Sports Wearable Protection Device: Automatic Inflatable Headband

by

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Abstract

This study explored how people who have high myopia can safely participate in group sports. This article analyzes the existing Theory/Practice and combines the author's background to design an automatic Inflatable sports wearable prot ection device for high myopia to solve this problem. The significance of this research can be used to promote high myopia to participate in different types of exercises, increase the length of exercise, and provide an inclusive exerci se environment for people who have high myopia.

Keywords: High Myopia, Sports, Wearable device.

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Chapter 1 Addressing the Design Issue

Section 1.1 Introduction

Due to intense study or work and frequent eye use, many people have eye discomfort such as dry eyes, sore eyes, and decreased vision. Exercise is an excellent way to relieve eye fatigue. Studies have shown that in some significant ball sports with a wide field of vision, the ciliary muscle is in a completely relaxed state, which has an irreplaceable effect on alleviating eye muscle fatigue(Viikari, K. 2011). In some ball sports, the eyeball will constantly adjust and move far and near, up and down, so that the muscles that control eye movement can be fully activated. The ciliary muscles can contract continuously and relaxed, effectively improving ciliary muscle fatigue caused by close work. Research data has confirmed that children who engage in outdoor activities for more than three and a half hours a day have a significantly lower risk of developing myopia(Guggenheim et al., 2012). However, if one has myopia(Nearsighted) already, he/she needs to be cautious when exercising because myopia may not be suitable for all sports.

Myopia is divided into severity, and myopia can divide into three categories: low myopia (within -3.0 diopters), medium myopia (between -3.0 to -6.0 diopters) and high myopia (over -6.0 diopters). For people with low to medium myopia, it is deficient to cause damage to the eyes during most exercises(Pietilä et al., 1998). For example, if a professional basketball player has a medium/low myopia, he/she can choose to wear contact lenses to maintain normal vision during the game. Contact lenses are a more mainstream method, and most professional athletes with myopia choose this method. Because this method does not require surgery, the operation is convenient, and there is almost no risk. However, this method is only suitable for people with low to medium myopia; when myopia deepens to a certain diopter, there will be no suitable contact lenses.

When a person’s eyesight develops to high myopia, he/she can only wear glasses to maintain clear vision. Wearing glasses when participating in physical sports will cause some trauma around the eyes, and taking off the glasses will cause blurred vision and increase the risk of other injuries(Napier et al.,1996). Eye surgery is a reliable way to help people with medium/high myopia restore normal vision so they can take off their glasses. The basic principle of laser eye surgery can be expressed as removing part of the cornea, thereby permanently changing the eye’s refractive power. There are multiple treatment methods globally, including UltraLASIK, Accu-wave LASIK, Custom LASIK, Zyoptix. Still, there are only three main types of treatment: PRK/LASEK, LASIK, and SMILE.

Section 1.2 Vision Restoration Surgeries

PRK(Photorefractive Keratectomy), many people regard it as the first generation of laser vision correction surgery, and new methods in clinical practice have gradually replaced it. PRK can treat low myopia, hyperopia and astigmatism. In PRK surgery, the cornea’s outer layer eyes’ refractive power (also called the epithelium) is first gently removed manually with an instrument. Then the doctor uses an excimer laser to reshape the patient’s cornea and correct his/her vision(Mohan et al., 2003).

- Pros of PRK/LASEK PRK is a good choice for patients with thin or irregular cornea, prone to chronic dry eye, and patients whose eyes will contact directly in work and life (such as boxers and fighters). Thin cornea, dry eye syndrome, and high-risk occupations may make patients unsuitable for LASIK surgery (but they may still be a good candidate for SMILE, which will introduce later). The procedure takes about 5 minutes per eye and is a rapid outpatient operation.

- Cons of PRK/LASEK. No skin flaps are produced during PRK/LASEK surgery; It damages the five-layer structure of the corneal circle to a greater extent, resulting in slower vision recovery and easier corneal turbidity after surgery. The postoperative recovery period is long, and the side effects of the corresponding hormone drugs are also more significant.

LASEK(Laser Epithelial Keratomileusis), compared with PRK, the removed epithelium will be put back in place after surgery. Because the main principle of the two is the same: the surgical site includes the upper elastic layer; thus, they are often listed simultaneously(Kanellopoulos, A. J. 2009).

LASIK(Laser-assisted In Situ Keratomileusis) is the most familiar laser eye surgery for most patients. It is a relatively new laser corneal surgery, which originated in the 1980s, and is now the most commonly used laser eye surgery in clinical practice in the World. LASIK can treat low/ medium myopia, hyperopia and astigmatism. During the LASIK procedure, a femtosecond laser is used to create a corneal flap, folded back after the operation. Then, the doctor uses an excimer laser to reshape the underlying corneal tissue to correct vision(Melki, S. A., & Azar, D. T. 2001).

- Pros of LASIK. The thickness of the corneal flap generally exceeds at least the upper elastic layer and even includes part of the stromal layer. Layers make it better to retain the physiological structure of the cornea itself compared with PRK/LASEK.
- Cons of LASIK. Patients who want to receive LASIK need to have sufficient corneal thickness. Due to the need to create a corneal flap, a certain amount of corneal thickness is required, and patients with thin or irregular cornea may not receive LASIK surgery. Patients with too thin or irregular cornea are usually more suitable for SMILE or PRK/LASEK(Randleman et al., 2003).

