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Retraction

Retracted: Application of Mathematical Model in Orthodontics

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Q. Wang, Z. Jiang, Z. Xue, W. He, and Z. He, "Application of Mathematical Model in Orthodontics," *Mobile Information Systems*, vol. 2022, Article ID 5286225, 12 pages, 2022.

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Research Article

Application of Mathematical Model in Orthodontics

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With the development of digital information technology and big data technology, the medical industry has also undergone tremendous changes. Traditional medical treatment mainly relies on the technical experience of the attending doctor for treatment, and there is no sophisticated instrument or scientific analysis system to assist in treatment. With the improvement of people's living standards, people's attention to teeth has increased significantly. Traditional orthodontics is based on the subjective judgment of orthodontists and manual treatment. Due to the differences in the experience of orthodontists, the traditional orthodontic effect is often very poor. Using digital information and big data technology to carry out quantitative diagnosis and treatment analysis of teeth, 3D modeling, and simulation of prosthesis, personalized treatment of the prosthesis model, and finally applied to orthodontics, digital-based orthodontics make the orthodontic diagnosis and treatment process evidence-based, safer, and more effective. This article compares orthodontics and traditional oral orthodontics based on the mathematical model, to analyze the comfort of orthodontics, the aesthetics of orthodontics, the matching degree of aligners, and the stability of the environment in the periodontal ligament. It is concluded that the average orthodontic comfort based on the mathematical model is 85.6%, and the average aesthetic degree is 64.0%, which are more than 20% better than traditional orthodontics. It is also superior to traditional orthodontics in terms of the degree of matching of the appliance and the stability of the environment in the periodontal ligament. Therefore, the combination of mathematical models and orthodontics can lead to better orthodontic results.

1. Introduction

With the rapid development of information technology, an information revolution occurred following the industrial revolution. In recent years, the combination of information technology and many fields has brought a qualitative leap in different disciplines. The development of the information industry has made people combine digital information and medical fields. Orthodontics is an important subject in oral research. With the improvement of people's living standards and the development of the information-based medical system, people's requirements for orthodontics are getting higher and higher. Due to the shortcomings of traditional orthodontic appliances such as mismatch of aligners, poor comfort, and unsightly appearance, many people resist orthodontic treatment in their hearts. Moreover, in the process of clinical diagnosis and treatment of traditional orthodontics, doctors rely entirely on their own medical experience to judge and treat, which also causes the problem of uneven resources for traditional orthodontic diagnosis and treatment. Even in the process of traditional orthodontics, enamel demineralization, caries, and periodontal tissue destruction are prone to occur. Improper treatment will seriously damage people's health.

In this study, based on the application of mathematical models in orthodontics, in the face of various problems of traditional orthodontics, digital information technology, and orthodontics are combined to solve the slow and poor treatment effect of traditional orthodontics, to realize the informatization development of orthodontics. The innovations of this study are as follows: (1) research on the combination of digital information and other technologies with orthodontics; (2) conduct a comparative experiment between orthodontics based on mathematical models and traditional orthodontics, and compare and highlight the advantages of orthodontics based on mathematical models. Therefore, this study is innovative.

2. Related Work

With the improvement of living standards, people pay more and more attention to oral health, and many people have conducted in-depth research in the field of orthodontics. Among them, the Shukla experiment conducted a study on 60 orthodontic patients and concluded that effective orthodontic treatment can greatly reduce oral colonies [1]. Alouini experiment used lingual orthodontics to improve the problem of inappropriate occlusion in adolescents and promote the development of an oral medical career [2]. Rohmetra study showed that pressing the teeth in the oral cavity with physical fingers can relieve tooth pain to a certain extent, which is an orthodontic method [3]. The study by Thote changed the protrusion of the mandibular canines in the oral cavity by lingual orthodontics [4]. Through a comparative test of assisted orthodontics and traditional orthodontics, Parker analyzed that assisted orthodontics can better treat adolescent oral problems than traditional orthodontics [5]. Although traditional orthodontics can treat oral problems to a certain extent, it lacks the assistance of scientific calculations and precise instruments.

