Visual Analysis Algorithm of Sports Injury Intervention Effect from the Perspective of Sports Biomechanics

Kai Wang
Changhui Sun

Using visualization technology to judge the effect of sports injury intervention under the key parts of sports injury is a cutting-edge technology. On this basis, the visual analysis algorithm of sports injury intervention effect from the perspective of sports biomechanics is proposed. On the basis of analyzing the characteristics of sports biomechanics injury, real-time monitoring of the change of sports injury posture was carried out, and the intervention information was visualized to make up for the defects of sports injury intervention, effectively identify potential injuries and take corresponding preventive measures. The simulation results show that the visual analysis algorithm of sports injury intervention effect from the perspective of sports biomechanics can effectively improve the accuracy and intervention effect of sports injury location judgment, and can effectively divide the spatial distribution of the medium in the injured part, reduce the damage probability and degree, and provide guarantee for the occurrence of potential sports.

Keywords: sports biomechanics, sports injury, injury intervention
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INTRODUCTION

Sports biological force is a science which studies the mechanical law of human body structure in the process of movement. The correct characteristics of sports biomechanics can effectively guide the human movement and make full use of the kinetic energy and muscle elasticity of the body[1]. Based on this, combined with sports biomechanics, the intervention methods of sports injury are guided, and the effect of injury intervention is analyzed and calculated with the help of visualization technology[2]. Based on the form of body movement, the body structure is simplified into particles, and the changes of structural straight line and curve movement characteristics are observed, so as to better help athletes reduce sports diseases during training and competition, ensure the effect of athletes' injury and rehabilitation, improve their sports health status and prolong their sports career[3]. The analysis of sports injury research content is helpful to understand the thinking and development trend of sports injury research, provide reference for the research of sports injury in China, and promote the improvement of sports injury research and training quality in China.

VISUAL ANALYSIS OF SPORTS INJURY INTERVENTION EFFECT

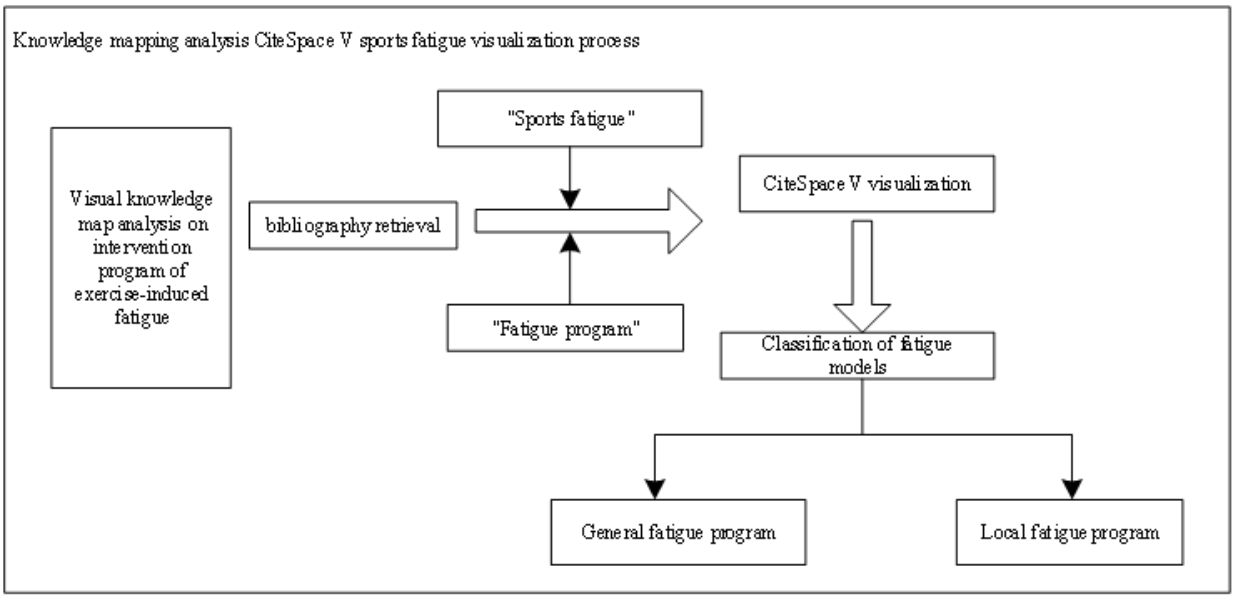
Information Collection of Sports Injury Intervention Based on Visualization Technology