SMILE(Small Incision Lenticule Extraction) is the latest laser corneal surgery. SMILE has been in clinical practice since 2012 and widespread in the United States in 2016(Sekundo, W., Kunert, K. S., & Blum, M. 2011). The main difference between SMILE, LASIK and PRK/LASEK is that there is no excimer laser. In contrast, a femtosecond laser makes a tiny incision in the patient's cornea during surgery. Then through two interlayers "blasts" in the cornea, a small piece of corneal tissue known as a microlens is removed. Besides, the laser is used only once during the entire operation(Sekundo, W., Kunert, K. S., & Blum, M. 2011).

- Pros of SMILE. Compared with LASIK, SMILE is a less invasive laser surgery. During the LASIK procedure, the doctor will create a corneal flap with a circumference of 20mm. PRK/LASEK will remove an 8mm diameter piece of tissue on the cornea. In contrast, SMILE only requires a 3mm corneal keyhole incision, increasing the cornea's stability after the operation and reducing the interference to the corneal nerve during the operation(Reinstein et al., 2014. SMILE does not create flaps, and there is no risk of flap-related complications after surgery. Safe, accurate, and fast vision recovery is the advantage of SMILE, and it can achieve the same vision correction as LASIK.
- Cons of SMILE. One disadvantage of SMILE is that it cannot treat hyperopia; SMILE can only treat certain types of myopia; compared with LASIK, the visual recovery time is slightly longer(Reinstein et al., 2014).

Laser surgery is suitable for most people with low/medium myopia (few people high myopia) to restore vision. Taking off the glasses means avoiding some injuries around the eyes during the exercise. However, most laser surgery is irreversible and carries certain postoperative risks. Most people with high myopia

have longer axial length, thinner eyeball wall, and a series of degenerative changes in the fundus, which means the retina becomes fragile and prone to retinal detachment (Barsam, A., & Allan, B. D 2014). Playing basketball, high jump, football, running, diving, bungee jumping, dancing, badminton, boxing, and other extreme sports may not be suitable for most people with high myopia. Because these exercises will increase the chance of retinal detachment, eye surgery cannot wholly solve high myopia at this stage of medical technology. People with high myopia can only wear glasses or undergo other operations to improve their vision.

ICL(Implantable contact lenses). The operation method puts an intraocular lens directly into the eye, equivalent to putting a contact lens into the eye. Because intraocular lenses can correct an extensive range of degrees, they are suitable for high myopia and those with a thin cornea(Lackner et al., 2003). After the operation, if the patient's vision has not changed significantly and the implanted ICL is no longer suitable, it can be taken out or replaced, and wear ordinary glasses or contact lenses again. Although ICL implant surgery has many advantages such as high safety, convenient operation, no bleeding, no pain, it is an intraocular surgery after all, and the risk is relatively high. It has high requirements on hospitals, equipment, and surgical capabilities(Gonvers et al., 2001). The charges are costly; it costs about $2,000 to 3,000 Canadian dollars per eye. The total cost of binocular surgery is about $5,000 to 6,000 Canadian dollars for all people who do not need to wear it.

- Pros of ICL. Small incision, high safety, reversible (can be taken out if necessary).
- Cons of ICL. Infection may occur during surgery, and the risk is higher than other eye surgeries. Not recommended to high astigmatism to wear; t

he axis may rotate, seriously affecting the clarity and comfort of weari ng.

ICL is the last choice that other surgeries cannot achieve, such as high myopi a or thin corneal thickness. Therefore, according to the actual condition of t he eyes, individuals must go to a professional hospital for preoperative exami nation before surgery, follow the doctor's advice, and see what type of surger y is suitable. For high myopic people who love extreme/group sports, in additi on to surgery, what kind of eye protection is appropriate? How to reduce the r isk of retinal detachment during intense exercise? The MRP started with this q uestion through the concept of inclusive design, using design methods (not med icine) to provide an opportunity for people with high myopia to participate in radical/group sports like other groups carefree during the game.

Section 1.3 Existing Theory/Practice

ICL only corrects myopia after ICL surgery but does not improve a person's ret inal condition. The vast majority of high myopia is "axial myopia," that is, the eye axis is longer than an average person (Uusitalo, R. J., Aine, E., Sen, N. H., & Laatikainen, L. 002). The eye axis is elongated; just like blow up a balloon, the wall of the balloon will become thinner. In the same way, the ret ina of people with high myopia will also become thinner; the thinning of the r etina will also weaken its ability to withstand severe vibrations and intraocu lar pressure fluctuations.

People with high myopia participate in violent sports, and collisions will cha nge drastically with external pressure. Therefore, doctors usually do not reco mmend high myopia to participate in excessively intense sports, such as physic al contact, falling/jumping from high altitudes, and ball sports. In these typ es of sports, glasses can cause some external injuries to high myopia eyeballs

. It is more likely to cause retinal detachment, which means permanent blindness(Alio et al., 2007).