The development of information technology has led many scientists to combine information technology with orthodontics. Among them, the experiment of Franzotti E7 achieved painless treatment of orthodontics through laser-assisted dental surgery [6]. Melman's research pointed out that information technology-assisted laser cutting of gingival soft tissue can be very good for orthodontics [7]. Padmavati experiment uses resonance frequency to analyze and judge the stability of orthodontics [8]. Jokanovi uses information technology to analyze and observe the reasons for endodontic cases, the experiment shows the defects of traditional endodontic treatment, and endodontic medicine based on information technology can improve the success rate of endodontic treatment [9]. Aldabbagh helps dentists improve orthodontic accuracy by using test tools and shortening the diagnosis and treatment time by accurately placing brackets [10]. HY Hou scans teeth more accurately through 3D technology, providing more accurate data for orthodontics [11]. Although the combination of information technology and orthodontics can improve the efficiency of diagnosis and treatment and shorten the time of diagnosis and treatment, the use of information technology is not the most perfect.

3. Orthodontic Method Based on Mathematical Model

3.1. Image Feature Extraction Technology. Image features include two parts: image vision and image semantics. The extraction of oral image features is based on the extraction of image content and the visual comparison of images. The visual characteristics of images are mainly reflected in color characteristics, shape characteristics, texture characteristics, etc. [12]. By analyzing these characteristics of the image, in the process of orthodontics, the accuracy of the tooth position and the position of the jaw can be accurately analyzed to achieve the effect of effective orthodontics. The image feature extraction model diagram is shown in Figure 1.

3.1.1. Color Characteristics. Color characteristics are the most important characteristics of image characteristics. Colors are divided into chromatic and achromatic colors. In the computer world, the color pigments of images are composed of red, blue, and green. Noncolored pigments are gray, black, and white. Generally, the color feature extraction is mainly performed on the color space [13].

The most common color space is based on the establishment of the Cartesian system. The three coordinate axes are red, blue, and green, which is RGB in informatics. RGB is a three-dimensional cube structure, the value of the three coordinate axes is [0, 1]. Each color is a point in the RBG cube, and the three most common colors, red, blue, and green are three places in the RBG cube. Using RBG can indicate any color. In the process of oral orthodontics, it can judge the color of the teeth or the mandibular and oral color. It is the basis for oral orthodontic image recognition. The RBG model is shown in Figure 2.

RBG color space can be converted into other color space, which can be suitable for different application scenarios [14]. Orthodontic scenes sometimes use a color space called HSV. HSV is a visual experience model. HSV color space is visual characteristics that imitate human eye recognition of image color. Therefore, in the HSV model, a tapered circular space is generally used to represent the color collection. In the HSV coordinate shaft, the horizontal coordinate S is saturated, vertical coordinate V is brightness, and the slope H represents the color. The HSV model is shown in Figure 3.

The process of converting RBG to HSV is as follows:

$$H = \arccos\left\{\frac{(R-B)+(R-G)}{2\sqrt{(R-B)(R+B)+(R-G)^2}}\right\}, (B \le G), \tag{1}$$

$$H = 2\pi - \arccos\left\{\frac{(R-B)+(R-G)}{2\sqrt{(R-B)(R+B)+(R-G)^2}}\right\}, (B > G), \tag{2}$$

$$S = \frac{\max(B,G,R) - \min(B,G,R)}{\max(B,G,R)}, \tag{3}$$

$$V = \frac{\max(B,G,R)}{255}. \tag{4}$$

In formula (1)–(4), R, B, and G are the values of the RBG coordinate axis, and the value range is between [0, 255], arccos is an inverse trigonometric function.