To study and measure the physiological, biochemical, biomechanical and anatomical characteristics of sports injury is of great significance to understand the mechanism of sports injury, diagnose and evaluate sports injury, and the measurement of sports injury is helpful to understand the mechanism of sports injury[4]. Based on this set visualization technology, an instrument helmet device with multiple single axis acceleration

*Kai Wang*Tianjin College, University of Science and Technology Beijing, Tianjin 301830,China, Changhui SunTianjin College, University of Science and Technology Beijing, Tianjin 301830,China, *Corresponding author: Kai Wang Tianjin College, University of Science and Technology Beijing, Tianjin 301830,China (E-mail: kylebird@qq.com)*

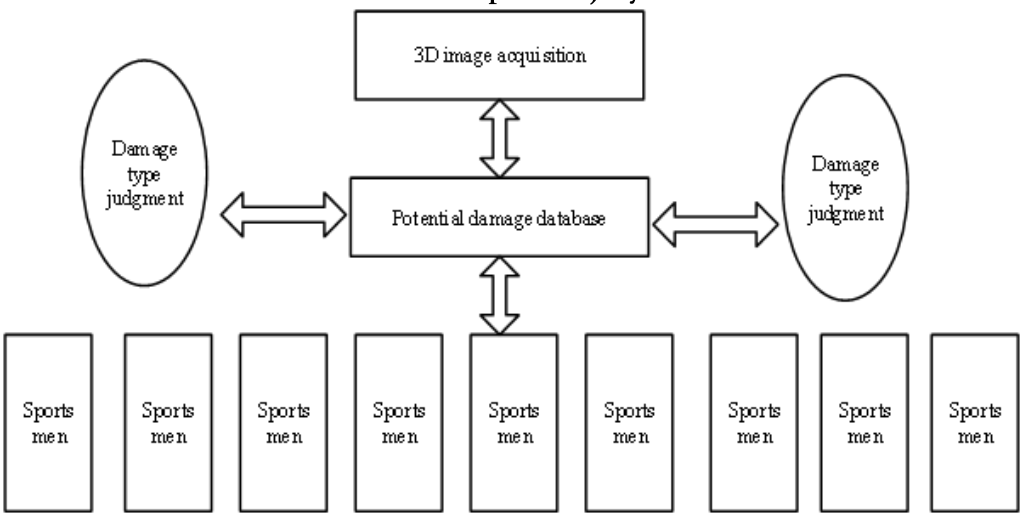
sensors and micro data acquisition system can capture and record the rotational acceleration of the head in motion, measure the recovery of injury intervention, and measure and evaluate the sports injury based on the collected data, so as to determine the damage location and degree, and make qualitative diagnosis such as magnetic field Resonance imaging, diagnosis and evaluation of tendon, tendon or ligament rupture, can be used as a reference for further treatment[5]. The specific steps are shown in Figure 1:

Figure 1.
Information collection steps of sports injury intervention effect



Due to the limitation of the athlete's life law, the poor physique athlete's physiological load is too large and the rhythm is out of balance, so that the body is often in a state of fatigue[6]. Due to the vigorous metabolism, excessive lactic acid accumulation, muscle elasticity, ligament extension, the coordination of antagonistic muscles and the flexibility of joints are weakened to varying degrees, which is easy to cause sports injury to athletes[7]. Therefore, it is necessary to judge the potential hazard prevention according to its own damage condition. As a result, the movement precision and ability decreased obviously, the flexibility decreased, the attention lost, the defense response was slow and so on[8]. Based on this, the measurement and evaluation of the effect of sports injury intervention can evaluate the rehabilitation status of athletes and determine the rehabilitation time. Combined with sports biomechanics, the rehabilitation status of athletes after injury was evaluated to determine whether the recovery of joint function reached the recovery level[9]. The structure of the above-mentioned sports model is optimized as shown in Figure 2:

