	±21.6
Handling	1.2	±42.3	2.1	±24.5
Peer Perception	5.2	±29.2	-3.7	±20.2
Overall Average	4.7	±19.4	-1.1	±13.2

Table 7. PREP Spectacle wearers comparing repeatability by age group.

For contact lens wearers, none of the scale scores were significantly different between the first and second administration ($p<0.005$). The Symptoms, Handling, and Peer Perception scales all had limits of agreement less than ±20 on the PREP for contact lenses (Table 8).

Contact Lens Wearers	Mean Difference	95% Limits of Agreement	P-value
Overall Vision	-4.59	-37.04, +27.87	0.23
Near Vision	1.25	-23.76, +26.26	0.67
Far Vision	0.00	-21.03, +21.03	1.00
Symptoms	-3.44	-20.03, +13.15	0.09
Appearance	-0.01	-24.82, +24.81	0.99
Satisfaction	0.00	-22.48, +22.48	1.00
Activities	-6.25	-29.42, +16.92	0.03
Academics	3.75	-30.99, +38.49	0.36
Handling	-0.31	-16.42, +15.80	0.87
Peer Perception	-0.01	-19.84, +19.82	0.99
Overall Average	-0.95	-6.25, +4.35	0.13

Table 8. Mean difference and 95% limits of agreement for the first and second administration of the PREP for Contact Lenses. After Bonferroni adjustment for multiple comparisons, the p-value must be less than 0.005 to be considered statistically significant.

The contact lens wearers were split into two age groups, age eight to 11 and age 12 to 14, to see how the repeatability changes when age is not a factor on the PREP (Table 9). For contact lenses, the younger group had smaller limits of agreement than the older group on all scales, except Symptoms, Handling, and Overall Average on the PREP. For the younger group, all the scales were less than ±20, except Handling. For the older age group, only the Symptoms, Handling, and Overall Average had limits of agreement less than ±20.

Contact Lens Wearers	Age 8-11 (n=3)		Age 12-14 (n=17)	
	Mean Difference	95% Limits of Agreement	Mean Difference	95% Limits of Agreement
Overall Vision	0	±16.3	-5.4	±34.6
Near Vision	0	±0	1.5	±27.2
Far Vision	0	±0	0	±22.9
Symptoms	-4.2	±18.6	-3.3	±16.8
Appearance	-5.5	±18.8	1.0	±25.7
Satisfaction	0	±0	0	±24.5
Activities	-4.2	±14.1	-6.6	±24.7
Academics	-4.2	±14.2	5.1	±36.8
Handling	-2.1	±25.5	0	±15.0
Peer Perception	0	±16.4	0	±20.8
Overall Average	-2.0	±5.9	-0.8	±5.3

Table 9. PREP Spectacle wearers comparing repeatability by age group.

There was not a significant bias between the first and second administration for any scale of the PREP2 for spectacle wearers (Table 10). Peer Perception was the only scales that had 95% limit of agreement less than or equal to ±20 for glasses wearers.

Spectacle Wearers	Mean Difference	95% Limits of Agreement	P-value
Overall	-3.39	-37.24, +30.45	0.34
Vision	0.79	-22.21, +23.80	0.74
Symptoms	-1.60	-28.62, +25.41	0.57
Appearance	-2.25	-27.66, +23.16	0.39
Activities	0.43	-28.09, +28.94	0.88
Handling	1.64	-27.61, +30.90	0.59
Peer Perception	-1.32	-21.33, +18.69	0.52

Table 10. Mean difference and 95% limits of agreement for the first and second administration of the PREP2 for Glasses. After Bonferroni adjustment for multiple comparisons, the p-value must be less than 0.005 to be considered statistically significant.

The glasses wearers were split into two age groups, age eight to 11 and age 12 to 14, to determine the repeatability of a younger population to an older population on the PREP2 (Table 11). The older age group has smaller limits of agreement for all scales except Symptoms and Handling. The Symptoms and Handling scales were the only scales with 95% limits of agreement less than ±20. The Appearance and Peer Perception scales were the only scales under ±20 for the older group.

Spectacle Wearers	Age 8-11 (n=16)		Age 12-14 (n=9)	
	Mean Difference	95% Limits of Agreement	Mean Difference	95% Limits of Agreement
Overall	-0.6	±30.1	2.1	±27.0
Vision	4.5	±33.7	1.9	±23.1
Symptoms	3.5	±18.4	-3.8	±27.5
Appearance	0.2	±34.2	4.5	±17.9
Activities	3.6	±39.1	1.0	±21.9
Handling	3.2	±16.1	6.6	±20.4
Peer Perception	3.3	±44.7	-0.2	±17.6

Table 11. PREP2 Spectacle wearers comparing repeatability by age group.

There was not a significant bias between the first and second administration of the PREP2 for contact lens wearers on any scale (Table 12). For contact lens wearers, Overall, Vision, Appearance, Handling, and Peer Perception had a 95% limit of agreement less than ±20.

Contact Lens Wearers	Mean Difference	95% Limits of Agreement	P-value
Overall	0.16	-11.51, +11.82	0.91
Vision	-1.09	-19.66, +17.47	0.61
Symptoms	-3.59	-28.91, +21.72	0.23
Appearance	0.16	-16.41, +16.72	0.94
Activities	2.50	-17.82, +22.82	0.29
Handling	-1.25	-16.44, +13.94	0.48
Peer Perception	1.65	-14.69, +18.00	0.39

Table 12. Mean difference and 95% limits of agreement for the first and second administration of the PREP2 for Contact Lenses. After Bonferroni adjustment for multiple comparisons, the p-value must be less than 0.005 to be considered statistically significant.

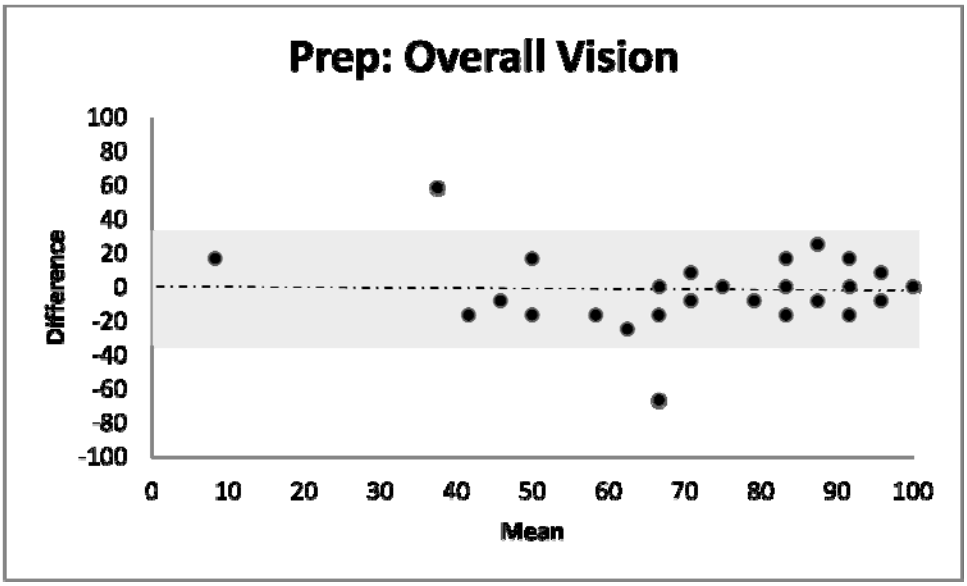
For the PREP2, the 95% limits of agreement was calculation for the two age groups (Table 13). The younger group had smaller 95% limits of agreement on the Symptoms, Appearance, Activities, and Peer Perception scales. For the younger group on the PREP2 for contact lens wearers, all the scales were less than ±20, except Vision. For the older group, all the scales were less than ±20, except Symptoms and Activities.

Contact Lens Wearers	Age 8-11 (n=3)		Age 12-14 (n=17)	
	Mean Difference	95% Limits of Agreement	Mean Difference	95% Limits of Agreement
Overall	1.0	±19.7	0	±10.6
Vision	-7.3	±23.2	0	±17.6
Symptoms	-4.2	±18.7	-3.5	±26.8
Appearance	-2.1	±3.5	0.5	±17.9
Activities	-5.2	±9.4	3.9	±20.7
Handling	5.2	±18.7	-2.4	±14.0
Peer Perception	8.3	±15.4	0.5	±15.8

Table 13. PREP2 Contact Lens wearers comparing repeatability by age group.

Figures 1 through 7 show Bland-Altman mean versus difference plots (Bland & Altman, 1986) for the two administrations of the scales that are similar for the PREP (a) and PREP2 (b).

a



b

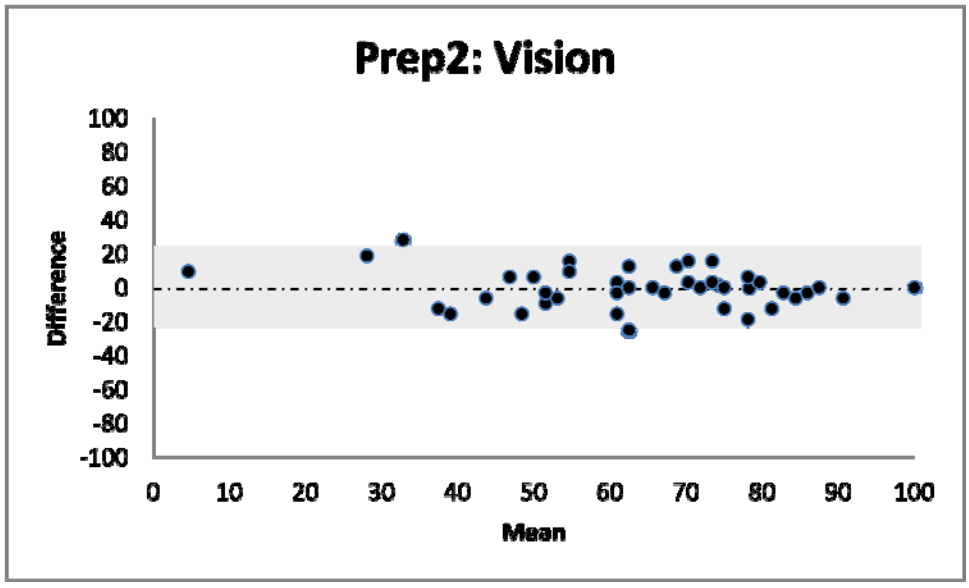
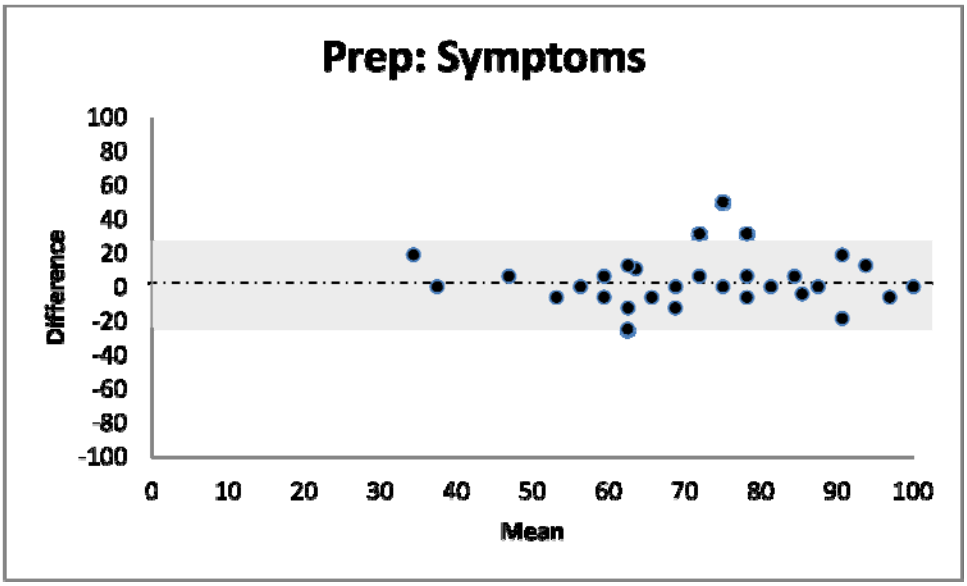