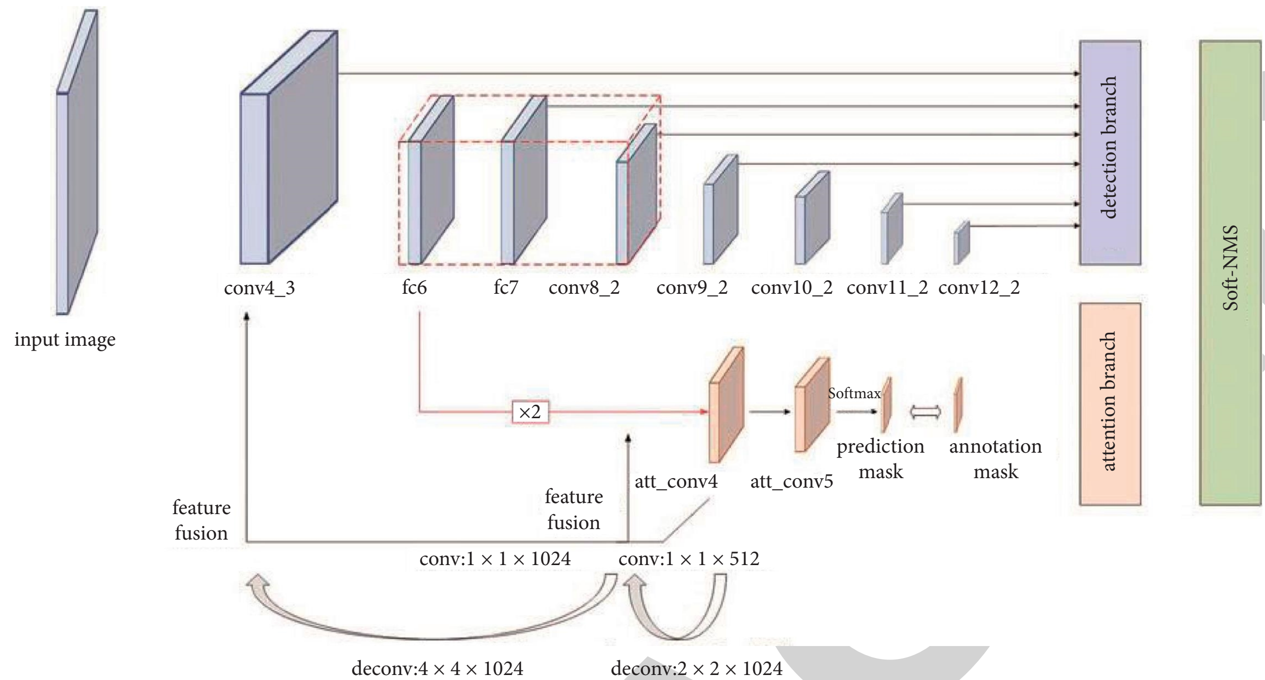

Figure 1: Image feature extraction model diagram.

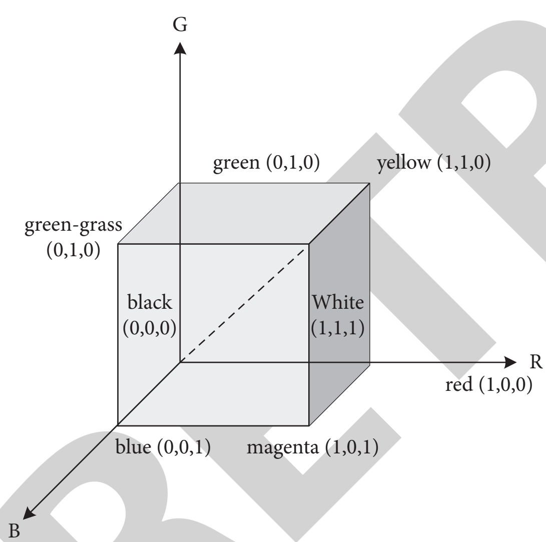

Figure 2: RBG model diagram.