Figure 2.
Structural model of sports injury intervention



In the process of sports injury intervention analysis, the measurement and monitoring of human function changes in the process of sports injury intervention can effectively track and detect the effect of sports injury intervention[10]. Through the comprehensive analysis of the above research results, taking sports injury as an example, this paper focuses on the prevention, mechanism, treatment, rehabilitation and rehabilitation boundary of sports injury[11]. Using the latest and reasonable research methods, the injury degree was evaluated and identified, the sports injury was diagnosed and evaluated, the rehabilitation status of athletes was evaluated, and the recovery time was determined[12]. At the same time, combined with sports biomechanics, the continuous exploration and innovation of sports injury intervention methods, so as to more effectively improve the effect evaluation system and evaluation method, simplify the process of sports injury into a single scale, and integrate with the computer, reflecting the long-term and consistency of sports injury research, so as to directly apply visualization technology to athletes[13]. In the process of injury prevention and recovery, scientific research and training are interdependent and promote each other.

Evaluation Algorithm of Sports Injury Intervention Effect

Based on the injury intervention information collected in the previous paper, the effect evaluation is carried out based on the injury intervention information collected in the previous article, combined with the visualization technology to analyze the individual acceptance and recovery of sports injury, so as to judge the effect of sports injury intervention[14]. The visual information processing is carried out by using the sports injury intervention parameters, and the visualization characteristics of two-dimensional visualization image are studied. The characteristic points are as follows:

$$\begin{bmatrix} u_{ij} \\ v_{ij} \end{bmatrix}_j^i = 1, \cdots, F \tag{1}$$

Furthermore, the damage function of the matrix is optimized as follows:

$$W_{2F\times P}=\begin{bmatrix} u_{11} & \cdots & u_{1p} \\ v_{11} & \cdots & u_{1p} \\ \cdots & \cdots & \cdots \\ u_{F1} & \cdots & u_{F_p} \\ v_{F1} & \cdots & u_{F_p} \end{bmatrix}$$

(2)

In order to make the two-dimensional coordinates of known points clearer, the visual image information is optimized in the motion calculation intervention image sequence:

$$W_j=\begin{bmatrix} u_{1j} \\ v_{1j} \\ \cdots \\ u_{Fj} \\ v_{Fj} \end{bmatrix}$$

(3)

For image sequence, W_j represents J feature points in feature points. Based on this, 3D reconstruction of human body structure is carried out:

$$W_{ij}=\begin{bmatrix} X_{1j} & Y_{1j} & Z_{1j} \\ \cdots & \cdots & \cdots \\ X_{Fj} & Y_{Fj} & Z_{Fj} \end{bmatrix}$$

(4)

Furthermore, the change of this point can be obtained by transforming the structural parameter matrix of sports injury recovery:

$$\mathrm{T}_j=\begin{bmatrix} u_{1j} \\ v_{1j} \\ \cdots \\ \bar{u}_{Fj} \\ v'_{pj} \end{bmatrix}$$

(5)

In the above algorithm, compared with T_j in the j frame image, the visual information transformation is further tracked and recorded as follows:

$$\begin{aligned} DE_4 &= W_{2F\times P}T_{ij}-W_{ij} \\ &=\left[\ \mathrm{quater}(R)\times\left[\mathrm{quater}\left(Q_i\right)\times W_{ij}+T_i\right]-W_{ij}\right. \\ &=\begin{bmatrix} u_{1j}-u_{1j} \\ v_{1j}-v_{1j} \\ \cdots \\ u_{Fj}-u_{Fj} \\ v_{Fj}-v_{Fj} \end{bmatrix} \end{aligned}$$