Figure 1. Mean versus difference plot for the Overall Vision scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



b

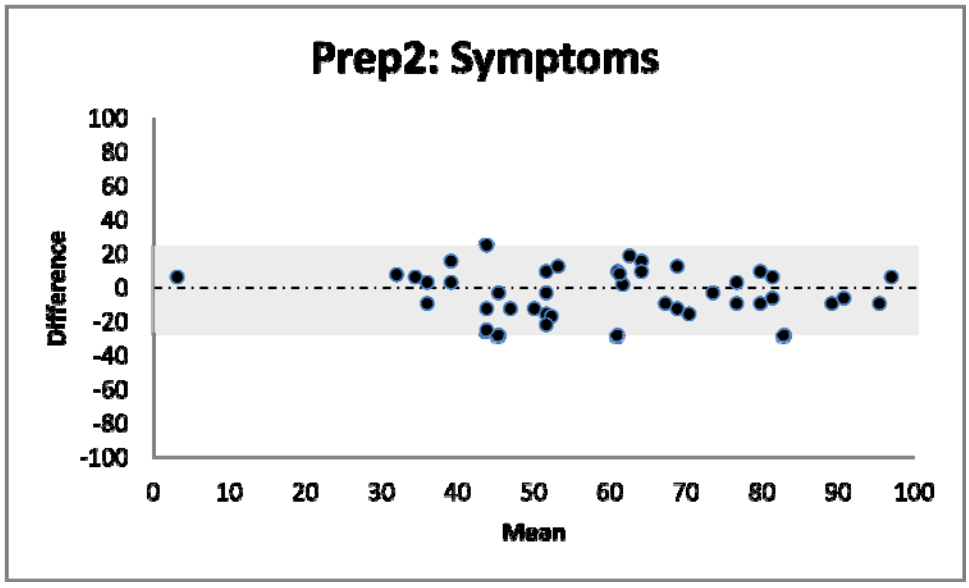
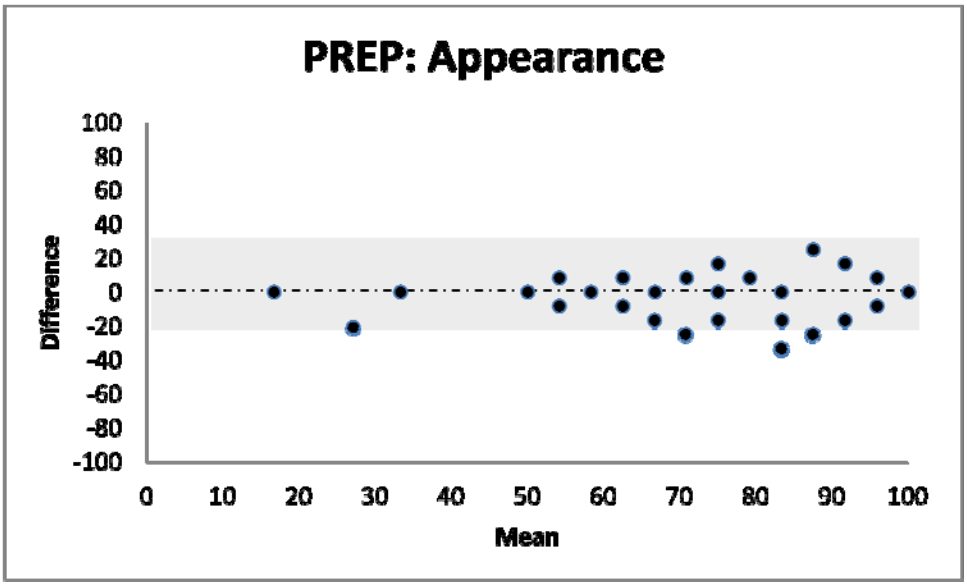


Figure 2. Mean versus difference plot for the Symptoms scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



b

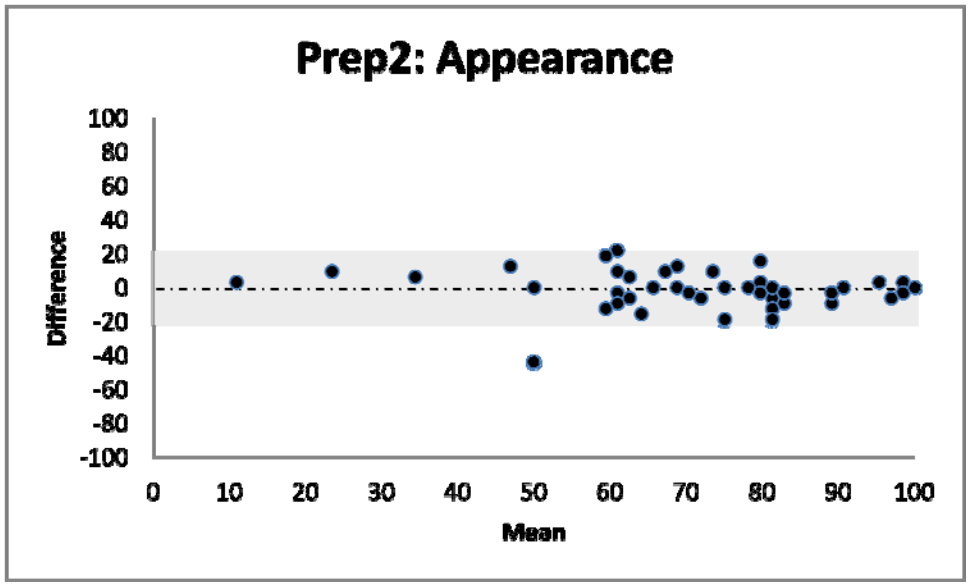
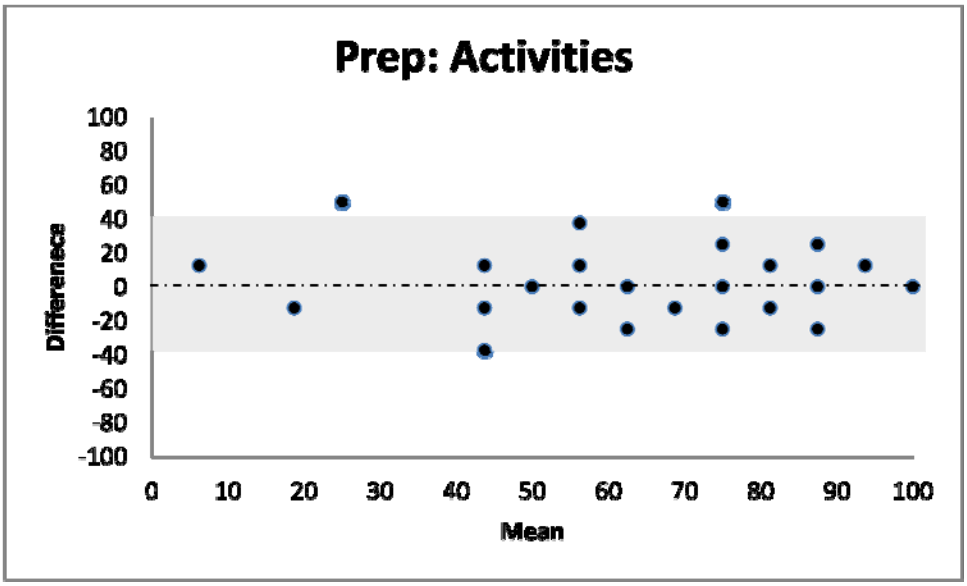


Figure 3. Mean versus difference plot for the Appearance scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



b

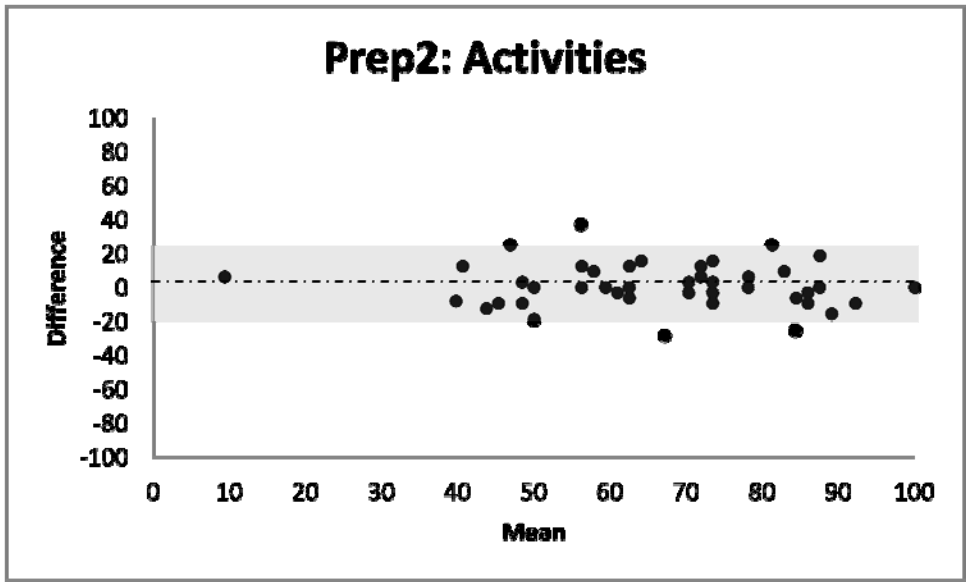
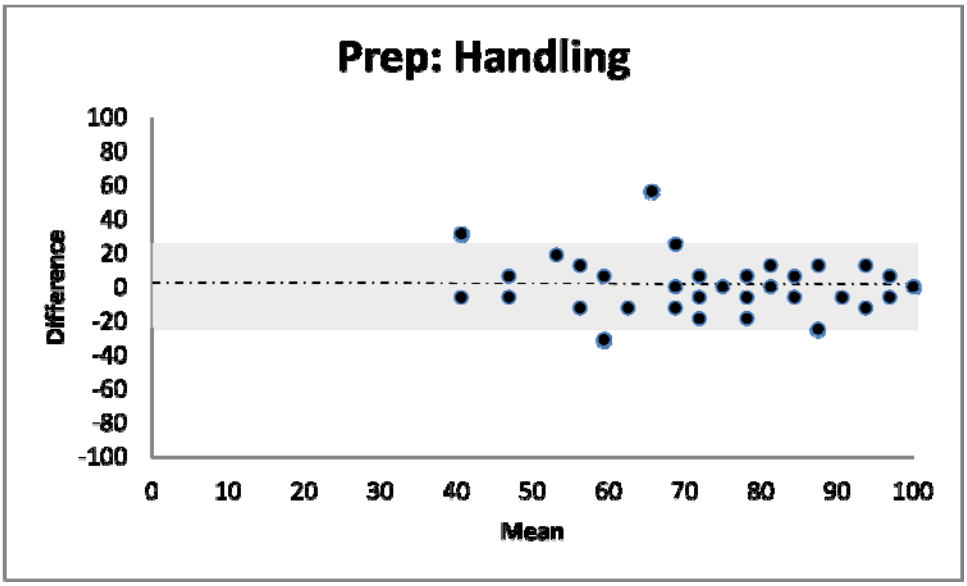