So can people with high myopia participate in sports? The answer is yes. People with high myopia can still participate in some lightweight personal sports, such as jogging and yoga, which is the more official doctor's answer to high myopia.

However, recent studies have shown that for normal eyes, the incidence of retinal detachment in a lifetime is about 1:10,000, to high myopia, the incidence is increasing about ten times(Pandya, H. K. 2020). Yet, it is still far below 1%; several studies support the finding that LASIK or PRK surgery does not increase the incidence of retinal detachment (Shao et al., 2020)(Mounir et al., 2020). Most forms of exercise can be considered safe as long as people observe proper eye protection.

Chapter 2 Other Approaches and Gaps

Section 2.1 Sports Glasses

Injuries during sports cause severe damage to the eyes, but sports glasses help prevent this from happening. Although the type of exercise determines different types of glasses, the basic principles are the same. The advantage of sports glasses is that they are durable, light and comfortable to wear. The glasses are close enough to the eyes to prevent stray light from penetrating in. These features can reduce the chance of injury, such as in the event of a fall, sports glasses will "step way" instead of breaking. The lighter the glasses, the more comfortable they are on the bridge of the nose, and it can reduce the risk of eye injury(Dashtevska, E. G., & Ivanova, M 2020). The resin materials used in sports glasses (such as polycarbonate and polyamide) are about 50% lighter than glass lenses(Zhang, H., & Jiang, X. 2020). At the same time, sports glasses also solve the four major problems that people who wear glasses often face when exercising: 1. Sweating makes the glasses fall. 2. physical exercise causes the glasses to fly out. 3. In the rain, snow, and freezing weather, the glasses will get fogged, affecting the sight.

The public successfully accepts sports glasses because It provides a clear vision and a comfortable & convenient wearing experience. From professional athletes to amateurs, they will wear sports glasses to improve their level in the games. However, sports glasses have little effect on head protection; in fierce sports confrontation, people with high myopia can wear sports glasses to protect their eyes to a certain extent, but their heads still lack reliable protection.

Section 2.2 Hövding

When it comes to head protection during sports, sports helmets are now the best head protection equipment. In individual sports such as cycling a nd skiing, athletes will choose a combination of sports glasses and helmets to protect their heads and eyes. Although the helmet has strong protection capabi lities, it does not meet lightness, comfort and simplicity. If all people do n ot need to wear helmets for specific sports (rugby, ice hockey), then the popu larity of helmets is not high. Regarding head protection equipment, Airbag for Urban Cyclists Hövding is another mature product in the market. It is an Airba g for Urban Cyclists head protection, which is worn like a collar around the n eck; in an accident, the airbag inflates to protect the user's head. Hovding is divided into three parts to achieving head protection:

- **Airbag:** Hövding protects nearly all the head while leaving the field of vision open. It is kept around the user's neck by a zipper holding it t ogether in the front and keeping the airbag in place during inflation. T he airbag fixates the neck and provides exceptionally soft and gentle sh ock absorption. The pressure remains constant for several seconds, makin g it able to withstand multiple head impacts during the same accident. A fter that, the airbag slowly starts to deflate. The gas inflator that in flates the airbag is a so-called cold gas inflator that uses helium. It is placed in a holder in the back system of the collar on the cyclist's back(Hövding - airbag for urban cyclists. 2021).
- **The hardware:** The sensor that senses the movement of the collar will re ad the sensor data 200 times every second to check if an accident is ong oing. When the hardware is active, it performs self-checks always to kno w that all vital parts are functioning normally.(Hövding - airbag for ur ban cyclists. 2021).

- **Tech:** In the event of an accident, the airbag inside the collar inflates in 0.1 sec; it will efficiently fixate the neck and protect the head from injury.

The passive head protection mechanism and airbags have opened up the limitations of sports wearable equipment. The airbag helmet provides users with a wide field of vision when it is not triggered, and the airbag pops up when danger occurs, providing comprehensive head protection. The protective ability of the product is unquestionable, but market acceptance has yet to be verified. Because of its high price and non-recyclable nature, it is difficult for the product to be accepted by the public like traditional bicycle helmets. Similarly, the product is highly targeted and is for urban cycling. Users do not need to face high-speed collisions or emergency stops and fall for other sports, so do users still need such powerful head protection? Nevertheless, the passive protection mechanism of the product and the use of airbags have broadened the research road for sports wearable equipment, and some protection devices using the same principle have also begun to appear in the market.

Section 2.3 Airbag Vest

The most eye-catching is the airbag vest. This product is mainly aimed at the elderly with limited mobility; the airbag waist/vest can release the airbag immediately before the elderly accidentally fall to protect the elderly's lower limbs. So, can people with high myopia also benefit from this? The principle of adding airbags to sports wearable equipment to provide reliable head protection for highly myopic people in sports accidents will also become a possibility.