(6)

In the above algorithm, the known parameter is the j-th characteristic point of the measurement matrix, while the unknown parameter is the coordinate point w'_{ij}. The motion rationality is

analyzed in three-dimensional coordinates[14]. According to the corresponding feature points of the front and back frames, the damage estimation model is established. Use s={1,2, …, n}. In general, they are disordered and irregular, so s is a set of irregular positions, and its mark is used as the motion parameter of feature points[15]. Suppose x_1-x_3 represents Euler angle, then its corresponding rotation matrix should be equal to the rotation matrix on three rotation axes

$$\mathbf{R}=\begin{bmatrix} \cos x_2 \cos x_3 & \cos x_2 \sin x_3 & -\sin x_2 \\ \sin x_1 \sin x_2 \cos x_3 - \sin x_3 \cos x_1 & \sin x_3 \sin x_1 \sin x_2 + \cos x_1 \cos x_3 & \sin x_1 \cos x_2 \\ \sin x_2 \cos x_1 \cos r + \sin x_1 \sin r & \sin x_2 \cos x_1 \sin x - \sin x_1 \cos r & \cos x_1 \cos x_2 \end{bmatrix} \tag{7}$$

For the motion injury image, each pixel can be expressed as three bytes, and each byte corresponds to the brightness of R, G, B. assuming that the brightness of R, G and B is different, this is the color image; if the brightness of R, G, B is the same, this is the gray image; if R, G, B are the same, this is the gray image, B has the same brightness, which is the gray image. Based on this, the gray value conversion formula is optimized. The specific algorithm is as follows:

$$\mathrm{Gray}(i,j)=0.299\times R(i,j)+0.587\times G(i,j)+0.114\times B(i,j) \tag{8}$$

The transformed gray image is 24 bits, which can effectively improve the recognition effect of high intensity sports injury image[16]. In order to obtain accurate recognition results, it is necessary to extract the contour of the damaged area. According to the characteristics of the damage image, a method of damage contour extraction based on adaptive threshold and mathematical morphology is proposed[17]. The active contour method is used to approximate the initial contour and the curve method is used to approximate the damage contour. The failure active contour model is a snake model, which can generate deformation through the movement of snake points[18]. In mechanical theory, the energy of motion contour model is the least. Under the joint action of external force and internal force, the motion contour gradually approaches to the damage edge, and driven by the internal force, the motion contour becomes smooth and clear[19]. It is assumed that the serpentine points are in equilibrium, and the corresponding energy is the minimum and converges to the edge of the damage region. The specific algorithm is as follows:

$$E(C)=DE_4R\left[\alpha E_{in}(C)+\beta E_{a\alpha}(C)\right]\mathrm{Gray}(i,j) \tag{9}$$

Where $E(C)$ is the intervention value, $E_{in}(C)$ is the internal energy, $E_{a\alpha}(C)$ is the external energy, and α and β are the weighted energies. The internal energy depends on the shrinkage of the damaged image, while the external energy depends on the gray level and gradient energy. After the damage image processing, the damage location is initially determined, and the pixel value of the damage point is calculated[20-23]. It can be used in the diagnosis of high-intensity sports injury.

Optimization of Visual Analysis Algorithm for Sports Injury Intervention Effect

Visual technology is used to identify the effect of sports injury intervention on moving targets. Firstly, the target area is located and the posture is judged. If n (a, t) is used to represent the human body structure image of the moving target, and a is the intervention degree and n is the center matrix of attitude judgment, then:

$$\mu_{cy} = \sum_{a} E(C) \sum_{l} (a-\bar{a})^{c} (t-\bar{t})^{y} n(a,t) \quad (10)$$