Figure 4. Mean versus difference plot for the Activities scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



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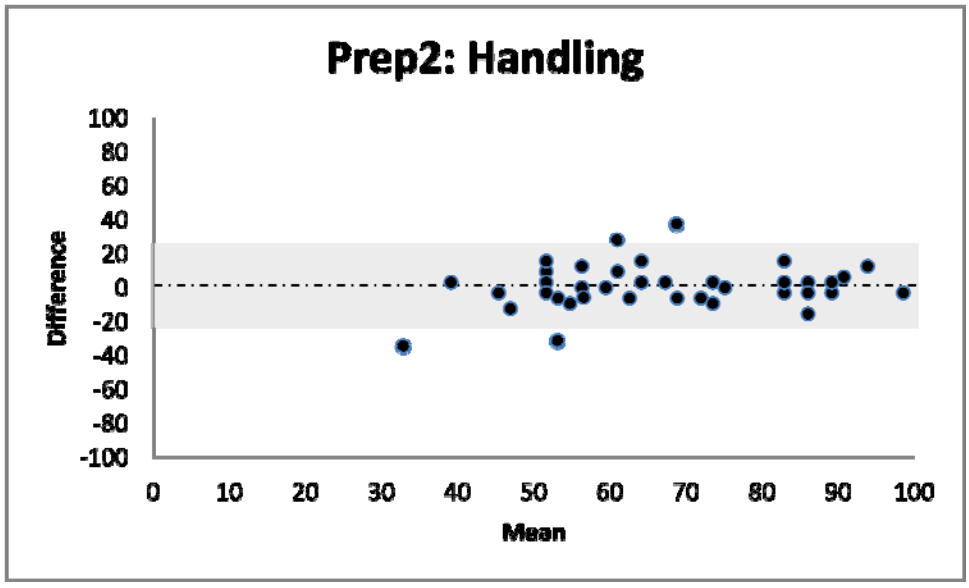
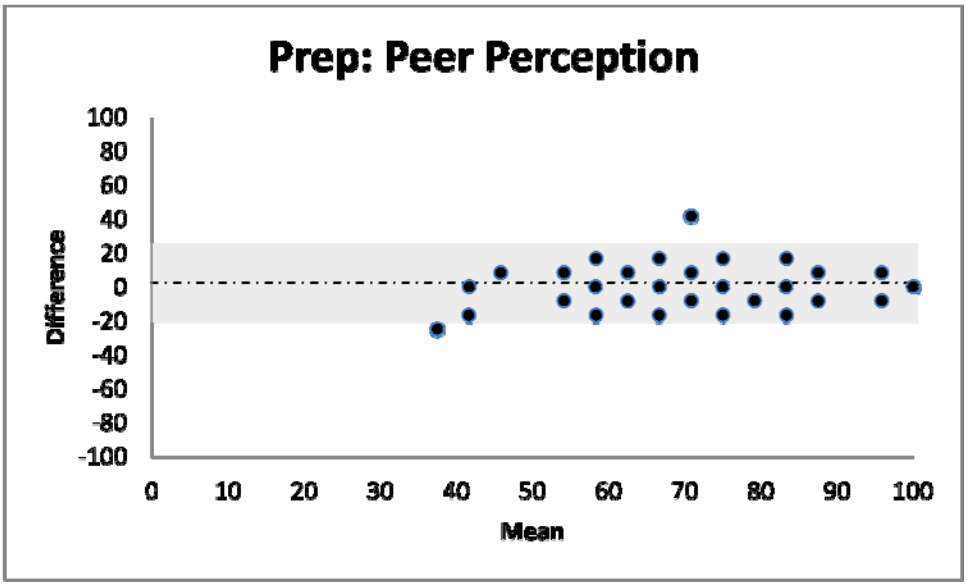


Figure 5. Mean versus difference plot for the Handling scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



b

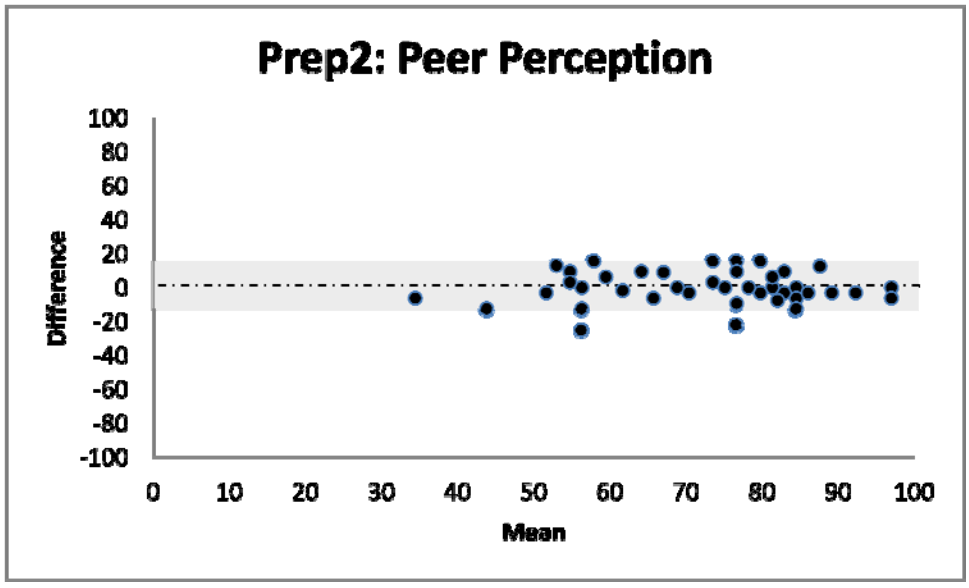
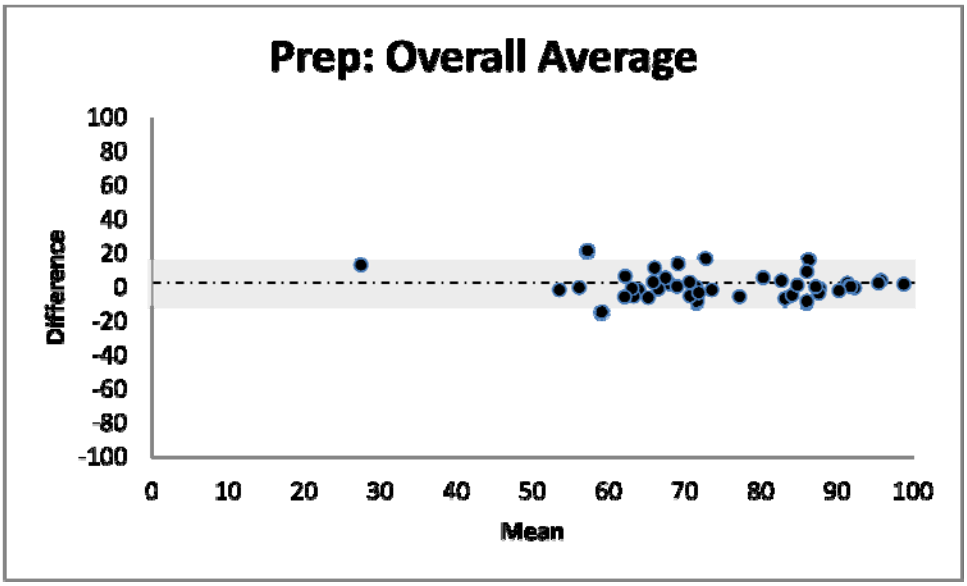


Figure 6. Mean versus difference plot for the Peer Perception scale on the a) PREP and b) PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

a



b

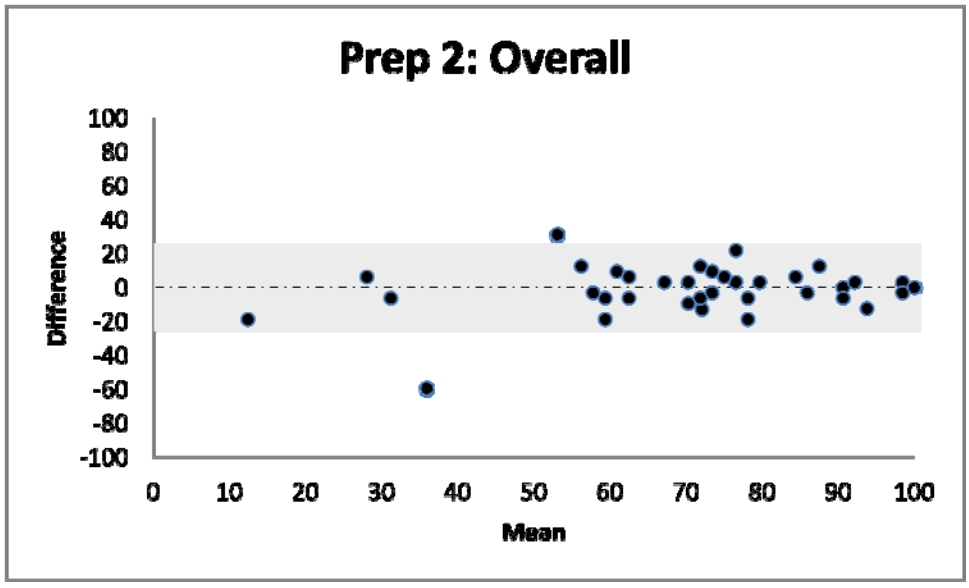


Figure 7. Mean versus difference plot for the a) overall average of the PREP and b) Overall scale of the PREP2. The dashed line represents the mean difference between the first and second administration. The grey box represents the 95% limits of agreement between the first and second administration.

The correlation of the first and second administration of the PREP for Glasses and PREP for Contact Lenses was examined for each scale. On the PREP for Glasses, the Near Vision scale was not significantly correlated (p=0.166; Figure 8).

