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An Interview Study on Children's Spectacle Frame Fit

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Abstract. Although studies have examined problems with spectacle frame fit, little is known about appropriate frame design for children. To identify practical problems in this area, semi-structured interviews were conducted in Hong Kong with dispensing opticians, children who wear glasses, and the children's parents. The data analysis showed that frame width, nose pads, and leg shape were related to fit problems. However, there is no fit standard between faces and frames, and the temple width was the main reference used by dispensing opticians to help children choose spectacle frames. In conclusion, dispensing opticians are important actors in the selection of more appropriate spectacle frames for children, but they might be unable to solve fit problems in the nose area and ears due to deficiencies in frame design. As little research has been conducted on problems in children's spectacle design and fit, further studies on spectacle frame design should investigate children's facial features and special needs.

Keywords: Semi-structured interview; Spectacle fit; Children

1 Introduction

An increasing number of children wear glasses for visual correction and protection [1, 2]. Researchers have long been concerned with frame fit problems. Although some research has led to advancements in spectacle frame design, previous studies have indicated that research results based on adult facial dimensions cannot be used for designing children's frames, as children are not sized as miniature adults [3–6].

Children's heads change with age, more so than those of adults [7], posing difficulties in the design and fitting of comfortable headwear and face wear for children. To improve the design of these products, a standard for the head–face dimensions of Chinese minors [8] has been introduced in China. However, the standard provides only 15 head–face dimensions, which are insufficient for improving the morphological fit of spectacle frames. In addition, foreign and domestic studies have been conducted to record one-dimensional measurements of children's facial changes for the design of specific products, such as spectacle frames, helmets, and oxygen masks [5, 6, 9–11].

Among these studies, a quantitative method involving the collection of facial measurements has been the dominant means of determining the relationships between head and product measurements. The main problems of children's spectacle frame fit are still unclear, although previous studies have discussed morphological fit problems on Caucasian children [5] and Chinese children [6]. The limited amount of research means that existing fit problems and necessary improvements in children's spectacle frame design are still unclear.

The quantitative method is useful for investigating a variety of work and research questions [12] and has been widely applied in ergonomics studies in fields such as foot-wear [13] and personal protective eyewear [14]. In terms of eyeglass design, a previous study demonstrated the general needs of children through the storytelling method [15].

This study employed interviews to obtain a more thorough understanding of this area of concern. The major research question was: what are the existing practical problems in children spectacle frame fit? Because fit preference is influenced by the style, material, and weight of spectacle frames, in addition to size [16], three subsidiary questions were posed: What are the practical problems of fit between facial and frame dimensions? What are children's needs regarding weight, material, and style? Do they have any other requirements when choosing frames?

2 Method

2.1 Participants

A total of 23 groups of children and parents were interviewed. The children recruited had different levels of vision problems and all needed to wear glasses. Because children might not listen and respond to questions as seriously as adults [17], parents were included in the interviews to improve the quality of answers, assisting or substituting for their children and replying to questions based on their parenting experience. Three dispensing opticians took part in this study, all of whom had more than 3 years' working experience in prescribing glasses. All participants were recruited from an optometry clinic.

2.2 Interview Design

Two semi-structured interviews were designed. The format rendered the investigation process more flexible, as the interviewer could develop questions beforehand and vary them depending on situational demands [18]. Two different questionnaires were developed for interviewing children and their parents and interviewing dispensing opticians.

The child-parent questionnaire was aimed at understanding the practical problems that children encounter when wearing a pair of glasses, and contained 24 questions. The first questions concerned basic information: gender, age, number of years having worn glasses, eyesight, number of frames worn, frequency of changing frames, and reasons for changing frames. To understand facial dimensions and fit problems, three questions were asked regarding facial discomfort, poorly fitted frames, and other discomfort. Then, based on a literature review, further questions were designed regarding the following four aspects: size (nose pads, frame legs, frame rims, and joints), weight, materials, and style. Participants were required to rank these factors and provide detailed explanations of their ranking. Subsequently, the children's frame-wearing experiences were investigated, including their difficulties in selection, inconveniences in daily life, and favorite frames.