If u is the repair degree, it is standardized and calculated:

$$\eta_{vy} = \mu_{n} / \mu_{\infty}^{t} \quad (11)$$

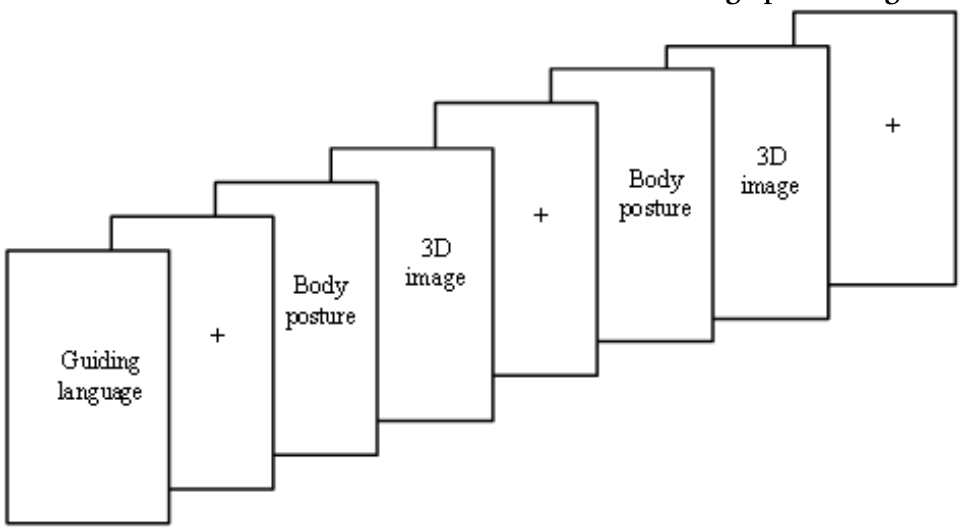
Furthermore, the following invariant matrix and change matrix are defined:

$$\varphi_1 = \eta_{30} + \eta_{\square} \quad (12)$$

$$\varphi_j = (\eta_{s0} - \eta_{02})^2 + 4\eta_{\mathrm{II}}^2 \quad (13)$$

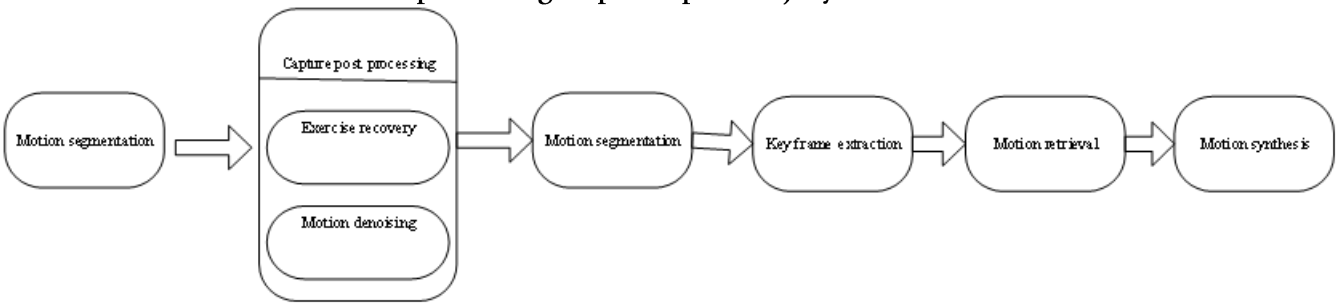
Furthermore, the affine moment invariants algorithm is optimized by combining sports biomechanics. The variance of moment invariants is calculated by visualization method. If the matrix variance is large and the sports injury is large, the corresponding preventive measures should be taken. If the difference is not big, it indicates that the potential injury of athletes is small. Based on this, the visualization process of sports injury intervention effect is optimized, as shown in the Figure 3.