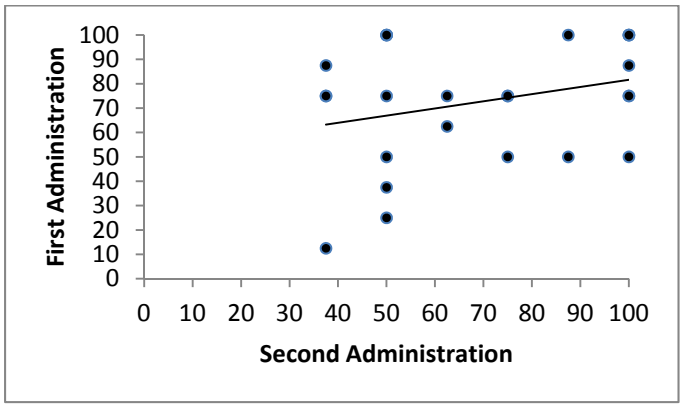


Figure 8. Near Vision scale of the PREP for Glasses was not significantly correlated, comparing the scale score of the first administration to the scale score of the second administration.

All other scales on the PREP for Glasses and PREP for Contact Lenses were significantly correlated ($p<0.05$; Table 14).

	PREP for Glasses		PREP for Contact Lenses	
	Pearson's Correlation Coefficient	P-value	Pearson's Correlation Coefficient	P-value
Overall Vision	0.77	<0.001	0.58	0.007
Near Vision	0.29	0.166	0.76	<0.001
Far Vision	0.60	0.002	0.80	<0.001
Symptoms	0.67	<0.001	0.83	<0.001
Appearance	0.84	<0.001	0.67	0.001
Satisfaction	0.79	<0.001	0.76	<0.001
Activities	0.57	0.003	0.82	<0.001
Academics	0.65	<0.001	0.69	0.001
Handling	0.46	0.022	0.76	<0.001
Peer Perception	0.75	<0.001	0.80	<0.001
Overall	0.82	<0.001	0.98	<0.001

Table 14. PREP comparison of correlation coefficient of spectacle wearers and contact lens wearers.

The correlation between the first and second administration of the PREP2 for glasses wearers and for contact lens wearers were also compared (Table 15). All scales were significantly correlated between the first and second administration of the PREP2 for both glasses and contact lens wearers ($p<0.05$).

	PREP2 for Glasses		PREP2 for Contact Lenses	
	Pearson's Correlation Coefficient	P-value	Pearson's Correlation Coefficient	P-value
Overall	0.70	<0.001	0.89	<0.001
Vision	0.85	<0.001	0.80	<0.001
Symptoms	0.78	<0.001	0.79	<0.001
Appearance	0.82	<0.001	0.84	<0.001
Activities	0.70	<0.001	0.74	<0.001
Handling	0.55	0.005	0.89	<0.001
Peer Perception	0.79	<0.001	0.80	<0.001

Table 15. PREP2 comparison of correlation coefficient of spectacle and contact lens wearers.

3.4 Validity

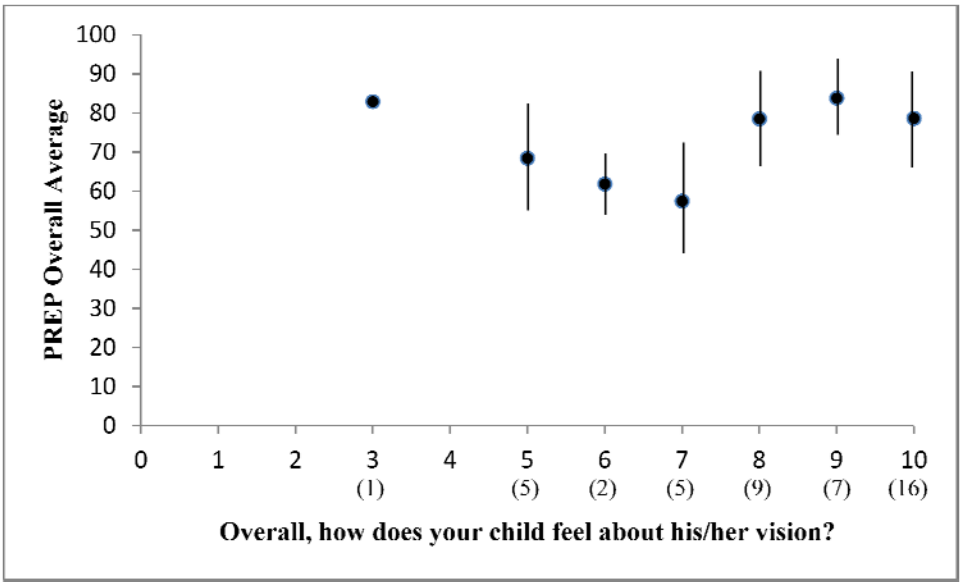
The scales of the PREP and PREP2 were compared to corresponding answers provided by the guardian using Pearson's correlation coefficient. For the PREP, Handling was the only scale with significant correlation ($p<0.01$). For the PREP2, Overall, Appearance, and Activities scales all had significant correlation ($p<0.01$). The PREP2 had higher correlation than the PREP for all scales, except Symptoms and Handling (Table 16).

Scale	PREP Pearson's Correlation Coefficient (p-value)	PREP2 Pearson's Correlation Coefficient (p-value)
Overall-Overall, how does your child feel about his or her vision correction?	0.34 (0.022)	0.61 (<0.001)
Vision-How does your child feel about his or her vision?	0.24 (0.120)	0.27 (0.069)
Symptoms-How does your child feel about his or her eye comfort?	0.28 (0.064)	0.19 (0.203)
Appearance-How does your child feel about his or her appearance?	0.38 (0.011)	0.50 (0.001)
Activities-How does your child feel about participating in activities while wearing vision correction?	0.18 (0.237)	0.46 (0.001)
Handling-How does your child feel about handling his or her vision correction (put on/off, clean, fear of breaking, etc.)?	0.40 (<0.001)	0.34 (0.022)
Peer Perception-How does your child feel about friends' impressions of himself or herself due to vision correction?	0.15 (0.318)	0.27 (0.078)

Table 16. PREP and PREP2's correlation with answers given on the Parent Survey for each scale.

Children's answers compared to that of their guardian were mapped on scatter plots (figures 9-15).

a



b

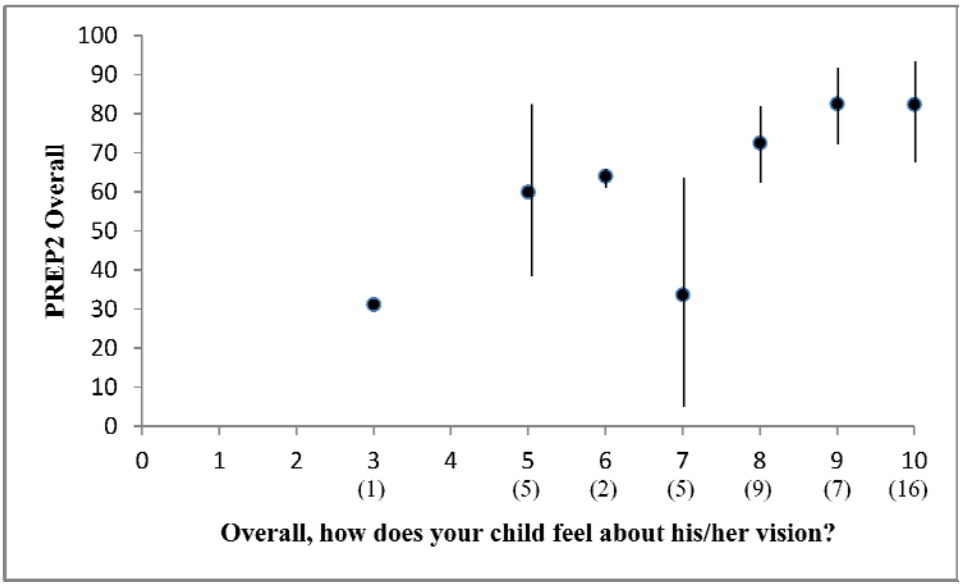
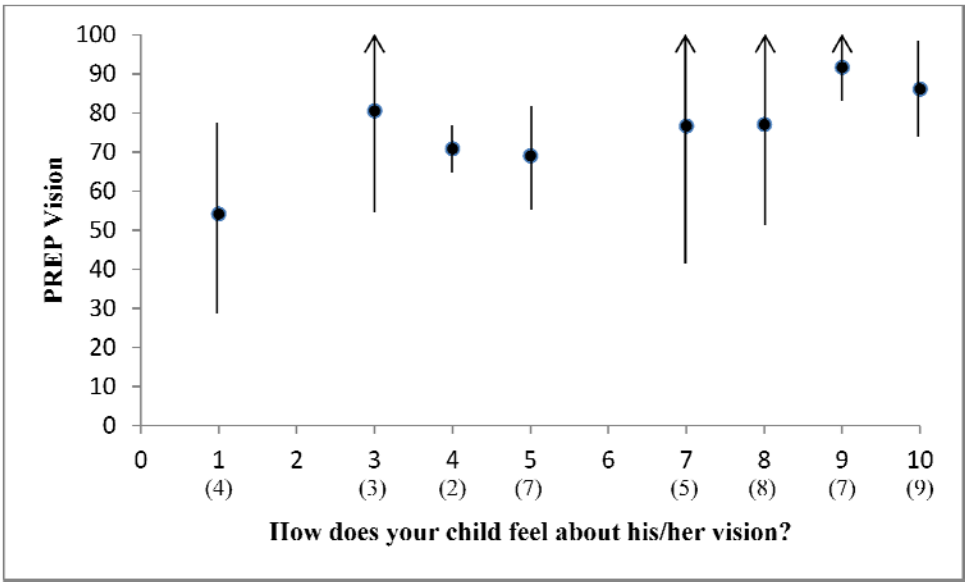


Figure 9. Overall scale score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.34; p=0.022) and b) PREP2 (correlation coefficient=0.61, p<0.001) The dot represents the mean score and bars indicate the standard deviation. The number in the parenthesis indicates the number of parents that gave that score.