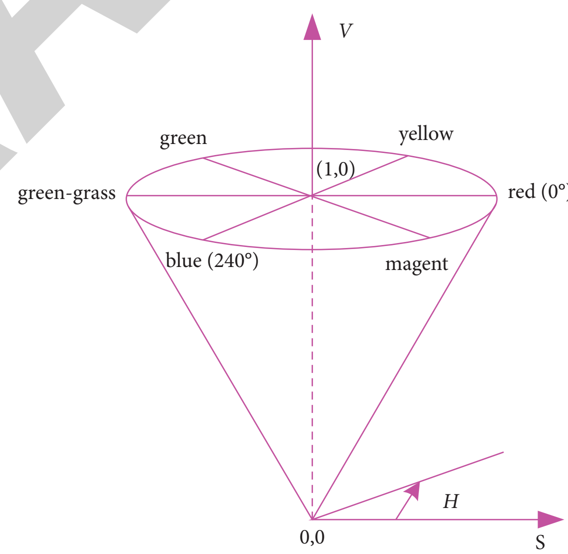

Figure 3: HSV model diagram.

The color extraction method of the oral image generally adopts the color moment. The color moment is a method that can be extracted without large storage. Usually, three-order moments are used to represent the color characteristics. The three-order moments are the mean order moment α, the variance order moment β, and the slope order moment χ.

The mathematical representation of the three order moments is:

$$\alpha_a = \frac{1}{N}\sum_{b=1}^{N} f_{ab}, \tag{5}$$

$$\beta_a = \sqrt{\frac{1}{N}\sum_{b=1}^{N}\left(f_{ab} - \alpha_a\right)^2}, \tag{6}$$

$$\chi_a = \sqrt[3]{\frac{1}{N}\sum_{b=1}^{N}\left(f_{ab} - \alpha_a\right)^3}. \tag{7}$$

In formulas (5)–(7), f_{ab} represents the probability when the color of pixel b is a, and the total number of pixel points is N.

3.1.2. Texture Characteristics. The texture characteristic of the image is also a common image feature method for analyzing image information [15]. When analyzing the texture characteristics of oral images, people recognize the image based on the human eye, mainly through roughness, contrast, and directionality.

The roughness is calculated as follows:

Assuming that the pixel size in the image is $2^r \times 2^r$, the pixel intensity of its rectangular space is given as follows:

$$B_r(x, y) = \sum_{a=x-2^{r-1}}^{x+2^{r-1}-1} \sum_{b=2^{r-1}}^{y+2^{r-1}-1} \frac{g(a,b)}{2^{2r}}. \quad (8)$$

In formula (8), $r = 1, 2, \cdots, 5$, $g(a,b)$ is the intensity of pixel point (a,b), $B_r$represents the pixel intensity of the rectangular space with side length r.

$$F = \frac{1}{P \times Q} \sum_{a=1}^{P} \sum_{b=1}^{Q} S(a,b). \quad (9)$$

In formula (9), F is the roughness, P and Q are the number of pixels on the x-axis and y-axis, respectively, $S(a,b) = 2^r$.

The directionality is calculated as:

There are two key points in the representation of pixels, pixel size, and pixel direction. The mathematical representation is as follows:

$$|\Delta K| = \frac{(|\Delta a| + |\Delta b|)}{2}, \quad (10)$$

$$\theta = \tan^{-1}(\Delta b/\Delta a) + \frac{\pi}{2}. \quad (11)$$

In formulas (10) and (11), Δa and Δb are the changes of the x-axis and y-axis, respectively, and $|\Delta K|$ and θ are the pixel size and the pixel direction, respectively, tan is a trigonometric function.

Then the histogram probability is:

$$H(x) = \frac{N_\theta(x)}{\sum_{i=0}^{n-1} N_\theta(i)}. \quad (12)$$

In formula (12), $N_\theta(x)$ is the number of pixels, n represents the number of pixels in the histogram where the pixel is located.

$$F = 1 - Qn \sum_{p}^{n_p} \sum_{\rho \in w_p} \left(\rho - \rho_p\right)^2 H(\rho). \quad (13)$$

In formula (13), n_p represents the number of histogram peaks, w_ρ is the distance from the peak to the trough, ρ is the center of the peak, and Q is the directional factor.