Figure. 3.
Motion arithmetic is the intervention visualization image processing flow



Due to the limitation of motion capture device and the occlusion of obstacles on clothes, the collected data are often lost or noise is generated. The denoising and complete processing of captured data is very important for obtaining high-quality and high-precision captured data. After obtaining a large number of high-quality motion capture data, it is necessary to store these data effectively. When it is necessary to move, it is necessary to obtain the motion information quickly and accurately. Image segmentation is a basic operation in data processing of human motion information capture. Furthermore, a piece of data containing multiple action types is decomposed into several data segments of different action types, and each action is endowed with certain semantic features, so as to reuse the existing motion data and synthesize new motion data according to the user's needs. The following figure briefly summarizes the visual processing of the characteristic data obtained during the intervention process and the general order between them. The specific steps are as follows. (Figure 4)

Figure 4.
Visual processing steps of sports injury intervention



Visual technology analysis method is used to simulate the intervention effect of sports injury, judge the posture, integrate and share the data information of all visual databases, so as to realize the comprehensive and accurate positioning of sports injury. Provide high quality service for athletes' health source.

ANALYSIS OF EXPERIMENTAL RESULTS

Taking "College Students' sports injury" as the retrieval subject, accuracy as the retrieval condition, journals as the data source, source classification and CNKI as the database, 599 literatures retrieved on August 30, 2018 were analyzed. The visual extension software is released based on CiteSpace 5 and visual esp5.0. 599 articles were analyzed by CiteSpace, including organization chart, author core, literature keywords, knowledge mapping, network co-occurrence analysis and word frequency analysis. Based on this, the research information was statistically analyzed in Table 1.

Table 1.
Details of subjects

Project	Remarks
Male / person	55
Female / person	45
Height range / cm	162-183
Weight range / kg	44-75
Training program	Weightlifting, sprinting, long distance running, long jump, high jump, shot put, basketball, football, table tennis, javelin, etc

The experimental research mainly includes five parts: the installation of software, the determination of topics, the collection of data, the drawing and the quantitative analysis. In order to ensure the stability of the software, the installed software version should match with the computer; the subject of retrieval should be determined as "College Students' sports injury" according to the research theme, purpose and content, so as to ensure the scientificity of the analysis results; the collected data should exclude irrelevant subject literature to ensure the representativeness of the data; the effective data retrieved should be exported from "refworks" in 2018 To "download". Before drawing the knowledge map, the corresponding parameters are set in the urban space function interface, and the time domain is divided. The topic words, the literature title, the abstract, the

author keyword (DE) and the keyword plus sign (ID) are selected. According to the analysis topic, the node type is selected to analyze the keyword parameters, cut the network and select the path, so as to reduce the network density and improve the network performance Readability. Click the "go" button to generate the knowledge map, and use expert scoring and validity test to score. The score of the questionnaire is 8.3, which shows that the validity of the questionnaire is high, and it can effectively reflect the knowledge, attitude and behavior related to sports injury. The specific research results are shown in the Table 2.

Table 2.
Experts' evaluation of questionnaire content (n = 10)

	Exercise volume and sports injury (1)	Participation in extracurricular sports activities (1)	Sports survey (2)	Prevention of sports injury (2)	Treatment of sports injury (2)
Content validity score	8.0	8.6	8.4	8.2	8.3

Using the control variable method, taking face-to-face teaching times and online publicity as variables, Abc3 was set as the experimental group and D as the blank control group. The specific arrangement is shown in the Table 3:

Table 3.
Sports injury intervention arrangement

Group	Number of people	Intervention content
A	60	(1) Hand out the sports injury knowledge popularization Handbook; (2) A face-to-face teaching of sports injury knowledge; (3) An online publicity of sports injury knowledge
B	70	(1) Hand out the sports injury knowledge popularization Handbook; (2) An online publicity of sports injury knowledge
C	52	Hand out the sports injury knowledge popularization Handbook
D	52	nothing

The questionnaire survey shows that the incidence of sports injury of college students is as high as 40.58%, which is 0.57 times higher than that of ordinary college students, which is highly consistent with the 40.90% of College Students' sports injury rate obtained by researchers. The most common injuries were ankle (23.92%), knee (18.10%) and finger wrist (18.14%). The most common injuries were bruise (41.59%), sprain (31.00%) and strain (12.35%). The lateral ankle ligament is weak, the medial ligament is developed; in the lower limb strength training, the ankle joint movement is not big, so the stability is poor, prone to sprain. Knee joint is one of the main joints of human body. The clinical anatomy structure is complex, the movement ability is strong, prone to violence, and accompanied by a variety of structural and functional damage. The specific research results are shown in the Figure 5 and Figure 6.