Another questionnaire was developed to collect the views of dispensing opticians on children's spectacle frame fit problems; it contained 21 questions. Three questions on gender, age, and years of working experience were designed to acquire basic information. Practical circumstances were understood through four types of questions: standard process (prescribing glasses, fit standards, and sizing), working experience (necessary questions before prescribing, parent and child needs,

preferences, and complaints), fit according to facial dimensions (current fitting problems, frame measurement, and fit) and current spectacle design (recommended products, as well as advice for spectacle frame design).

The results from these two types of interviews were compared and combined to derive answers to the research questions.

3 Result

3.1 Interviews with Parents and Children

General Information. A total of 23 groups of parents and children took part in this investigation, including 12 boys and 11 girls aged from 4 to 16 years old (average of 8.9 years, standard deviation of 3.2). All of the children suffered from vision problems, including myopia only, astigmatism only, hyperopia only, amblyopia only, both hyperopia and astigmatism, and both myopia and astigmatism (Fig. 1). Their levels of eyesight varied as well, from 100° to 600° (Fig. 2). A total of 17 of the children had been wearing a pair of glasses for more than 2 years, and 17 had bought more than two pairs of glasses. This indicated that the respondents had adequate wearing experience for the purposes of this study.

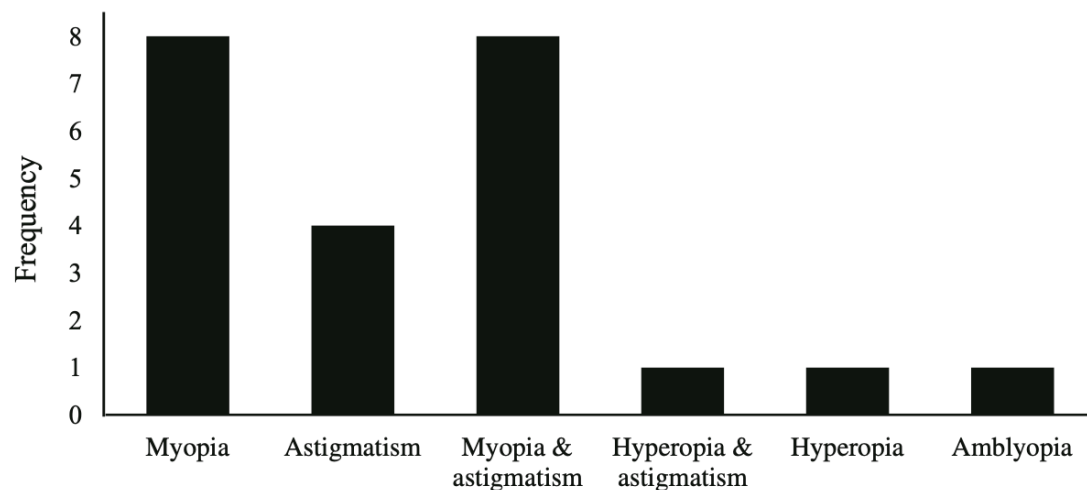


Fig.1. Frequency of children's vision problems

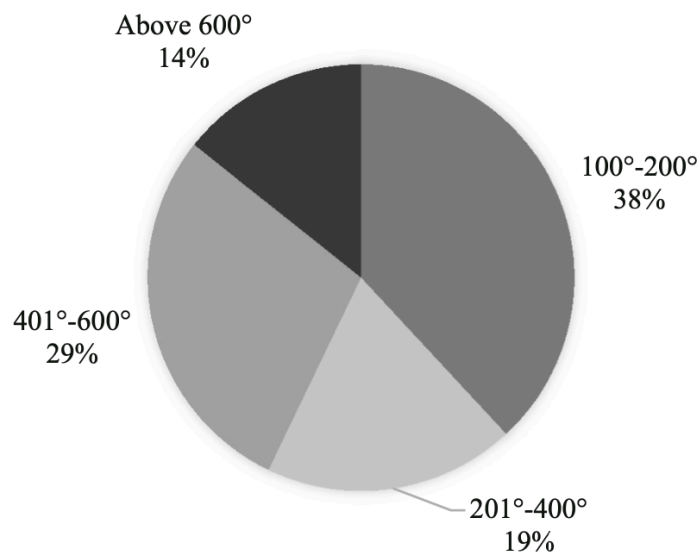


Fig.2. Proportion of children's eyesight level

Fit Problems. Although the majority of the children (22) had bought another pair of glasses due to a change in vision, four of them also reported that they had done so in response to head growth. Rim width and leg length were unsuited to the children's temple width and the distance from front to bend. Complaints about the frame being uncomfortable were mostly lodged by the older children (aged at least 7 years), accounting for 52% of participants. Pressure and pain on the nasal bridge (30%) and ears (22%) were the main reasons provided. In addition, six participants stated that the nose pads did not fit their noses and three participants indicated that the curves of the legs did not match the shapes of their ears. However, respondents who reported frame-induced discomfort did not necessarily think that there were any problems with the frame measurements, and vice versa.

Special Needs. To understand how parents, who usually make final frame-purchasing decisions, considered frame selection, parents were required to rank factors from most important (one) to least important (five). The mean rankings are shown in Table 1. Frame size was the highest-ranked consideration. The mean rankings of materials and weight were similar, followed by style; price had the lowest ranking. Parents were also required to provide detailed explanations of their rankings. Parents paid attention to frame size, but many of them (six) depended heavily on dispensing opticians' opinions when making such a decision, stating that they might lack knowledge