Chapter 3 Context

Section 3.1 Intended User

Primary User

- People with high myopia: According to the ophthalmologist's instructions, some sports are not suitable for them to participate in. However, people with high myopia should also enjoy the freedom to participate in various sports, especially group sports. By wearing sports wearable devices designed to reduce the risk of eye injuries, people with high myopia can participate in any sports they want to participate in.
- Medium and low myopia: If this design concept is suitable for people with high myopia, it can also be applied to medium myopia; their eyeballs are more substantial compare to high myopia. They need relatively more minor protection. Wearing protective devices during sports can provide them with more comprehensive head/eye protection and minimize the hidden dangers of sports injuries. Even for people with low myopia who do not need too much protection during exercise, lightweight and beautiful sports equipment is also protective. It can also be a choice for their sports wearable device.

Secondary User

- Patients with eye and head injuries: Sports wearable devices with protective mechanisms can prevent sports injuries and provide additional protection for users with injuries during exercise. For users with eye and head injuries, they are recovering. Participating in a certain amount of individual exercise regularly helps to recover from injuries. Such users can wear sports equipment with protective mechanisms to protect them and reduce users' worries during exercise.

- The aged: Older adults with limited mobility often encounter falls, and equipping them with active protection tools such as crutches or anti-skid shoes cannot wholly avoid accidental falls. Passive protection wearable devices for the head and eyes in an accidental fall are also crucial.

Section 3.2 Goals

Design a wearable sports protection device for people with high myopia to protect their head and eyes during the exercise. The device can be well compatible with the user's glasses to provide the user with clear vision during exercise continuously. The wearable device is composed of airbags, sensors, and fabrics with sweat absorption functions. It is convenient to wear and has a simple appearance. When the wearable device sensor feels an external force, the internal airbag will quickly inflate and pop out, protecting the user's head from physical impact/falling.

When people with high myopia participate in some extreme sports and group sports, head/eye injuries will increase the hidden danger of retinal detachment. Therefore, compared with other people, people with high myopia can participate in fewer types of exercise and less time for exercise. Wearable sports protection devices designed for high myopia can avoid head/eye injuries during the exercise. It is allowing high myopia to integrate into various sports instead of being excluded.

Section 3.3 Requirements

Because of myopia inheritance, I have been wearing glasses since seven years old. From low myopia to the current high myopia, glasses have been on me for nearly 20 years. However, I have not given up sports, and I still play basketball every twice a week. I know how hard it is for a high myopic person to play b

asketball or participate in other sports with glasses. So after discussing wit h my mentor, we decided not to apply for REB and interview others. I will comp lete the user research part independently. So what are people with glasses nee d to have in a new wearable sports protection device?

A sports wearable device that can protect a user's head and this device need to be accepted by the public.

When designing a new wearable device, it is crucial to consider the factors th at will affect acceptability. As the most influential basketball league globa lly, the NBA's players' choice of sports wearable equipment is also worth le arning. NBA Players have particular head/eye protection choices: players with eye injuries will wear sports glasses to protect their eyes. Players with conc ussions will be required to wear the face mask, which is wearable face protect ion equipment. There are many knowledge and applications in face masks that ca n be applied and designed new headwear protection devices. There are two face masks on the market for reference.

Generic Mask. The generic one size fits all. These masks may have limitations such as comfort, every person's face structure is different, and the mask may sit differently on the user's face than someone else wearing it. The material s of the mask may not be of the highest quality, such as the velcro straps or the face mask itself, causing the user to become hot & itchy.

Custom Fit Mask. Getting one that is custom-fitted will cost more money, but it will make sure it is as comfortable as it can be. Custom Fit Mask is a bett er option than a size fits all If those generic masks may not fit the face pro perly.(Gandy, J. R., Fossett, L., & Wong, B. J. 2016).

The great thing about custom-fit is that they will take a mould of the face a nd adjust anything they need to maximum comfort.

Companies that make masks understand players are using peripherals to make crucial decisions on the court. If the mask hindered their vision, they would likely get tunnel vision, and no one would end up wearing them. Materials range from hard plastic with a fancy name to Carbon Fiber which can be lightweight and impact resistant. Others are made of shatterproof medical-grade polycarbonate. The company will use the materials that they feel help the athlete and make them most comfortable.

The head protection that NBA players can accept must have the following characteristics:

- **The protective gear material has a sweat absorption function：**NBA players are on the court for 48 minutes, and they are constantly engaging in much movement such as running, jumping, and shuffling their feet. As a result, they sweat profusely, and that is why having a headband is useful. The primary purpose is to get rid of sweat in the player’s eyes. (Salehi et al., 2020)
- The protective gear provides a clear vision and protects the eyes: Goggles in basketball started with players wearing glasses to help them see. Goggles were before corrective eye surgery, and contact lenses were popular. Kareem Abdul Jabbar did not start wearing glasses to help with his vision, but he had his cornea scratched during a game. He did not want to risk losing his eyesight, so he used the goggles for extra protection. Chicago Bulls player Horace Grant did wear sports goggles to help him see better, and they quickly became a part of his look. Even after having corrective surgery, he still sported the glasses to encourage young children to wear their glasses while playing.
- The protective gear accelerates recovery from previous injuries: NBA Players wear masks to protect a broken nose from more damage. The injury ha

ppens due to an inadvertent elbow. When a player broke his nose, the doctor will have to align the nose bone; this must be done within the first two weeks, so the bone does not heal the way it is. The Mask is not just for broken noses; other reasons for wearing the mask are a facial contusion, broken orbital bone, broken cheekbone, and broken facial bone. The doctor will not clear a player to play unless they wear the mask to protect and allow the healing process to take its course and not be disrupted by a hit or blow. If they do not wear the mask and get hit in the face, they may be out longer and cause more damage(McMurray, N., Means, G. E., & Stocklin-Enright, T 2020)

- For fashion purposes: Sometimes, players will choose to wear sports gear because of fashion factors. For example, players who wore the ninja headbands that were popular during the 2018-2019 season were the primary reason to wear them primarily for fashion purposes.