a



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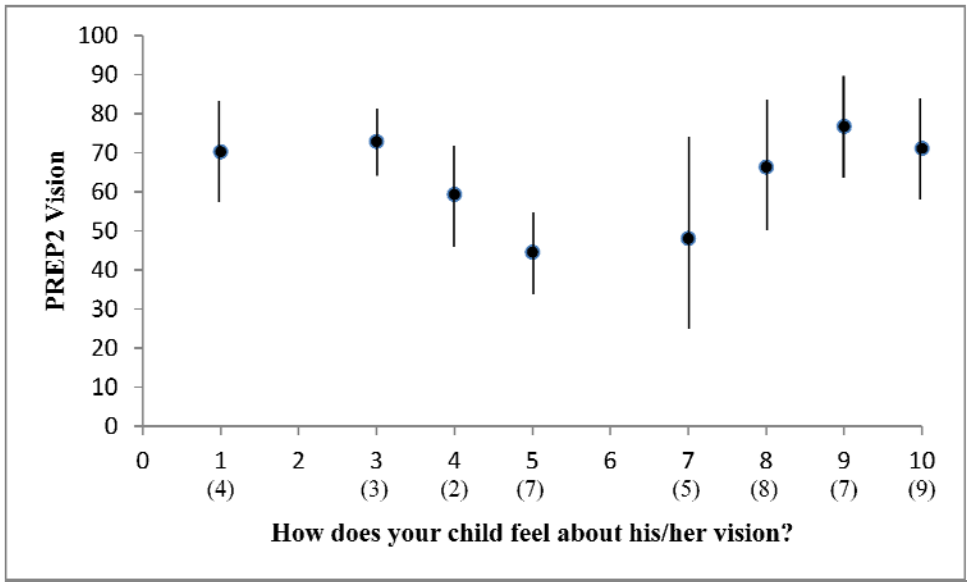
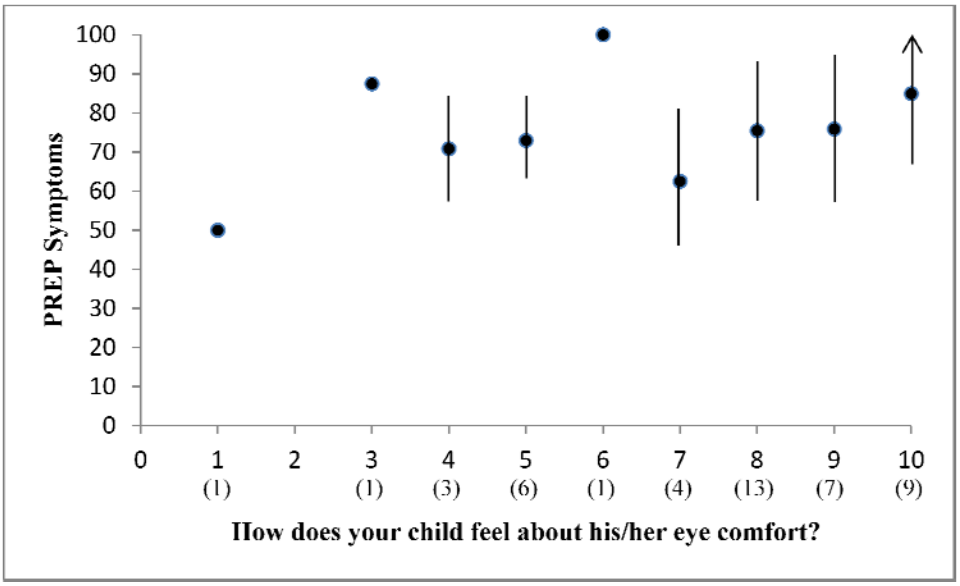


Figure 10. Vision score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.24; p=0.120) and b) PREP2 (correlation coefficient=0.27; p=0.069). The dot represents the mean score and bars indicate the standard deviation. Arrows indicates a standard deviation exceeding 100.The number in the parenthesis indicates the number of parents that gave that score.

a



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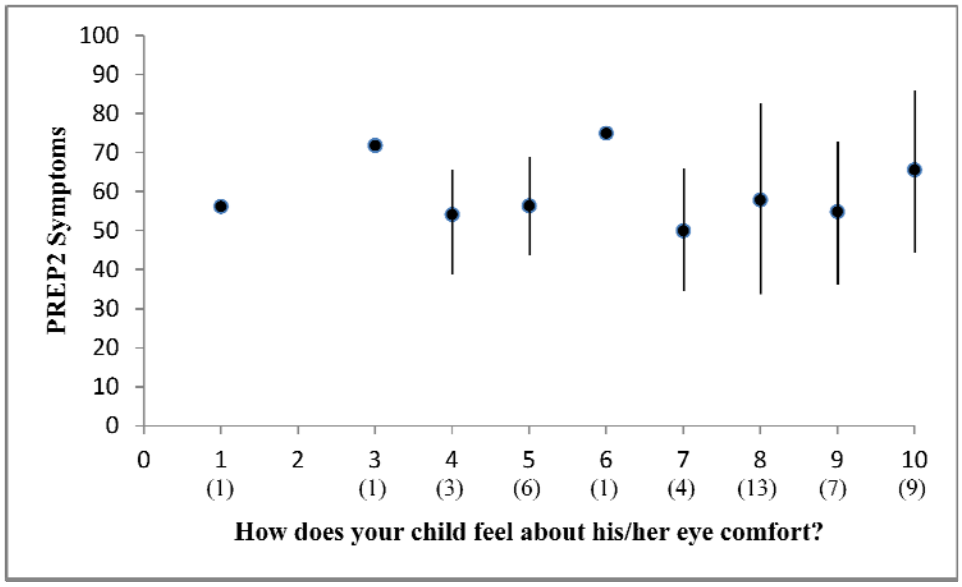
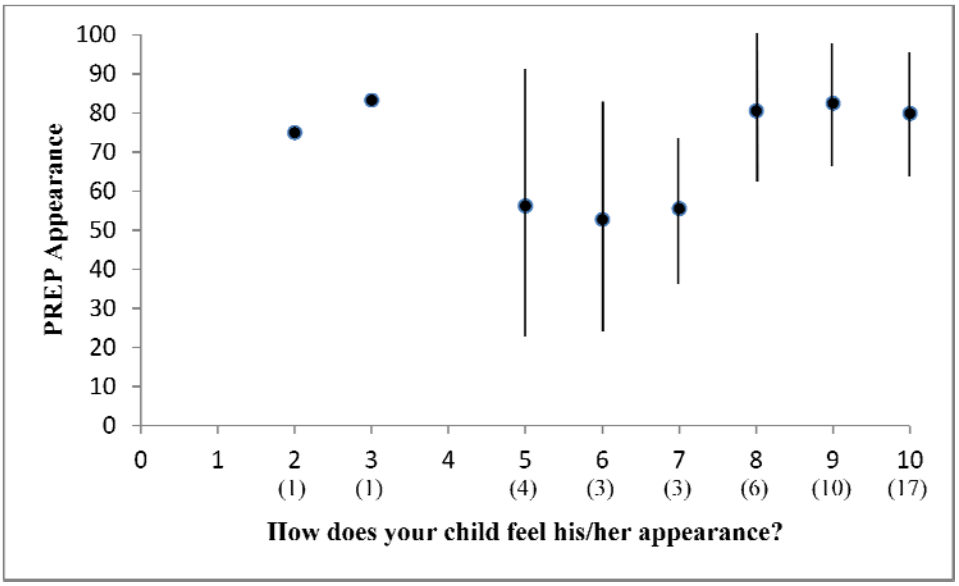


Figure 11. Symptoms score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.28; p=0.064) and b) PREP2 (correlation coefficient=0.19; p=0.203). The dot represents the mean score and bars indicate the standard deviation. Arrows indicates a standard deviation exceeding 100. The number in the parenthesis indicates the number of parents that gave that score.

a



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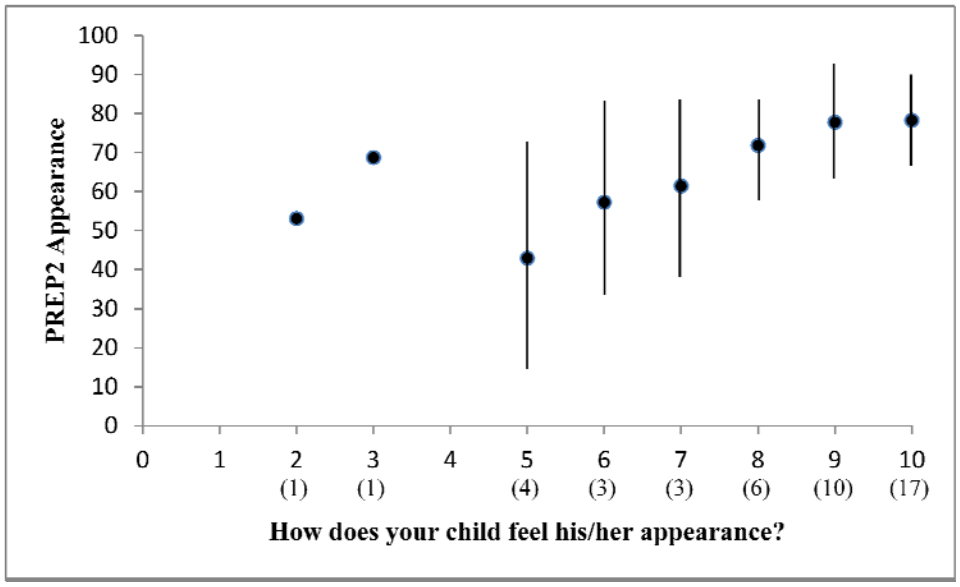
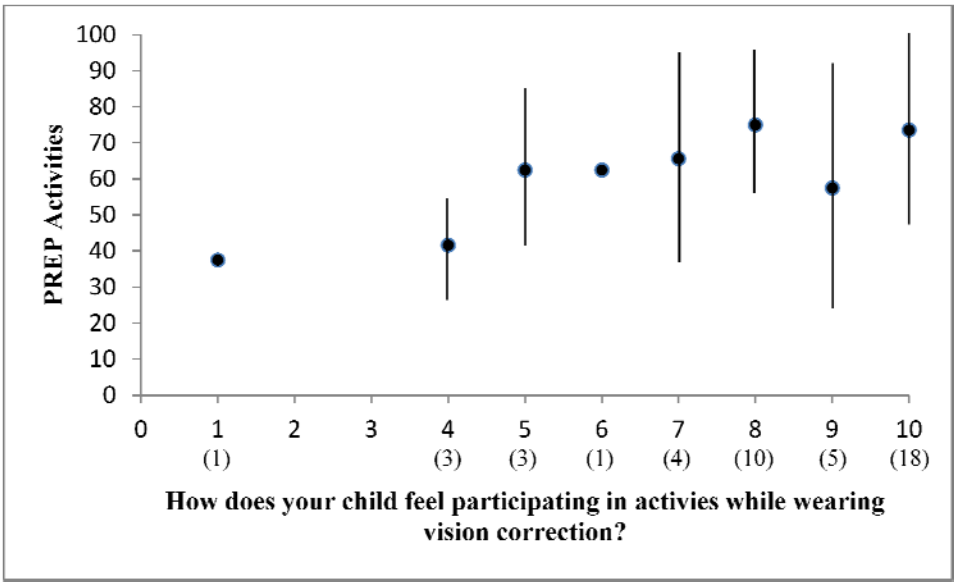


Figure 12. Appearance score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.38; p=0.011) and b) PREP2 (correlation coefficient=0.50; p=0.001). The dot represents the mean score and bars indicate the standard deviation. The number in the parenthesis indicates the number of parents that gave that score.