Figure 5.
Analysis of the proportion of common sports injuries

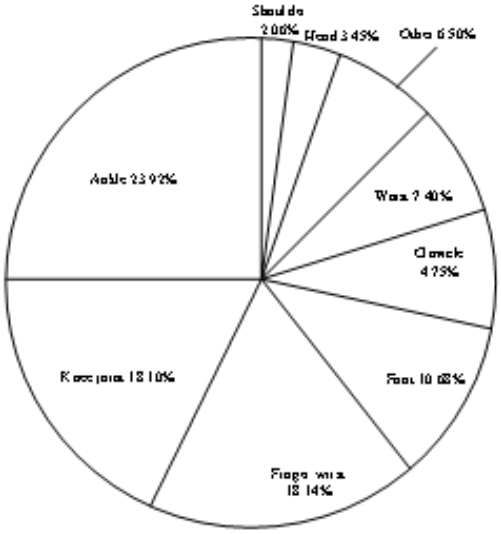
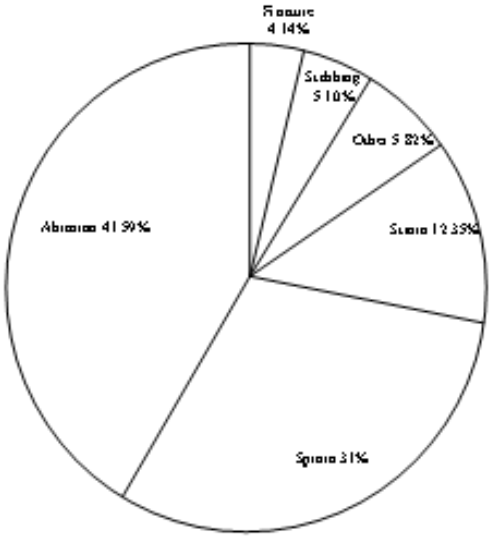


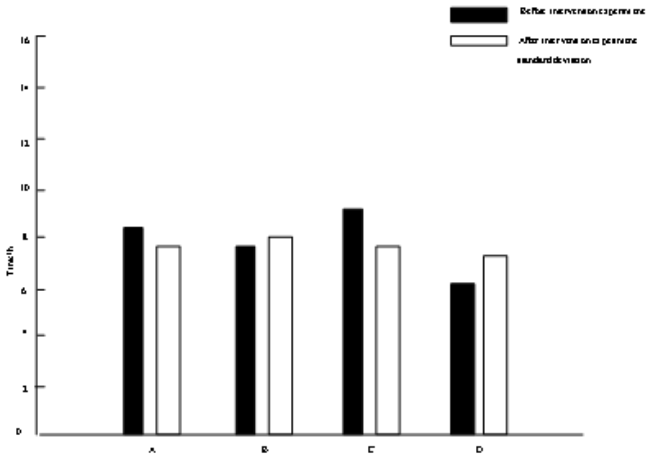
Figure 6.
Nature of sports injury intervention



The results show that the main causes of College Students' sports injury are: large amount of exercise (25%), lack of sports preparation (15%), mental paralysis (14%), irregular technical movements (13%), which reflects the serious lack of self-protection awareness and sports health knowledge of college students in physical exercise. However, in the current college physical education teaching system, sports theory teaching is a weak link. Some teachers and students are lack of sports knowledge and tend to attach importance to technology and neglect theory. Using artificial face-to-face, comprehensive intervention, multi-level teaching and other methods to treat sports injury did not improve the curative effect. Due to the complexity of sports injury treatment process, many contents and short face-to-face teaching time, the subjects lack a comprehensive understanding of the treatment process. The whole test is based on theoretical knowledge, and the lack of practical operation ability is an important factor affecting the test results. Based on this, the effects