Section 3.4 Design Choices

- Put the airbag into the headband: headband not only absorbs sweat but is easy to put on and take off; it also has a simple appearance and a particular aesthetic effect. Choosing a headband as the basic shape of the new design can be accepted by the public quickly. A headband can maintain its function and pop up airbags at critical moments to provide reliable protection for the user’s head/eyes.
- Can be used multiple times: The devices mentioned above, such as airbag helmets and airbag vests, are bulky; wearing them will seriously affect regular sports. There is no convenience at all, and they cannot be reused once airbags pop out.
- Contents of the new model: The purpose of the new model is to overcome the defects in the prior models and design a portable, automatic inflatab

le headband. The induction device with the trigger is triggered, and the response is fast.

To achieve the purpose mentioned above, the technical solution adopted by the present new model is a convenient automatic inflatable headband. The headband includes an airbag and a sensor shell arranged on the outer side of the headband. The headband includes a CO2 cartridge and an airbag connected with the CO2 cartridge through a pipeline. The pipeline has a switch, the triggering of a switch is connected to a sensor shell outside the headband; when the sensor shell is impacted, or when it is perceived by algorithms that danger is about to occur, the CO2 cartridge will quickly fill the airbag to form an airbag helmet. The CO2 cartridge is detachably installed at the back of the headband(The CO2 cartridge can be replaced for reuse purposes). The airbag is placed around the headband and connected to the CO2 cartridge. The advantages of the new headband are:

- The auto-inflating sports headband uses compressed gas as the power source; the airbag is filled with gas to increase the resistance to protect the user’s head. While in a collision/fall during exercise, the sensor will activate, then automatically opens the CO2 cartridge of carbon dioxide (or nitrogen). The gas will inflate the airbag, the volume and area of the sports headband increase, and the resistance increases accordingly; the headband will play the airbag role.
- The CO2 cartridge is a replaceable module; this design will reduce material loss and improve installation efficiency.
- The newly designed auto-inflating headband has the advantages of small size, easy to wear. It is automatically triggered to inflate and respond and can reuse.

