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A Safety Goggles for Dental Treatment That Can Monitor the Pulse

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Abstract: Objective: Using the safety goggles to protect and treat the process of fog, powder or laser injury to the eyes, reduce noise and thus reduce the patient's discomfort. At the same time, pulse frequency and vital signs of patients can be detected during treatment to improve the safety of treatment. Methods: The device is a safety goggles for dental treatment that can monitor the pulse, including a mirror frame, a protective lens mounted on one side of the frame and a first elastic band and a second elastic band located at both ends of the frame. The first elastic band and the second elastic band are connected and fixed together. The first elastic band is provided with a holding box body near the frame, and the top of the holding box body is provided with a power switch, an audio switch and a pulse monitoring switch. The body of the containing box is provided with a control chip, a power supply component, a pulse sensor, a memory and an audio component. The control chip is electrically connected with the memory, a pulse sensor, an audio component, a speaker and a power supply component, and the audio component is electrically connected with the first earplug and the second earplug through the data cable. Results: A kind of safety goggles for dental treatment which can monitor pulse was successfully designed. The device is equipped with safety goggles, so as to prevent the air fog and other dirt damage to the eyes; Pulse sensor was set to obtain pulse signal; Earplugs with extendable length are suitable for individual differences and can improve the sound insulation effect. Conclusion: The safety goggles can solve the problems of harsh light source equipped with dental treatment chair, easy to splash the eyes with aerosol during operation, and loud noise of operating instruments. In addition, it can also monitor patients' vital signs in real time during tooth implantation and extraction and prevent sudden symptoms.

Keywords: Pulse, Dental, Safety Goggles

1. Introduction

Teeth are one of the important organs of the human body, which can affect the daily eating and nutrition absorption, thus affecting human health [1]. The incidence of caries and periodontitis in stomatology is very high. Serious caries may develop into pulpitis and periapical periodontitis, and even cause inflammation of alveolar bone and jaw bone [2]. Therefore, dental treatment such as caries filling and periodontal cleaning should be carried out in time [3]. However, in the routine clinical dental treatment, patients reported the following problems: the light source equipped with the dental treatment chair is dazzling, The air in the process of drilling and cleaning is easy to spill into the eyes and other parts of the face [4], Dental handpiece are noisy, easily irritated and tired. In addition, pulse monitoring in the process of dental implant surgery and tooth extraction can be used for real-time monitoring of patients' vital signs to

prevent sudden symptoms. some patients may develop dental phobia, nervousness, fear, anxiety, inability to control their emotions and behavior during treatment, and clinical manifestations include rapid heartbeat, abnormal blood pressure, paleness and even fainting, This makes pulse monitoring particularly important [5].

At present, most medical staff and patients use goggles, headphones or face masks for single protection, but the effect is not good, and the pulse cannot be monitored. Therefore, it is necessary to design a kind of safety goggles that can monitor the pulse at the same time and prevent the noise of dental operation.

2. Materials and Methods

The device provides a kind of safety goggles for dental treatment that can monitor the pulse to solve the protection problems encountered in the process of dental treatment. A safety goggles for dental treatment capable of monitoring the pulse comprises a frame, two protective lenses mounted on one side of the frame and a first elastic band and a second elastic band at both ends of the frame. The first elastic belt and the second elastic belt are adjustable and fixed on the head through the eye buckle. The first elastic belt is provided with a through hole and a buckle near the frame for mounting the box body. The outer side of the box body is provided with an installation cover for easy disassembly and assembly. A power switch, an audio switch and a pulse monitoring switch are arranged at the top of the box body. A control chip, a power supply component, a pulse sensor, a memory and an audio component are arranged in the box body. The control chip is made of STM32 series chips. Audio module model VS1053B-L. The pulse sensor comprises an elastic mounting seat, a piezoelectric film and three pulse contacts tightly arranged on the outside of the piezoelectric film. The pulse contact is located on the side of the first elastic band away from the box body, and the first elastic band is located around the pulse contact with a buffer silicone layer, which further fixed the pulse contact at the temple, and the electrical connection between the control chip and the memory. Memory is used to store sleep music; The control chip is electrically connected with the audio component, and the audio component is electrically connected with the first earplug and the second earplug respectively through the data cable; The control chip is electrically connected with the pulse sensor and the speaker to monitor the patient's heart rate. When the heart rate exceeds the preset threshold (such as 100), the control chip will give instructions and the speaker will give an alarm. The first earplug and the second earplug structure: the first earplug includes a holding part, the plug body and the fixed rod used to adjust the length of the plug body elongation, the holding part is a cavity, one end of the fixed rod is fixed in the cavity through the thread, the other end is connected with the plug body. The plug body is composed of the first sound insulation part of the hemispherical hollow structure and the second sound insulation part designed by the circular platform structure, which is matched and fixed with the contour of the ear canal. The double sound insulation part can effectively improve the sound insulation effect and reduce the noise so as to reduce the discomfort of patients.

The pulse contact is located on the side of the first elastic band away from the housing box body. The first elastic band is provided with a cushioning silicone layer in the surrounding ring located at the pulse contact. The first earplug comprises a holding part, a plug body and a fixed rod for adjusting the extension length of the plug body. The holding part is a cavity, and one end of the fixed rod is fixed in the cavity through thread matching, and the other end is connected with the plug body. The plug body is composed of the first sound insulation part of the hemispherical hollow structure and the second sound insulation part of the round platform structure. The control chip adopts the STM32 series chip, and the audio component model is VS1053B-L.