3.1.3. Shape Characteristics. The shape characteristics of an image reflect the basic outline of an image, and the Fourier shape description is generally used in the process of orthodontics [16]. Assuming that the shape in the image is (x_k, y_k), where $0 \le k \le N - 1$, and the total number of pixels is N, then the curvature function is expressed as:

$$C(k) = \frac{d\theta(k)}{dk}. \quad (14)$$

The distance from the image boundary to the image center (x_u, y_u) is:

$$L(k) = \sqrt{(x_k - x_u)^2 + (y_k - y_u)^2}. \quad (15)$$

The complex transformation of formula (16) can be obtained:

$$Z(k) = (x_k - x_u) + (y_k - y_u). \quad (16)$$

The curvature function after the Fourier transform is expressed as:

$$f_i = [|F_1|, |F_2|, \cdots, F_N]. \quad (17)$$

In formula (17), F is the Fourier parameter.

3.2. Relevant Feedback Technology. In the process of orthodontic image recognition, due to the traditional backward technology, it is difficult to accurately identify each part in the orthodontic process [17]. This has a great impact on the orthodontic process. In order to solve the problem of inaccurate image recognition, a correlation feedback method is used for orthodontic recognition. The correlation feedback technology was originally used in text retrieval, and then later applied to image retrieval and achieved very good results. Relevant feedback technology is a way of human-computer interaction for image retrieval. Users can actively participate in the process of seeing the results, and can self-learn after retrieving images for many times to achieve the desired results. The relevant feedback algorithm model is shown in Figure 4.

The oral image retrieval process of relevant feedback is as follows: the user transmits the oral image to the system, the system expands the retrieval method, and feeds back the results with a high degree of similarity to the user through the resource library. If it does not match, let the machine learn from itself, and eventually reach the result returned to the user's expectation for users [18].

The movement process of the query point in the relevant feedback algorithm is:

$$G\prime = AG + B\left(\frac{1}{N_R} \sum_{i \in P_R} O_i\right) - C\left(\frac{1}{N_N} \sum_{j \in P_N} O_j\right). \quad (18)$$

In formula (18), A, B, and C are constant, G is the initial feature vector, and G' is the adjusted feature vector. P_R and P_N are related images and unrelated images, respectively. O_i and O_j are corresponding feature vectors. N_R and N_N are related images and unrelated images.

In formula (18), after continuous feedback, the value of G' finally reaches the expected result value.

During the process of oral image retrieval, there are uncertain factors, so sometimes the corresponding results

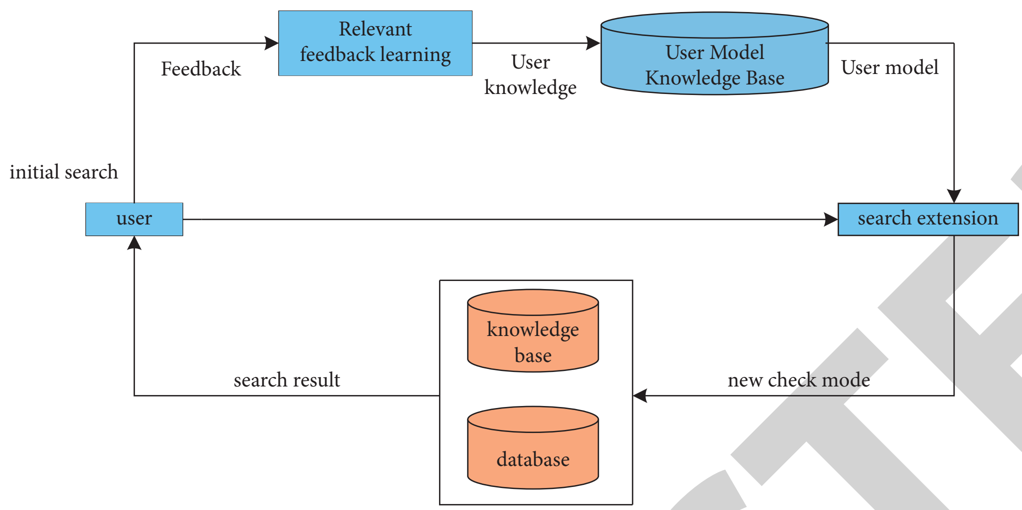

Figure 4: Related feedback algorithm model diagram.