Chapter 4 Design Concept

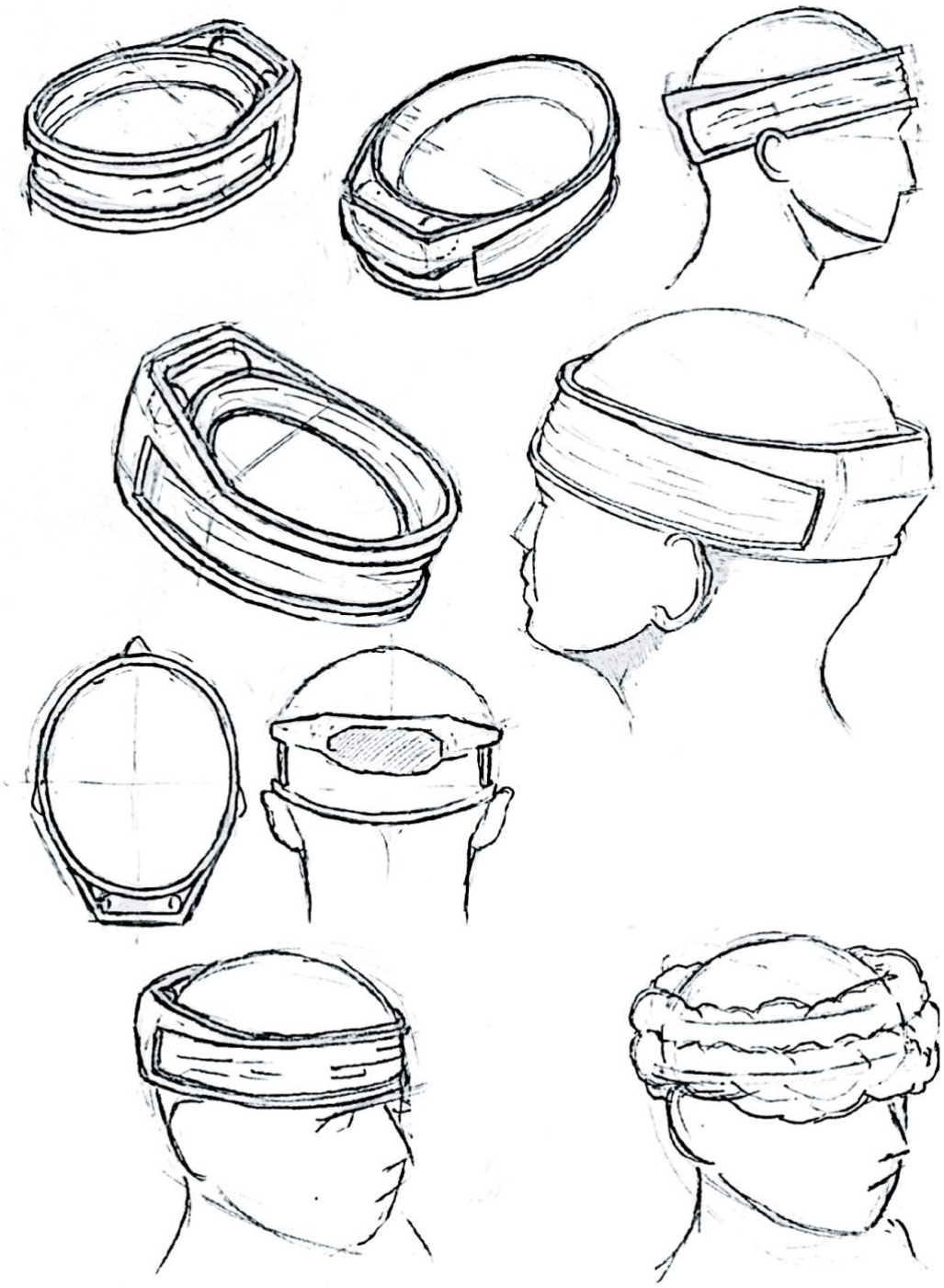

Fig 1: Draft of Auto-inflating headband.

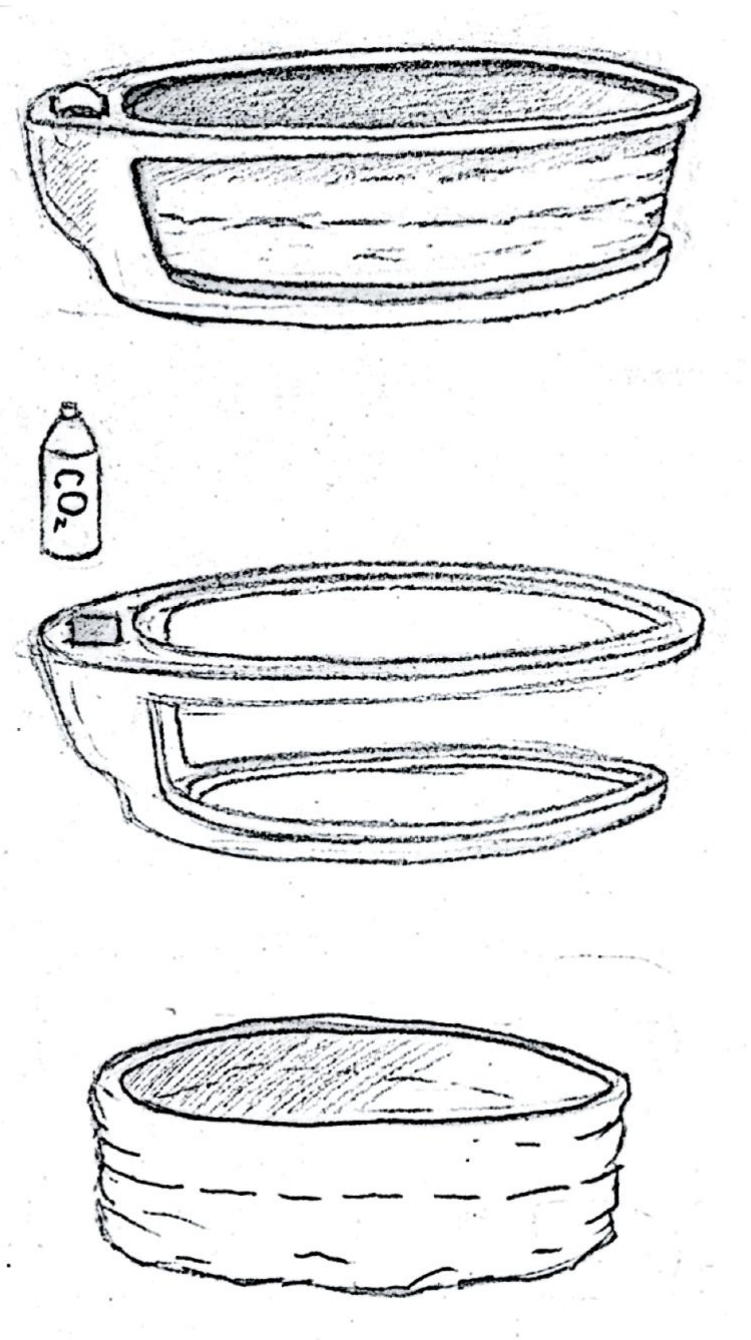

Fig 2: Auto-inflating headband is composed of a CO2 cartridge(middle picture), a shell surrounded by the sensor(middle picture), pipeline and airbag(bottom p icture).