a



b

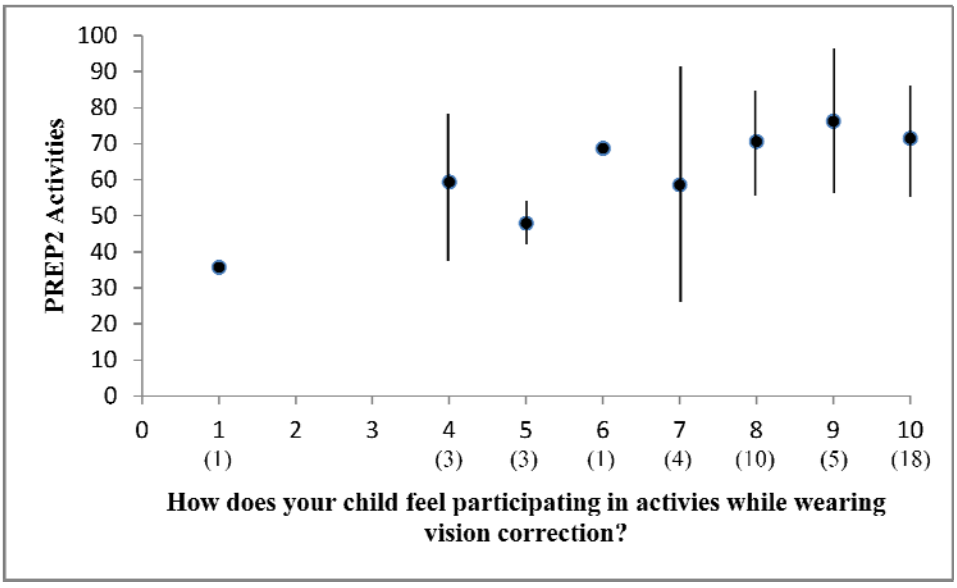
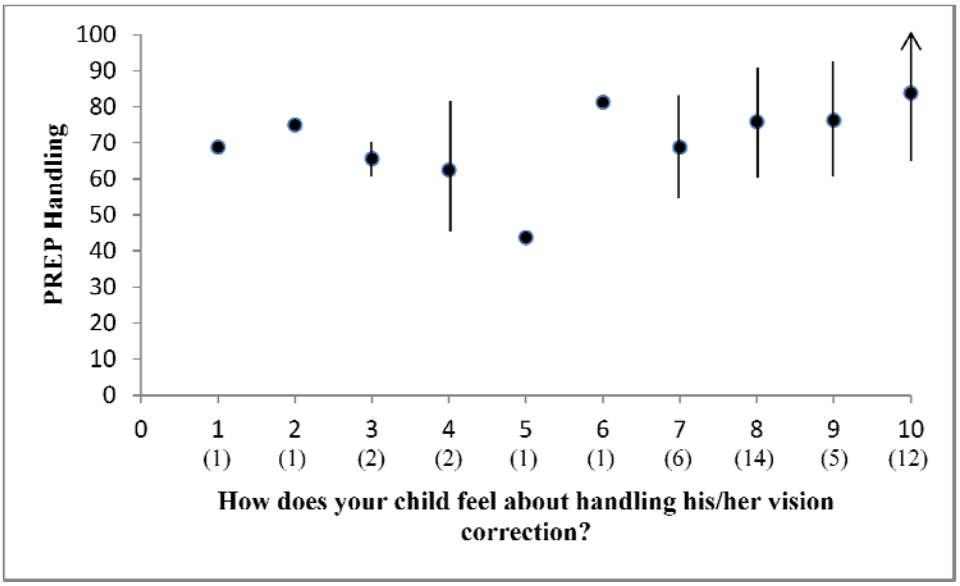


Figure 13. Activities score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.18; p=0.237) and b) PREP2 (correlation coefficient=0.46; p=0.001). The dot represents the mean score and bars indicate the standard deviation. The number in the parenthesis indicates the number of parents that gave that score.

a



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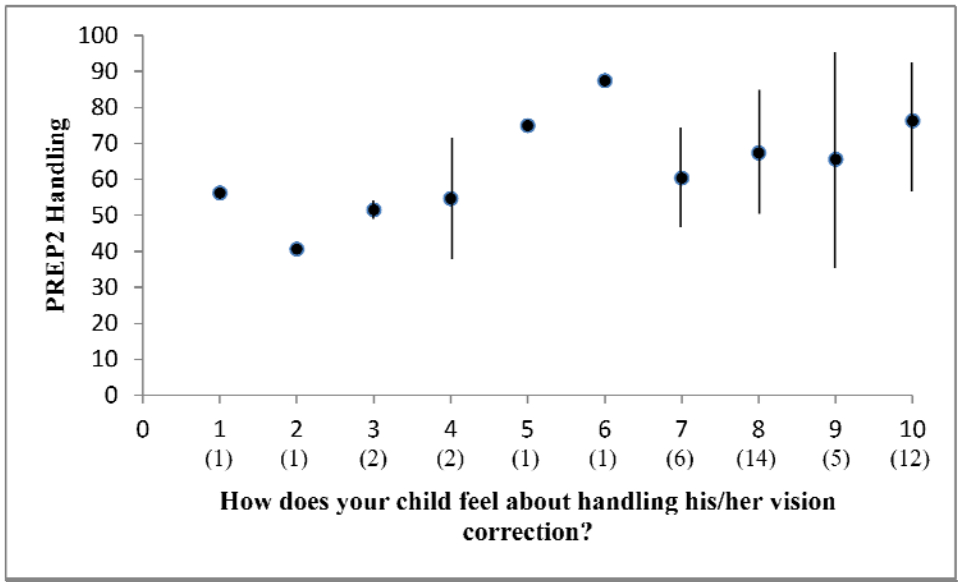
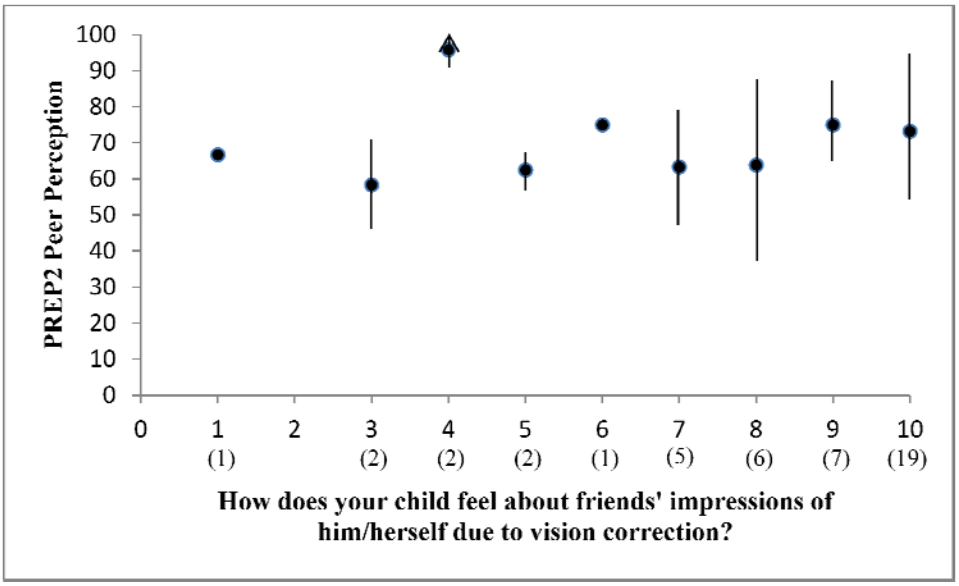


Figure 14. Handling score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.40; $p<0.001$) and b) PREP2 (correlation coefficient=0.34; $p=0.022$). The dot represents the mean score and bars indicate the standard deviation. Arrows indicates a standard deviation exceeding 100. The number in the parenthesis indicates the number of parents that gave that score.

a



b

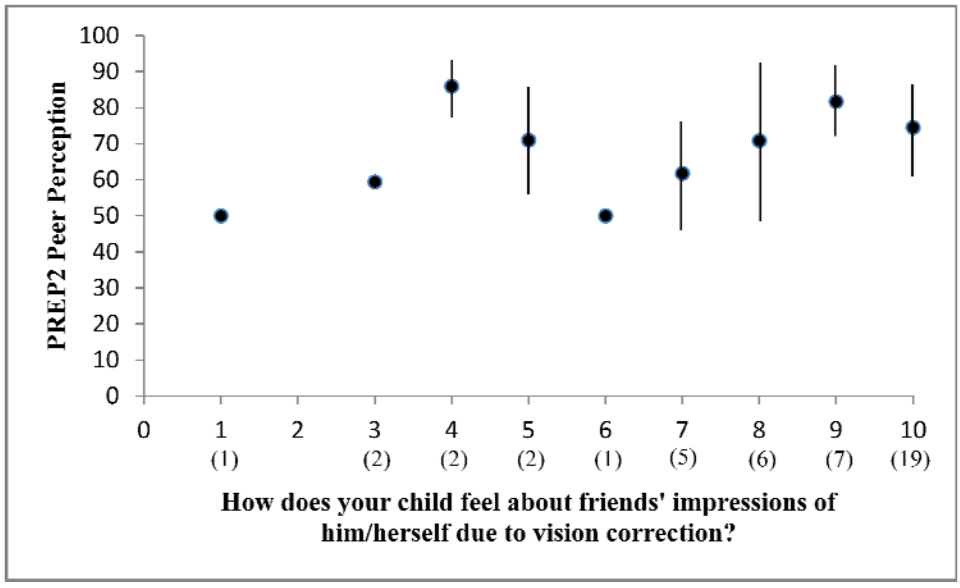


Figure 15. Peer Perception score compared to corresponding answer given by guardian on the a) PREP (correlation coefficient=0.15; p=0.318) and b) PREP2 (correlation coefficient=0.27; p=0.078). The dot represents the mean score and bars indicate the standard deviation. Arrows indicates a standard deviation exceeding 100. The number in the parenthesis indicates the number of parents that gave that score.

The internal consistency of the PREP and PREP2 was measured using Chronbach's alpha for all items within a given scale on the first time the survey was taken. Table 17 shows the items in each scale for the PREP. The purpose of Chronbach's alpha is to compare all items within a given scale to make sure all questions in that scale are measuring the same thing.

Satisfaction	Item 1: I like to wear my _____ lenses.
Handling	Item 2: It is easy to clean and take care of my _____. Item 15: It is easy to put on and take off my _____. Item 19: My _____ get lost or broken easily. Item 21: My glasses fall off my face/contact lenses fall out of my eyes.
Overall Vision	Item 3: When I wear my _____ I have problems seeing clearly. Item 9: When I wear my _____ my vision is very clear. Item 26: When I wear my _____ my vision is blurry.
Peer Perception	Item 4: When I wear my _____ my friends make fun of me. Item 13: When I wear my _____ my friends want to wear glasses too. Item 24: When I wear my _____ my friends like the way I look.
Symptoms	Item 5: When I wear my _____ my eyes hurt. Item 7: When I wear my _____ my nose, ears, or head hurts. Item 11: When I wear my _____ my eyes itch, burn, or feel dry. Item 20: When I wear my _____ my eyes feel good.
Near Vision	Item 6: When I wear my _____ I have no problems seeing the computer or video games. Item 16: When I wear my _____ I have problems reading.
Appearance	Item 8: When I wear my _____ I like how I look. Item 18: I don't like how I look with _____. Item 25: If I wore _____ I would look better.
Distance Vision	Item 10: When I wear my _____ I am able to see clearly far away. Item 23: When I wear my _____ I have problems seeing at the movies or when I look far away.
Academics	Item 12: When I wear my _____ I do better at school. Item 14: When I wear my _____ I do better on tests.
Activities	Item 17: I never have problem wearing my _____ when I play outdoor. Item 22: I am bothered by my _____ when I play sports, dance or do other activities.

Table 17. PREP items according to scale compared for internal consistency.

Overall Vision, Appearance, Distance Vision, and Academics had an internal consistency greater than 0.70 (Table 18).