cannot be output according to the user's wishes. Therefore, a related feedback algorithm based on probability model came into being. In the probability model, the most commonly used algorithm is based on the Bayesian theory. Bayesian is a posttest algorithm. In the process of related feedback, the Bayesian algorithm can be divided into positive feedback and reverse feedback. The feedback form in the two directions greatly reduced training samples and greatly improved orthodontics efficiency in the process of oral orthodontics [19].

The Bayesian algorithm has a K sample type, which is $(v_1, v_2, \cdots, v_k)$, and a posttest probability of a sample type is $P(v_i)$, so the postprobability of the random variable S is:

$$P(v_i|s) = \frac{P(s|v_i)P(v_i)}{\sum_i^k P(s|v_i)P(v_i)}. \quad (19)$$

In the process of oral orthodontics, through the query of vector S, the query result is the most probable image in $P(v_i|s)$. That is to find the optimal problem $\max_i f(s) = P(s|v_i)P(v_i)$

3.3. Strengthen Learning Technology. Strengthening learning technology is a branch of artificial intelligence technology, a nonmentor-style learning method, and is widely used in the fields of intelligent machines [20]. Reinforcement learning is mainly in a machine environment to realize self-learning and self-growth through interaction with the machine environment. It is usually used in orthodontics to identify detailed parts of oral images, judge the oral problem, and provide a scientific diagnosis and treatment method. The enhanced learning model is shown in Figure 5.

The agent in Figure 5 is the core function of strengthening learning. Agent is expressed by a perceiver *A*, a learning device *B*, and a selector *C*. Among them, the perception can mappore the external environment as an agent. The selector can choose the current action. The learning device can update the content of the agent through rewarding learning and self-learning. The process of reinforcement learning is that when the selector selects an action, the more rewards the system brings, the action will be strengthened, and vice versa [21].

The algorithm process of reinforcement learning is as follows:

$$f(x_t) = \sum_{i=0}^{+\infty} \eta^i p_{t+1}, 0 \le \eta \le 1. \quad (20)$$

In formulas (1) and (20) is the discount variable, and P_t is the reward value in the process from the environmental state X_t to X_{t+1}.

Then the optimal action is:

$$Q(x_t) = p_t + \eta \sum_{x_{t+1} \in x} P(x_{t+1}|x_t) f(x_{t+1}). \quad (21)$$

In formula (21), $P(x_{t+1}|x_t)$ is the probability of state transition.

In general, the assumed environments are Markov environments, and it can be seen from formula (21) that state transitions in Markov environments are only related to the current state and actions in the selector, and have nothing to do with rewards, very suitable for the orthodontic process.

4. Experiment of Orthodontics Based on Mathematical Model

4.1. Orthodontic Effectiveness Experiment Based on Mathematical Model

4.1.1. Sample Data. In order to carry out a multi-angle comparison test between orthodontics based on mathematical model analysis and traditional orthodontics, the selection of experimental samples must be very strict, and poor selection of experimental samples can easily lead to the failure of the experiment. In addition, the samples are also taken from subjects of different classes, and the time and effect of orthodontics are also different for people of different ages. In order to make the experiment extremely rigorous,