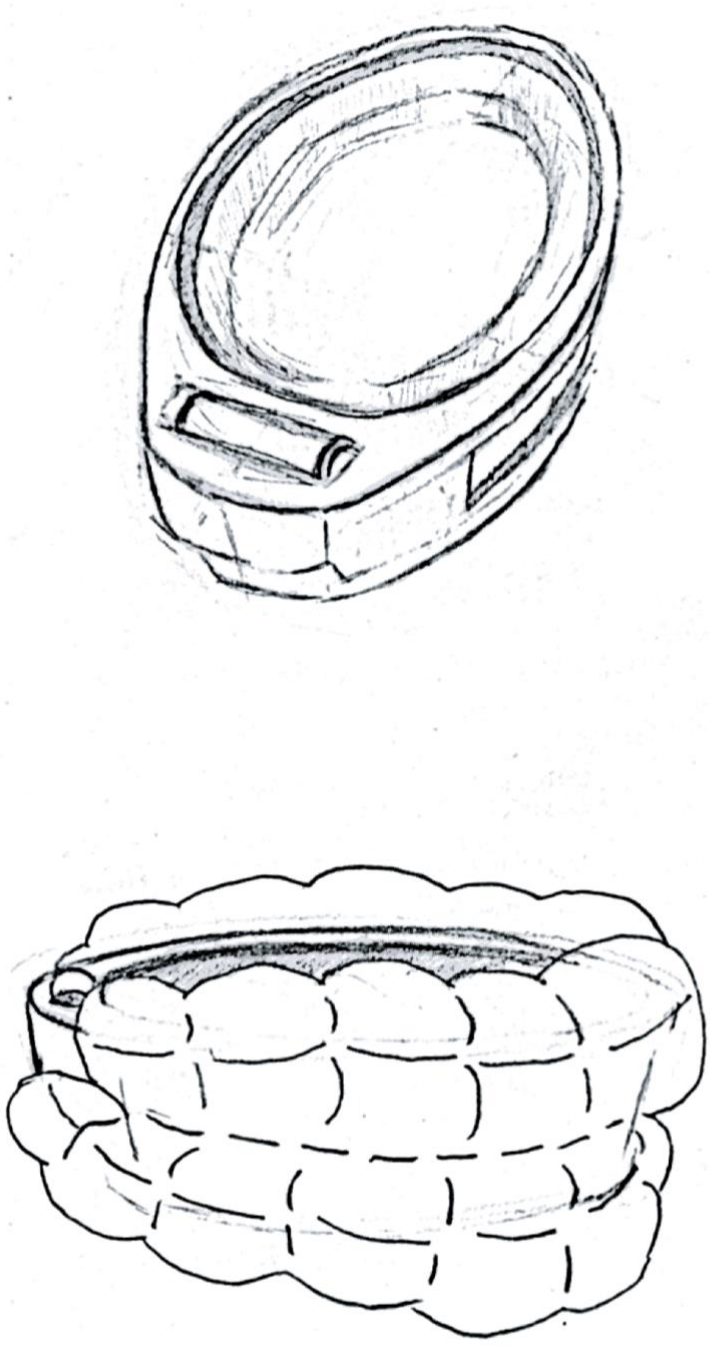

Fig 3: The CO2 cartridge is inserted at the back of the device(top picture). The sensor will make the CO2 cartridge release gas through an algorithm(or thr ough impact), and gas will inflate the airbag through the pipeline.

Chapter 5 Discussion

Section 5.1 Limitation of the MRP

Like all people who do not need to wear other sports protective devices, an auto-inflating sports headband can play a particular protective role, but it still has limitations. The protective devices cannot altogether avoid the injury caused by sports but can only reduce the chance of injury(Leppänen et al., 2014). Even if people with high myopia use an Auto-inflating headband, there is still a risk of retinal detachment during sports. The MRP cannot tell all high myopic people to play basketball or other sports without risk. The risk is small, but once it happens, it means permanent blindness in both eyes. Therefore, the promotion of Auto-inflating sports headband will be limited by such factors; that is, it is impossible to answer whether people with high myopia can participate in group sports; it is also the first issue and choice. If some people cannot tolerate the risk of blindness, then other personal sports can completely replace playing basketball. After all, life is more than everything; no amount of fierce enthusiasm can be worth seeing. Choosing to play basketball means bearing a specific risk. Even if they have surgery to remove their glasses, the risk of retinal detachment still exists(Colin, J., Robinet, A., & Cochener, B.1999). Although I choose to play basketball and design a headband for people who will make the same choices as myself, this does not mean that all people with high myopia should take the risk. The principle of high myopia should still be based on medical advice, understanding their own eyes, and acknowledging ophthalmic medical knowledge. Ophthalmologists are very influential in selecting and duration of the exercise for people with high myopia(Khurana, A. K. 2019). Data have shown that people with high myopia spend much less time exercising than people with normal vision(Sherwin et al., 2012). The ophthalmologist did not advise me to participate in basketball too much but did

not wholly prohibit me from participating. Playing basketball as an ordinary recreational activity, the possible damage to the eyes is shallow. However, this does not mean that playing basketball for people with high myopia is risk-free. Doctors are obliged to inform patients of all potential risks; As people with high myopia, we should understand our binocular conditions, acknowledge ophthalmological knowledge, and take the doctor's advice as a reference instead of completely refusing to participate in group sports.