	PREP	PREP2
Handling	0.557	0.736
Overall Vision	0.840	0.814
Peer Perception	0.573	0.718
Symptoms	0.683	0.829
Near Vision	0.223	
Appearance	0.779	0.821
Distance Vision	0.852	
Academics	0.711	
Activities	0.652	0.795
Overall		0.881

Table 18. Cronbach's alpha internal consistency for comparing items within a scale of the PREP and PREP2.

Table 19 shows the items in each scale for PREP2. All scales on the PREP2 had an internal consistency greater than 0.70, as opposed to the PREP, which had five scales under 0.70 (Table 18).

Handling	Item 5: When I play outdoors, I never have a problem with my vision correction. Item 12: My vision correction sometimes breaks or falls off while I am wearing it. Item 19: When I am active, my vision correction never falls off. Item 26: My vision correction is sometimes hard to put on or take off. Item 33: My vision correction never gets lost or broken. Item 40: Sometimes it is hard to clean my vision correction. Item 47: It is easy to put on or take off my vision correction. Item 54: I don't like cleaning my vision correction.
Overall Vision	Item 1: My vision if very clear when I look far away (movies or board at school). Item 8: When I look far away, my vision is not as clear as I would like it to be. Item 15: My vision is very clear when I look at something close (book or cell phone) Item 22: When I read, my vision is not as clear as I would like it to be. Item 29: My vision is always excellent. Item 36: Sometimes my vision is not clear. Item 43: I can always see better than my friends. Item 50: My friends usually see better than me.
Peer Perception	Item 6: My friends make fun of me because of my vision correction. Item 13: My friends want the same kind of vision correction that I have. Item 20: My friends don't like how I look when I wear my vision correction. Item 27: My friends only say good things about my vision correction. Item 34: My friends sometimes say things that are not nice about my vision correction. Item 41: My friends never mention my vision correction. Item 48: My friends sometimes laugh about my vision correction. Item 55: When I wear my vision correction, my friends like the way I look.
Symptoms	Item 2: My eyes are sometimes uncomfortable. Item 9: My eyes are always comfortable. Item 16: My eyes sometimes itch, burn, or feel dry. Item 23: My eyes never feel irritated. Item 30: I am sometimes uncomfortable when I wear my vision correction. Item 37: My eyes always feel great. Item 44: Sometimes I don't like how my eyes feel.

Continued

Table 19. PREP2 items according to scale that were compared for internal consistency.

Table 19 continued

	Item 51: Wearing my vision correction is always comfortable.
Appearance	Item 3: I am happy with the way that I look. Item 10: I do not like how I look when I war my vision correction. Item 17: My vision correction makes me look cool. Item 24: I think that I could be better looking. Item 31: When I wear my vision correction, I like how I look. Item 38: When I look in the mirror, I do not like how I look. Item 45: Nobody notices when I wear my vision correction. Item 52: Wearing my vision correction makes me look worse.
Activities	Item 4: When I play sports or other activities, I sometimes don't wear vision correction because it bothers me Item 11: When I play outdoors, I never have a problem with my vision correction. Item 18: When I play outside, my vision correction sometimes bothers me. Item 25: I am never bothered by my vision correction when I am active (sports, dance, etc.). Item 32: I am worse at sports because my vision correction bothers me. Item 39: I never have any problems when I wear my vision correction while I play sports or do other activities. Item 46: I could be better at sports if I didn't have to wear vision correction. Item 53: I can play outside without ever thinking about my vision correction.
Overall	Item 7: I love my vision correction. Item 14: I don't like my vision correction very much. Item 21: I never have problems with my vision correction Item 28: I wish I had a different kind of vision correction. Item 35: I like to wear my vision correction. Item 42: In general, wearing my vision correction bothers me. Item 49: I don't even notice my vision correction. Item 56: I hate wearing vision correction.

Chapter 4: Discussion

4.1 PREP versus PREP2

The PREP's and PREP2's repeatabilities were established using the 95% limits of agreement and correlations for the two repeat administrations of the corresponding surveys. Based on the data collected in this study, all scales of the PREP2 completed by spectacle wearers had better repeatability than the corresponding PREP for Glasses scales. Although the Overall Average for the PREP had better repeatability than the Overall scale for the PREP2, the PREP2's Overall scale is an individual scale, which accounts for what is most important to the child, opposed to the PREP, which is an average of the entire survey. Therefore, they are not comparing the same thing. The PREP2 also had better repeatability on all scales, except for the Symptoms scale.

For glasses wearers, the PREP2 had lower bias between the first and second administration than the PREP for Glasses on all scales except Handling. For contact lens wearers, the PREP2 had less bias on the Overall, Vision, Symptoms, and Activities scales than the PREP, but the PREP for Contact Lenses had less bias than the PREP2 on the Appearance, Handling, and Peer Perception scales. However, there was not a statistically significant bias between the first and second administration for any scale except the Academics scale of the PREP for Glasses. This bias may be because many of the surveys were completed during the summer months when children were not in school. Therefore,

children may have forgotten how they felt while in school or gotten new glasses since they last attended school.

When comparing repeatability between age groups, the older age group, age 12 to 14, was more repeatable than the younger group for glasses wearers. This is not true for contact lens wearers. This could be because the younger age group of contact lens wearers only consisted of a population of 3, with no subject younger than 11.

Pearson's correlation coefficient was used to compare the score of the two administrations of each survey. All scale correlations for glasses wearers, except Appearance, were higher for the PREP2 than for the PREP. On average, the PREP2 correlation was 0.04 greater than the PREP for glasses, with the largest difference on the Activities scale (0.57 for PREP and 0.70 for PREP2). Although this difference is small, it does show that the PREP2 offers better correlation than the PREP, even if minimal. The difference in correlation coefficient between the two Appearance scales was minimal (0.84 for PREP and 0.82 for PREP2). Contact lens wearers had a higher correlation on the PREP2 for Vision, Appearance, and Handling. The PREP was higher on Symptoms, Activities, and Peer Perception. On average, the difference in correlations was 0.09, with the PREP2 exhibiting higher correlations. For both glasses and contact lens wearers, the PREP2 was slightly more repeatable than the PREP. When comparing glasses wearers to contact lens wearers, the contact lens wearers often had slightly better correlation on both surveys. This is most likely because the contact lens wearers were older than the glasses wearers.

The PREP's and PREP2's validities were established by comparing correlation with the guardian and examining internal consistency. Most of the correlations with both the PREP and PREP2 were insignificant. This is most likely due to the fact that the guardians did not know exactly how their children felt and may have been including some of their own opinions and concerns. However, the PREP2 did have a higher correlation with guardian responses than the PREP for all scales, except Symptoms and Handling. On average, the PREP2 correlation with the parents was 0.09 better than the PREP. The Symptoms and Handling scales had better correlation with the PREP than with the PREP2 (0.09 better and 0.06 better respectively). In general, those parents that rated low for any scale, by giving a score less than five, rated each scale consistently low. The exception to this is the Vision scale. Two parents who rated their child's vision as a one proceeded to assign five or better to every other scale, assigning most of the other scales a ten. Nine parents thought their child felt poorly about their vision, by rating it below five. This may be because subjects were not excluded from the study based on visual acuity, so several subjects' habitual acuity was reduced. Another reason may be that the parent interpreted the question to be without vision correction.

Cronbach's alpha was used to establish internal consistency. The PREP2 had a higher internal consistency than the PREP in all scales, except Vision. However, both surveys' Vision scale showed high consistency with a Chronbach's alpha score greater than 0.80 (0.84 for PREP and 0.81 for PREP2). The PREP's Handling, Peer Perception, and Near Vision scales had low internal consistency with alpha scores less than 0.60. The

PREP had a lower internal consistency, most likely because of the small number of questions in each scale.

Previous reports of the PREP's repeatability have been published in the literature. According to Rah et al., the repeatability of the PREP is low, especially for the Near Vision, Far Vision, Satisfaction, Activities, and Academic scales for both contact lenses and glasses (Rah et al., 2010). This is consistent with our data, especially for the Near Vision scale. The difference between the two administrations of the PREP survey for glasses and contact lenses were similar in most scales between our data and that found in the literature (Rah et al., 2010). The differences between the two administrations of the PREP2 were at least one point smaller in most scales than the PREP scores reported by Rah et al. , except for in the Peer Perception and Handling scales. This indicates that compared to the literature, the PREP is unreliable and the PREP2 is slightly more reliable than the PREP.

For the scales in which the PREP had a smaller difference between the two administrations, it was only smaller than the PREP2 by one point, except for the Symptoms scale for contact lens wearers which had a difference two points higher for the PREP2. Overall, the PREP2 had a smaller difference in most scales compared to the PREP data reported by Rah et al., showing that the PREP2 has better repeatability than the PREP on most scales, but for those that are not better, the scales are nearly the same. This improved repeatability is most likely from the increased number of questions in each scale and the lack of bias created by asking an equal number of positively and negatively worded questions.

4.2 PREP2 vs. NEI RQL and RSVP

One vision survey with well established repeatability and validity is the National Eye Institute Refractive Error Quality of Life survey (NEI-RQL). This survey, designed for adults (Hays et al., 2003), showed an overall 95% limits of agreement of -9.1 to 10.1 (Nichols et al., 2003). This is similar to that found in the PREP2 for contact lenses on the Overall Scale. There was not a significant bias between the first and second administration of the NEI-RQL for any scales (Nichols et al., 2003), similar to what was found for the PREP2. The literature reports the NEI-RQL to have a correlation ranging from 0.49 to 0.91 (Nichols et al., 2003), which is lower correlation on some scales compared to the PREP2. This survey has been reported to have an overall internal consistency of 0.91 (Nichols et al., 2003), which is slightly higher than the Overall scale of the PREP2, which had an alpha score of 0.881.

The Refractive Status and Vision Profile survey (RSVP) is another vision correction-specific survey with high repeatability and validity for adults (Kadkhoda et al., 2006; Nichols et al., 2003; Vitale et al., 2000). This survey has an overall 95% limits of agreement of -12.1 to +12.5 (Nichols et al., 2003), which is similar to that found in contact lens wearers. There was not a significant bias between the first and second administration of the NEI-RQL for any scales (Nichols et al., 2003), similar to the PREP2.

The RSVP had a similar range of correlation coefficients to the NEI-RQL and PREP2 for spectacle wearers, with a range of 0.47-0.85 (Nichols et al., 2003). The range for internal consistency of the different scales of the RSVP was slightly lower than that of

the PREP2, but the Chronbach's alpha score for the overall scale was similar to the RSVP, with an alpha score of 0.81 (Nichols et al., 2003) and the PREP2, with an overall alpha score of 0.88.

4.3 Sample

Our sample consisted of 45 children between the ages of eight and 14 years. Of those subjects, 55% wore spectacles for vision correction. Just over half of the subjects were female. The majority of subjects in our study were Caucasian or African American. Our subject pool is fairly consistent with that of the US population. 56% of our subjects were Caucasian, which is slightly lower than that of the United States population which is 72.4% (Humes et al., 2011). Our survey consisted of a larger percentage of African Americans and Asians than in the US population, 12.6% and 4.8% respectively for the population (Humes et al., 2011), compared to 27% and 9% in our study. The demographics of our survey did not change from those who started the study to those who completed the study. This is important to note because it shows that the PREP and PREP2 are not more challenging for any specific ethnicity.