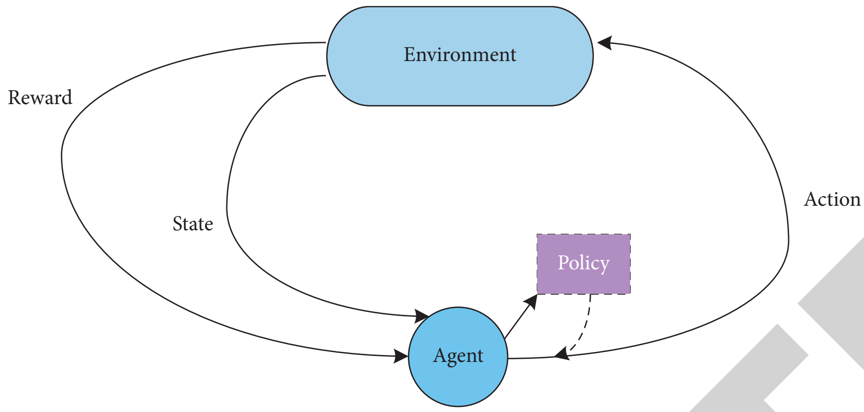

Figure 5: Strengthen the learning model diagram.

this experiment will select a total of 360 people from three age groups, namely young people (3–25 years old), middle-aged people (26–50 years old), and old people. people (51–75 years old), including 120 young people, middle-aged people, and 120 elderly people. By tracking the age groups of the experimental population, the impact of the oral cavity in different age groups was counted, and used as an indicator to evaluate the effectiveness of orthodontic experiments. The oral injury situation is shown in Table 1.

As can be seen from the data in Table 1, from the above-mentioned 6 oral conditions, the average percentage of young people affected by these oral indicators is 59.6%, the average percentage of middle-aged people affected by these oral indicators was 72.5%, and the average percentage of elderly people affected by these oral indicators was 87.8%. All three different age groups were greatly affected, so the indicators in Table 1 can be correlated.

4.1.2. Correlation Results of Samples. The selection of orthodontic samples will directly affect the experimental results, so when selecting orthodontic experimental indicators, it is necessary to conduct a correlation analysis test on the orthodontic experimental indicators and orthodontics [22]. The correlation analysis of samples is to prevent the failure of experiments due to improper sample selection. The correlation analysis of the samples can maximize the main characteristics of the orthodontic experiment. By observing the oral indicators in the experiment, the key factors affecting the oral problems can be found. From the data in Table 1, it is obvious that the oral lesions of the three age groups are greatly affected by these oral indicators. And the data dimension used in this experiment is not very large, so all the oral index data in Table 1 are subjected to correlation analysis that affects the oral injury. The correlation analysis table of oral injury is shown in Table 2.

From the correlation analysis results in Table 2, it can be seen that the stability of the periodontal ligament is the most influential indicator of oral health, followed by the compression resistance of the cementum, the lowest is the proliferative ability of the jaw, which is only 11.1% relevant. However, in general, all oral indicators have a great impact on oral health, so all oral indicators in Table 2 are used as indicators for evaluating oral health.

4.1.3. Validity Analysis of Samples. In order to test whether the oral health index is effective for the orthodontic experiment analyzed by the mathematical model and the traditional orthodontic experiment, the experiment will be verified by k-fold cross-validation [23]. The principle of k-fold cross-validation is to cycle back and forth between the test set and the test set when the sample data is not so sufficient so that each data can become the test data and the test data, which greatly improves the test efficiency. In the k-fold cross-validation process, all the data is divided into k parts, the experiment will be carried out k times, each time the experiment takes k-1 data as the test data, the remaining data is the test data, and the final result of the experiment is k times of experiments average of. In the orthodontic experiment, since the data dimension of the experiment is not very large, the method of 4-fold cross-validation is adopted in this experiment. That is, when $k = 4$, the experiment randomly selects 240 data as the sample data, according to the 4-fold cross-validation method, that is, 180 data are the test data, and the remaining 60 data are for testing data, to analyze the effectiveness of orthodontics and traditional orthodontics analyzed by mathematical models, respectively. The result analysis table of experimental cross-validation is shown in Table 3.

From the data analysis in Table 3, it can be seen that in the orthodontics analyzed by the mathematical model, the stability of the periodontal ligament is the most affected, with a correlation of 97.7%, while in the traditional orthodontics, the absorption capacity of the jaw is most affected, with a correlation of 88.0% correlation. However, these two methods of orthodontics are greatly affected by the above six oral indicators. The average impact rate of orthodontics in the mathematical model analysis is 91.0%, and the average impact rate of traditional orthodontics is 77.7%. Since these two methods of orthodontics have a high impact rate on these six oral indicators, a comparison experiment between orthodontics and traditional orthodontics based on mathematical model analysis can be carried out.