Even if some people with high myopia choose to play basketball or other group sports, they should also pay attention to the time and intensity and use suitable sports glasses during sports. Other protective measures are also necessary. As mentioned earlier, sports glasses use lighter materials, and many of their designs are also for sports scenes. High myopia use sports glasses will have a stable and clear vision, no need to worry about glasses slipping off, and no bruises (around the eyes)due to collisions. Choosing the right basketball sports goggles will help people to prevent eye injuries. Poly-carbonate lenses are virtually unbreakable and can sustain the impact of a finger or a ball. Choosing poly-carbonate lenses is one of the options that people should explore for safety reasons, and the frame needs to withstand the ball's impact; it needs to cover the whole eye and not just the eyeball because any injury to the delicate part of the eye can still cause a lot of damage(Lee, B. C., & Ji, B. C. 2020). Frames should sit close to the face, and the finger should be able to make its way through the gap; it also helps prevent injuries to the bone structure.

Section 5.2 Contribute to Inclusive Design

We always give priority to the interests of the majority. However, the world is diverse and fair. In addition to "target users" and "most people," there is

also a group that we ignore and need to be treated equally. Inclusive design is not the same as design specifically for minority groups.

For the minorities, the inclusive design feels warm; they will not feel abandoned or treated specially. For designers, inclusive design is a valuable design method, similar to the training method of athletes running with sandbags on their feet, putting themselves in the most challenging situation. There is no distinction between ordinary people and disabled people at a certain level, but each of us has different capabilities. The label should not be applied to a person, and it describes a situation in which a specific ability of the user is lower than the average level in a specific scenario. (Clarkson et al., 2013)

As a product designer, how to apply inclusive design to practical work to make products more inclusive? First, ask the question: what capabilities do people use, and what circumstances do they use the product? What kind of problems can be caused by the lack or deficiency of these capabilities? For example, common vision problems come from the following aspects:

Visual acuity: Myopia, hyperopia, or cataracts will cause the user's visual acuity to decrease. In users' eyes with weak visual acuity, the details of the image become blurred and only can recognize the extensive outline.

Effective field of view: Retinopathy causes the user's effective field of view to change. Loss of visual field may occur in the middle of the visual field (such as glaucoma), or it may occur in the periphery of the visual field (such as retinopathy caused by diabetes). In addition to the vision problems, under what circumstances do users choose to use the product?

Under certain sports, head safety must be considered; sports with physical contact are more prone to collisions; mobility is inconvenient and often falls.

Based on the above vision problems, we can check whether the designed product can accommodate these visually problematic users to the greatest extent from the following aspects.

Increase the degree of protection of the eyes and head: for the problem of visual acuity, use appropriate protective measures to protect the user's eyes and head. Prevalent thinking in inclusive design is—advantage of users' strong abilities to make up for their weaknesses. For example, users may not have good eyesight and wear glasses. We can design protective products that are compatible with glasses, preserve the area where the glasses exist, and reduce the cumbersome design around the eyes. This feature is also beneficial to users with normal vision because they can choose to wear sports glasses to improve their performance in sports.

The location of centralized protection measures: for effective vision, to allow users to focus on the most effective field of view, design products need to ensure that they do not block the user's field of view and do not occupy space.

A deliberate designer can test the product experience to ensure that the product used by a particular user is available. The official website of the Inclusive design toolkit has special simulation software. Designers can use the software to simulate what the user sees under conditions of inability to adjust the severity.

Compare an excellent product to an excellent person. In that case, he is intelligent and capable (availability) and generous (aesthetic), but there is also an essential quality that cannot be ignored; that is, he/she needs integrity and kindness, which is inclusive. The inclusive interface allows disadvantaged groups to use it well and makes mainstream users more pleasant to use.

This is my understanding of inclusive design, and it also summarizes how to us e inclusive design when it becomes a design method: starting from the ability of "sight," enumerating several common vision problems, and then starting fro m the problem Combined with the design scenario, design suggestions are given: increase the degree of protection, rational use of wearing positions, and cent ralized protection measures, to achieve the purpose of making the product more inclusive(Luck, R. 2018).

Section 5.3 Next Steps and Future Work

There are already some wearable devices on the market that use auto matic inflatable airbags as protection technology. For example, Hovd ing （bicycle helmets) Moreover, airbag vests mentioned earlier and s ome marine life-saving devices all use automatic inflation technolog y, but automatic inflation means that the switch is not in the user's h and; the device's sensor controls the switch. Airbags on Car must und ergo strict collision detection before selling to the market, but we l ack a qualified testing platform for airbags in wearable devices. The next step for the automatic inflatable headband is to pass professional qual ity inspections to ensure that the airbags will automatically inflate critical moments to protect users. As mentioned earlier in the article, the sensor on t he headband shell will inflate the airbag after receiving impact; this value o f impact needs to be tested; In other words, how can the sensor accurately jud ges the user is in danger and protects the user in time? Wearable auto-inflata ble products on the market all have self-developed accurate algorithms, and se ek cooperation with them might be the best option. All in all, the future work of automatic inflatable headband should be carried out in terms of product qua lity testing, aimed to cooperate with professional third-party platforms that meet safety standards and pass the quality test.

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