The age and race for those who began the study was statistically the same as those who completed the survey. However, those contact lens wearers that completed the study were statistically older than those glasses wearers that completed the study. This may be problematic in comparing the results of contact lenses to that of glasses wearers. However, since all subjects completed both the PREP and PREP2, when the contact lens wearers and glasses wearers are combined, the repeatability and validity reported would not be compromised.

Most subjects in the study were low to moderately myopic. On average, the glasses wearers had -2.22D of myopia, while contact lenses wearers had on average -3.17D of myopia. Both the glasses wearers and contact lens wearers had good vision. The glasses wearers on average got 50 letters correct on the Bailey Lovie chart when standing four meters away, while contact lens wearers on average got 55 letters. With these refractive errors and visual acuities, many of these subjects would meet the qualifications of myopia control studies.

4.4 Limitations

Although the age and ethnicity of those subjects who completed the study were statistically the same as those who began, our survey did have a dropout rate of 36%. In order to improve the retention rate, perhaps compensation should be split between the two administrations of the survey, instead of being given in full at the initial visit. This may incentivize subjects to complete the second administration. The high dropout rate may have also been caused by the PREP2 being substantially (30 questions) longer. Another reason the dropout rate was so high may have been because a majority of the surveys were administered during the summer, so many of the families may have gone on vacation after beginning the study and forgot to completed the second set of surveys. This dropout rate is similar to the 27.5% dropout rate seen in the validation of the RSVP (Vitale et al., 2000).

Another limitation was due to the execution of the study. The order of which survey was administered first was not randomized. Therefore, it would be expected that a subject would lose attention and give less repeatable answers on the survey taken second.

Also, some of the subjects read the surveys themselves, while others had the surveys read to them. This coulc cause changes in how the patient chose to answer the questions. Furthermore, many of the subjects' eyes were dilated during the first administration, which could result in changes to many answers, especially in the Near Vision scale on the PREP.

The United States Food and Drug Administration has given guidelines for the creation of surveys for patient reported outcomes for medical devices (US Food and Drug Administration, 2006). Although our study followed many parts of this guideline, we did not test very narrow age groups to find the youngest age in which the survey can still be understood. Also, these guidelines emphasize the importance of decreasing the drop out rate and having a plan on dealing with missing data, which is not something we had identified before the beginning of the study.

Compared to the PREP, the PREP2 does not address the scales of Satisfaction, Academics, Near Vision, and Far Vision. Although the questions on the PREP2 could apply to orthokeratology lens wear, no subjects in this study wore this style of contact lens. The other main limitation to our study is that we did not perform Rasch analysis, which would have been ideal to determine the scalability of our psychometric data.

Chapter 5: Conclusion

Currently, the only vision-correction specific quality of life survey for children is the Pediatric Refractive Error Profile (PREP). However, the repeatability of the PREP is poor (Rah et al., 2010). The Pediatric Refractive Error Profile 2 (PREP2) is a 56 question vision-correction specific pediatric survey with adequate repeatability and validity. On most scales, the PREP2 was more repeatable than the original PREP, and the correlation between the first and second administration is typically higher.

The PREP2 also has higher validity than the PREP when compared with the opinions of the parent or guardian to those of the child and when being examined for internal consistency.

The PREP2 has similar repeatability and validity to adult vision-specific surveys, such as the NEI-RQL and RSVP. As myopia control studies continue to advance, the PREP2 could be used to measure how different treatment options affect a child's vision-specific quality of life over time.

Further studies may also examine the possibility of including fewer questions per scale for the PREP2, conducting Rasch analysis to determine the scalability of the responses on the PREP2, and confirm the repeatability and validity of the PREP2 in subjects wearing orthokeratology lenses.

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Appendix A: PREP for Glasses

Below are several statements that describe what some children feel about wearing glasses. Read each of the statements below.
Circle whether you strongly disagree, disagree, neither agree or disagree, agree, or strongly agree.

1.	I like to wear my glasses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.	It is easy to clean and take care of my glasses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3.	When I wear my glasses I have problems seeing clearly.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.	When I wear my glasses my friends make fun of me.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5.	When I wear my glasses my eyes hurt.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6.	When I wear my glasses I have no problems seeing the computer or video games.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7.	When I wear my glasses my nose, ears, or head hurts.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8.	When I wear my glasses I like how I look.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9.	When I wear my glasses my vision is very clear.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10.	When I wear my glasses I am able to see clearly far away.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11.	When I wear my glasses my eyes itch, burn, or feel dry.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12.	When I wear my glasses I do better at school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13.	When I wear my glasses my friends want to wear glasses too.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
14.	When I wear my glasses I do better on tests.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
15.	It is easy to put on and take off my glasses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16.	When I wear my glasses I have problems reading.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
17.	I never have a problem wearing my glasses when I play outdoors.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
18.	I don't like how I look with glasses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19.	My glasses get lost or broken easily.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
20.	When I wear my glasses my eyes feel good.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
21.	My glasses fall off my face.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
22.	I am bothered by my glasses when I play sports, dance or do other activities.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23.	When I wear my glasses I have problems seeing at the movies or when I look far away.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
24.	When I wear my glasses my friends like the way I look.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25.	If I wore contact lenses I would look better.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26.	When I wear my glasses my vision is blurry.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix B: PREP for Contact Lenses

Below are several statements that describe what some children feel about wearing glasses. Read each of the statements below.
Circle whether you strongly disagree, disagree, neither agree or disagree, agree, or strongly agree.

1.	I like to wear my contact lenses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.	It is easy to clean and take care of my contact lenses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3.	When I wear my contact lenses I have problems seeing clearly.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.	When I wear my contact lenses my friends make fun of me.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5.	When I wear my contact lenses my eyes hurt.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6.	When I wear my contact lenses I have no problems seeing the computer or video games.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7.	When I wear my contact lenses my nose, ears, or head hurts.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8.	When I wear my contact lenses I like how I look.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9.	When I wear my contact lenses my vision is very clear.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10.	When I wear my contact lenses I am able to see clearly far away.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
11.	When I wear my contact lenses my eyes itch, burn, or feel dry.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12.	When I wear my contact lenses I do better at school.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13.	When I wear my contact lenses my friends want to wear contact lenses too.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
14.	When I wear my contact lenses I do better on tests.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
15.	It is easy to put in and take out my contact lenses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16.	When I wear my contact lenses I have problems reading.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
17.	I never have a problem wearing my contact lenses when I play outdoors.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
18.	I don't like how I look with contact lenses.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19.	My contact lenses get lost or broken easily.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
20.	When I wear my contact lenses my eyes feel good.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
21.	My contact lenses fall out of my eyes.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
22.	I am bothered by my contact lenses when I play sports, dance or do other activities.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23.	When I wear my contact lenses I have problems seeing at the movies or when I look far away.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
24.	When I wear my contact lenses my friends like the way I look.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25.	If I wore glasses I would look better.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26.	When I wear my contact lenses my vision is blurry.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix C: PREP2

Which vision correction do you wear most of the time?

Glasses ☐$_1$
Contact lenses ☐$_2$
Corneal reshaping contact lenses ☐$_3$

Below are several statements that describe what some children feel about wearing vision correction (glasses, contact lenses, or corneal reshaping contact lenses). Read each of the statements below, and circle ***one*** answer that describes how you feel when you wear the vision correction that you marked in the first answer.

1.	My vision is very clear when I look far away (movies or board at school).	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
2.	My eyes are sometimes uncomfortable.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.	I am happy with the way that I look.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
4.	When I play sports or other activities, I sometimes don't wear vision correction because it bothers me.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.	When I play outdoors, I never have a problem with my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.	My friends make fun of me because of my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.	I love my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.	When I look far away, my vision is not as clear as I would like it to be.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.	My eyes are always comfortable.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10.	I do not like how I look when I wear my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
11.	When I play outdoors, I never have a problem with my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
12.	My vision correction sometimes breaks or falls off while I am wearing it.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13.	My friends want the same kind of vision correction that I have.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
14.	I don't like my vision correction very much.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
15.	My vision is very clear when I look at something close (books or cell phones).	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
16.	My eyes sometimes itch, burn, or feel	Strongly	Disagree	Neutral	Agree	Strongly

	dry.	disagree				agree
17.	My vision correction makes me look cool.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
18.	When I play outside, my vision correction sometimes bothers me.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
19.	When I am active, my vision correction never falls off.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
20.	My friends don't like how I look when I wear my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
21.	I never have problems with my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
22.	When I read, my vision is not as clear as I would like it to be.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
23.	My eyes never feel irritated.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
24.	I think that I could be better looking.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
25.	I am never bothered by my vision correction when I am active (sports, dance, etc.).	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
26.	My vision correction is sometimes hard to put on or take off.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
27.	My friends only say good things about my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
28.	I wish I had a different kind of vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
29.	My vision is always excellent.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
30.	I am sometimes uncomfortable when I wear my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
31.	When I wear my vision correction, I like how I look.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
32.	I am worse at sports because my vision correction bothers me.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
33.	My vision correction never gets lost or broken.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
34.	My friends sometimes say things that are not nice about my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
35.	I like to wear my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
36.	Sometimes my vision is not clear.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
37.	My eyes always feel great.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
38.	When I look in the mirror, I do not like how I look.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
39.	I never have any problems when I wear my vision correction while I play sports or do other activities.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

40.	Sometimes it is hard to clean my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
41.	My friends never mention my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
42.	In general, wearing my vision correction bothers me.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
43.	I can always see better than my friends.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
44.	Sometimes I don't like how my eyes feel.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
45.	Nobody notices when I wear my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
46.	I could be better at sports if I didn't have to wear vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
47.	It is easy to put on or take off my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
48.	My friends sometimes laugh about my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
49.	I don't even notice my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
50.	My friends usually see better than me.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
51.	Wearing my vision correction is always comfortable.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
52.	Wearing my vision correction makes me look worse.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
53.	I can play outside without ever thinking about my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
54.	I don't like cleaning my vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
55.	When I wear my vision correction, my friends like the way I look.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
56.	I hate wearing vision correction.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Appendix D: Parent Survey

Child's age: __ __

Child's gender:
Boy ☐$_1$
Girl ☐$_2$

Child's ethnicity:
Hispanic or Latino ☐$_1$
Not Hispanic or Latino ☐$_2$

Child's race:
American Indian or Alaska Native ☐$_1$
Asian ☐$_2$
Native Hawaiian or other Pacific Islander ☐$_3$
Black or African American ☐$_4$
White ☐$_5$
More than one race ☐$_6$
Unknown or not reported ☐$_7$

The following questions are answered on a scale of 1 (dislikes) to 10 (likes).
Please consider times throughout the day when your child's vision is corrected.
Do not ask your child how he or she feels; give your own impression.

How does your child feel about his or her vision? _ __

How does your child feel about his or her eye comfort? __ __

How does your child feel about his or her appearance? __ __

How does your child feel about participating in activities while wearing vision correction? __ __

How does your child feel about handling his or her vision correction (put on/off, clean, fear of breaking, etc.) __ __

How does your child feel about friends' impressions of himself or herself due to vision correction? __ __

Overall, how does your child feel about his or her vision correction? __ __