The device can not only protect the eyes from fog or powder or laser in the process of treatment, but also reduce the noise, divert the patient's attention and thus reduce the patient's discomfort; At the same time, pulse frequency can be detected and vital signs can be monitored in the process of treatment to improve the safety of dental treatment. The elastic band and pulse sensor are used to fix, so that the pulse contact corresponds to the sun acupoint, the contact pressure is moderate, so as to obtain pulse signal more stable and reliable; The structure of the earplug is optimized to make it adjustable in length, suitable for individual differences, and improve the sound insulation effect. The protective lens of the device is made of black glass, which is shielded from light. The lens is clamped and fixed on the frame by an inner ring. The edge of the protective lens is provided with a buffer gasket, so that the protective lens is smoothly placed around the eye, reducing the pressure of the protective lens on the eye. In the other device, the control chip is also provided with an electrically connected wireless communication component, which is connected to a mobile terminal and can transmit a pulse signal to the mobile terminal.

3. Results

A safety goggles for dental treatment that can monitor the pulse has been successfully designed. The device comprises a mirror frame, a protective lens mounted on one side of the frame and a first elastic band and a second elastic band at both ends of the frame. The first elastic band and the second elastic band are connected and fixed with each other. The first elastic band is provided with a housing box body near the frame, and the housing box body is provided with a mounting cover on the outward side; The top of the box body is provided with a power switch, audio switch and pulse monitoring switch, the box body is provided with a control chip, power supply component, pulse sensor, memory and audio components, the control chip and memory, pulse sensor, audio components, speakers and power components are electrically connected, the audio components are electrically connected with the first earplug and the second

earplug through the data line. The pulse sensor comprises an elastic mounting seat, a piezoelectric film and a pulse contact arranged on the outside of the piezoelectric film.

The device aims the protective lens at the eye, and uses the first elastic band and the second elastic band to fix the head, so that the pulse sensor is close to the temple. both earplugs are inserted into ears at the same time and relaxing music is turned on. It can not only protect the eyes from fog or powder or laser in the process of treatment, but also reduce the noise and patient's discomfort; In addition, pulse frequency can be detected and vital signs of patients can be monitored during treatment to improve the safety of treatment. Further, the protective device is versatile, functional and simple in structure.

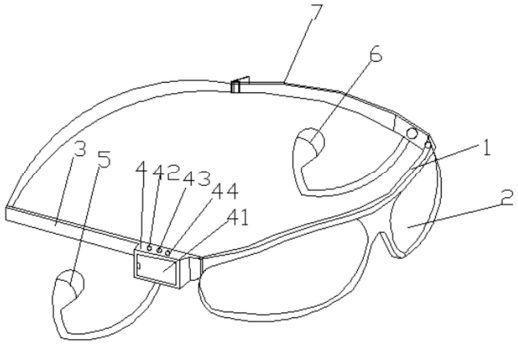

Figure 1. *Structural design of safety goggles for dental treatment that can monitor the pulse.*

1 Mirror frame, 2 Protective lens, 3 the first elastic band, 4 accommodate the box body, 5 First earplug, 6 Second earplug, 7 Second elastic band, 41 installation cover, 42 Power switch, 43 audio switch, 44 Pulse monitoring switch.

4. Discussion

Caries and periodontitis are two oral diseases with high incidence, and caries is listed as the third largest non-communicable disease by the World Health Organization, next to cardiovascular diseases and malignant tumors [6]. Caries is a kind of chronic, progressive and destructive disease mainly caused by bacteria [7]. The occurrence of caries is influenced by many factors, including oral hygiene habits, tooth morphology and surface features, diet habits, and saliva quality [8]. It will cause pain, and gradually affect the mastication function, maxillofacial bone tissue and soft tissue growth and development [9]. According to the results of the fourth national oral health epidemiological survey released in 2017, the prevalence of caries was 70.9% in the deciduous teeth of children aged 5, 34.5% in the permanent teeth of children aged 12, and 89.0% in people aged 35 to 44 [10]. Caries affect about 60 to 90 percent of children worldwide [11]. The treatment of dental caries usually involves the use of dental handpiece, which may cause aerosol and dirt spattering. In addition, the process of filling the cavity with resin requires the use of light curing lamp to accelerate the curing of the resin, and the short wave blue light generated by the light curing lamp will cause damage to the eyes [12]. Prolonged exposure to light from an oral therapy chair can also cause eye irritation. Therefore, both the doctor and the patient usually need to wear goggles during oral therapy procedures. Dental goggles are devices worn during oral procedures or treatments to protect the eyes from bright light, chemicals, blood, aerosol, and various contaminants [13]. In addition, dental handpiece drilling and grinding will produce noise, make patients irritable and tired, and patients will be afraid during tooth extraction and implant surgery, which may aggravate the occurrence of dental phobia to some extent [14]. Dental phobia refers to patients who have symptoms such as pallor, screaming, sweating, shortness of breath, palpitation, restlessness, irritability, increased blood pressure, rapid heartbeat, and even coma during dental treatment [15]. Therefore, it is very important to monitor the pulse.

A safety goggles for dental treatment that can monitor the pulse. The device is equipped with protective glasses, so as to prevent the air fog and other dirt damage to the eyes. Pulse sensor is set to obtain pulse pulse pulse pulse signal; The earplug with extendable length is set, which is suitable for individual differences and can improve the sound insulation effect. This device solves the problems of dazzling light source equipped with dental treatment chair, reducing the stimulation of light curing lamp on eyes, easy splashing of aerosol in the operation process, and loud noise of operating instruments. In addition, it can also monitor patients' vital signs in real time in the process of tooth planting and tooth extraction, so as to prevent sudden symptoms.

5. Conclusion

The light source equipped with the dental treatment chair is harsh, the dirt in the operation process is easy to splash into the eyes, the operation equipment is loud noise, and the real-time monitoring of patients' vital signs in the process of tooth planting and extraction needs to be solved. Therefore, it is very important to design and develop safety goggles for dental treatment that can monitor pulse.

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