in this area. Further information regarding preferences for frame components (nose pads, legs, and rim) was also explored. A total of 13 parent-child groups said that the nose pads required adjustment; six of these groups indicated that adjusted nose pads were an improvement; and 10 of them preferred to have the legs rest on the outer ears to keep the frame stable on the face, but two of them complained that this type of leg hurt their ears. Preferences for frame rims varied. Considerations of weight, durability, safety, and deformation meant that plastic frames were the most popular, with 19 children wearing them. Although frame style preferences varied, all participants chose full-rim frames and 22 groups preferred lighter frames.

Factors	Mean of rank
Size of frame	2.23
Materials	2.64
Weight	2.74
Style	3.0
Price	4.09

Table1. Rank of factors which influence the choice of spectacle frames

Wearing Experience. Many children (19 respondents) had had negative experiences when wearing glasses. For example, 12 children had experienced frames slipping on the nasal bridge, causing discomfort and even injury to the nose. A total of 10 respondents stated that they might wear their normal frames even when participating in sports. Among all participants, 65% thought that their current frames were optimal in terms of style, size, material, and comfort level.

3.2 Interviews with Dispensing Staff

General Information. Three male dispensing opticians who had been working in the industry for 3–10 years were interviewed.

Standard Process. When helping children to choose appropriate frames, interviewees suggested that vision and temple width were the main reference measurements, because frame width depended on these two factors. Furthermore, one of the opticians stated that unlike nose pads and legs, frame width was not adjustable. Children may try every recommended frame until they find one that matches their temple width, although their temple width will not be formally measured. In addition, all interviewees stated that there is no fit standard between the face and the frame, but they suggested that children use plastic full-rim frames with adjustable nose pads for reasons of safety and durability.

Working Experience. In the opticians' working experience, children generally need new frames owing to vision changes. The opticians would inquire as to the children's habits before recommending glasses types, because it would be safer for an active child to wear glasses with plastic frames. In their experience, parents often ask about frame size problems and are concerned about safety problems, weight, and price. When participants were asked what parents and children frequently complain about, one interviewee indicated discomfort in the temple, nose, and ears, and another noted frame quality.

Fit Problems. Fit problems regarding facial dimensions and frame measurements were also investigated in the interviews. All of the opticians suggested that the main fit problem was whether the frame width could match the child's temple width. An appropriate frame should fit a child's nose shape, outer ear shape, and temple width also. They reported that if the frame components could be adjusted, they would need to change the angle of the nose pads or the shape and length of the frame legs.