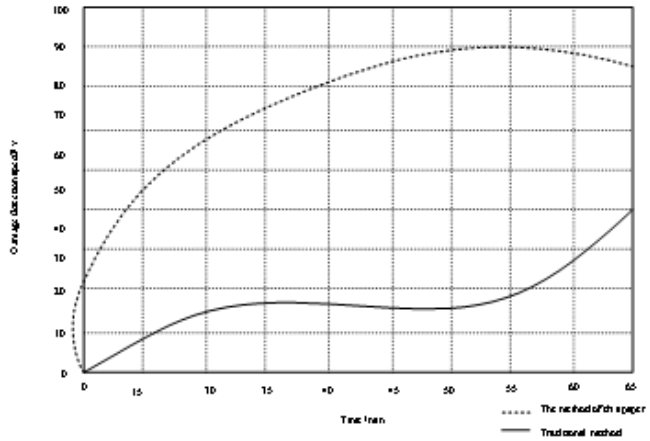
of injury intervention were compared and tested as follows. (Figure 7)

Figure 7.
Comparison of the effect of sports injury intervention before and after treatment



Based on the above information, the application effect of visualization technology in sports injury intervention was compared. Taking athletes as experimental objects, the sports environment and visual acquisition parameters were established. Compare the traditional method and visualization technology to judge the damage recovery of multiple sampling points in the sports environment under the intervention effect of sports injury site, as shown in the Figure 8.

Figure 8.
Comparative detection of injury intervention effect



Based on the above detection results, it can be seen that under the same experimental sample and environment, using different detection methods, the traditional detection speed is slow and the efficiency is low. The simulation results show that the visual analysis method of sports injury intervention effect under the perspective of sports biomechanics can effectively improve the incompleteness of the original sports injury data processing system, make the evolution process of injury intervention more intuitive, improve the speed and accuracy of potential damage judgment, reduce the occurrence risk of potential injury, and greatly reduce the damage probability The efficiency of damage identification and recovery is improved.

CONCLUSION

Based on the analysis of the existing position judgment methods, this paper discusses the application feasibility of visual analysis algorithm of sports injury intervention effect from the perspective of sports biomechanics. Through the establishment of visual recognition matrix based on motion classification and motion parameters, the accurate acquisition and judgment of potential sports injury position intervention effect is realized. The experimental results show that this method has a high visual accuracy in the sports environment, solves the problem of poor effect of sports injury intervention analysis, can quickly and accurately obtain the injury image, judge the movement posture, can effectively improve the prevention and treatment ability of sports injury, and ensure the health and safety of athletes.

According to the results of this study, in order to ensure the effectiveness of exercise intervention, the following suggestions are put forward.

(1)Organize various types of sports activities, increase the entertainment and interest of sports activities, so that the activities can meet the requirements of most college students' participation, and create a positive and healthy sports atmosphere.

(2)Combining sports with medicine, enriching the content of health education, combining theory with practice, colleges and universities should not only carry out the practical courses of sports technology and injury treatment and health care, but also strengthen the theoretical courses of health education such as medicine and health care, so as to enhance students' awareness of self-protection and enhance sports injury health care ability.

(3)Strengthen the training of "regular, periodic, safe physical exercise principle, in order to achieve the purpose of healthy exercise" correct understanding.

(4)The propaganda of sports and health knowledge should be strengthened by various means. In the campus, publicity columns are added, brochures are made and distributed, and lectures are organized regularly.

(5)Internet plus education, strengthen manual distribution and health education, and make full use of cyber source to enhance the publicity and popularization of sports health knowledge network. We should promote the use of new media to improve the theoretical level of physical education and health of teachers, and strengthen the construction of teaching staff of physical education and health courses.

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