Current Spectacle Design. Currently, no unified size chart exists for children's spectacle frames. However, all opticians recommend a particular brand (Tomato Glasses) that has a relatively wide variety of size specifications. One interviewee also suggested that this brand of glasses tends to closely fit a child's low nasal bridge even though its nose pads cannot be adjusted, and its frame legs can sit

comfortably on the ears to prevent the frame from slipping on the nose. Furthermore, they opined that this brand of frames uses materials relatively soft materials, which are safer than others, suitably tough, and do not easily become deformed. As a result, customers are likely to give positive feedback on this brand.

4 Discussion

4.1 Morphological Fit Problems

The findings of this interview suggest that only eyesight problems and temple width are considered when children choose frames. Although some types of frames have adjustable nose pads and legs, some children still experience nose and ear discomfort. This problem has been mentioned in studies focusing on adults [19]. However, among children, most complaints were lodged by participants aged 7 years or older, whereas those younger than 7 years were apparently more satisfied with their frames. This may be because younger children can adapt to pain more quickly than older children, leading to the faster alleviation of symptoms [4]. Another reason may be that children younger than 7 years old could be too young to express their feelings on the matter, considering how some of the younger children's parents noticed marks on the children's nasal bridges. Researchers indicated that nasal bridges are usually low in Caucasian children aged 5 to 7 years [5]. The same is likely true in Chinese children, as many participants reported that frames slip on their noses. However, few studies have provided information on how the growth patterns of children's nose are incorporated into spectacle frame design. The interviewees also reported outer ear discomfort. Previous studies [3–6] have mostly focused on children's facial measurements and ignored outer ear shape, which could have influenced frame leg design. This indicates the need for further study on the relationship between the shapes of frame legs and children's ears.

4.2 Comparison of Interview Statements

Comparing the responses from both the parent–child and dispensing optician interviews, both categories of interviewees were concerned about size problems in children's frames, with dispensing staff reporting that this problem is not often observed in adult frames. Surprisingly, parents thought that the suitability of frame size is very important; this view was especially prevalent among those who had experience wearing glasses. Both categories of interviewees suggested that plastic frames are more suitable for children, because they may be lighter, safer, and softer than metal frames. Parents and dispensing opticians also indicated that lighter frames are more comfortable to wear than heavier frames. Frame weight preference is thus a worthwhile topic for further exploration.

By contrast, parent–child groups and dispensing opticians had different opinions on choosing nose pads and frame legs. The opticians suggested that children should choose nose pads that could be adjusted to their smooth nasal bridges. Although some parents and children thought adjustable nose pads were necessary, some reported that the adjustable nose pads were easy to deform and had smaller areas of contact than the fixed nose pads did, leading to discomfort that caused them to prefer frames with fixed nose pads. Adjustable nose pads may temporarily solve morphological fit problems on the nose, but other factors such as design and children's needs in daily life should also be considered. Children tend to be more active than adults and may not comply with recommendations for spectacle frame use. Thus, frames that can be fixed to their faces and cannot be adjusted might be comparatively suitable.

5 Conclusion

This study investigated practical problems in children's spectacle frame fit through interviews with parents and children and opticians, providing an overall understanding of current problems in this field. Practical fit problems, considerations involved when choosing and wearing a pair of glasses, and current spectacle design can help with further studies of children's spectacle frame design that can identify research gaps and design opportunities. The findings of semi-structured interviews suggest that the lack of guidelines of how to choose an appropriate frame leads to confusion in dispensing process. The importance of the relationship between children's outer ear shape and frame leg design was demonstrated, implying that the results of previous studies have been insufficient for solving all spectacle frame fit problems. Future research must further explore preferences for spectacle frame weight, a concern mentioned by the interviewees. With technological development, the number of spectacle-like products such as Google Glass may increase. Research in this area will not only improve spectacle frame design but also provide information for the design of related products.

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