Table 1: Oral damage table.

Oral indicators	Young people (%)	Middle-aged (%)	Elderly (%)
Absorptive capacity of the jaw	60	70	86
The proliferative capacity of the jaw	55	68	84
Compression resistance of cementum	60	75	90
Periodontal ligament stability	60	76	95
Reasonable width between teeth	60	74	80
Absorptive capacity of alveolar bone	63	72	92
Average	59.6	72.5	87.8

Table 2: Correlation analysis table of oral damage.

Number of sample groups	Oral indicators	Relevance
1	Absorptive capacity of the jaw	0.121
2	The proliferative capacity of the jaw	0.111
3	Compression resistance of cementum	0.168
4	Periodontal ligament stability	0.289
5	Reasonable width between teeth	0.141
6	Absorptive capacity of alveolar bone	0.166

Table 3: Analysis table of cross-checking results.

Oral indicators	Orthodontics with digital model analysis (%)	Traditional orthodontics (%)
Absorptive capacity of the jaw	93.3	88.0
The proliferative capacity of the jaw	87.6	76.5
Compression resistance of cementum	93.3	77.4
Periodontal ligament stability	97.7	75.7
Reasonable width between teeth	86.0	72.8
Absorptive capacity of alveolar bone	88.1	76.0
Average	91.0	77.7

4.2. Comparison Experiment of Mathematical Model Orthodontics and Traditional Orthodontics. Orthodontics of mathematical models uses image recognition technology and reinforcement learning of positive feedback to assist orthodontics, while traditional orthodontics relies on the experience of doctors and traditional orthodontics for orthodontics. In order to comprehensively analyze the advantages and disadvantages of the two orthodontic methods, this experiment will carry out comparative experiments from four aspects, namely, the comfort of orthodontics, the aesthetics of orthodontics, the matching degree of aligners, and the stability of the environment in the periodontal ligament.

4.2.1. Orthodontic Comfort. Whether it is orthodontics analyzed by mathematical models or traditional orthodontics, the purpose is to make orthodontics better and better diagnose and treat oral patients. So from the patient's point of view, it is not only necessary to have good orthodontic diagnosis and treatment, but also to ensure the comfort of orthodontics. In order to better compare the comfort of the two methods of orthodontics, the experiment will conduct experimental analysis on three groups of experimental groups, including 30 young people, 30 middle-aged people, and 30 elderly people. The experiment was counted in turn according to the time gradient change, and the orthodontic comfort of the experimental population was counted every one week. Since the stabilizer is reached 6 weeks after orthodontic treatment, the time after 6 weeks of orthodontic treatment will be counted. The orthodontic comfort experiments of the two methods are shown in Figure 6.

From the analysis of the data in Figure 6, it can be concluded that whether it is the elderly, middle-aged or young people, in the first week after orthodontics, the orthodontics analyzed by mathematical models are more comfortable than traditional orthodontics. In the younger group, comfort levels can reach 85% in the first week, compared to 72% with traditional orthodontics. Combined with the analysis of (a), (b), (c), the orthodontic comfort level analyzed by the mathematical model will gradually increase and reach a high level of comfort in the following time. In traditional orthodontics, the comfort level will increase after 2 to 3 weeks, but the comfort level will decline after that, and the obviousness of the decline in comfort level is most obvious among middle-aged and elderly people.

4.2.2. The Aesthetics of Orthodontics. Orthodontics is due to the fact that many people do not keep their teeth clean, the proper placement of their tongues, and improper use of their teeth when they change their teeth at a young age, resulting in uneven teeth and even influence, making the facial contour asymmetrical. The purpose of orthodontics is to solve the problems of uneven teeth and irregular craniofacial

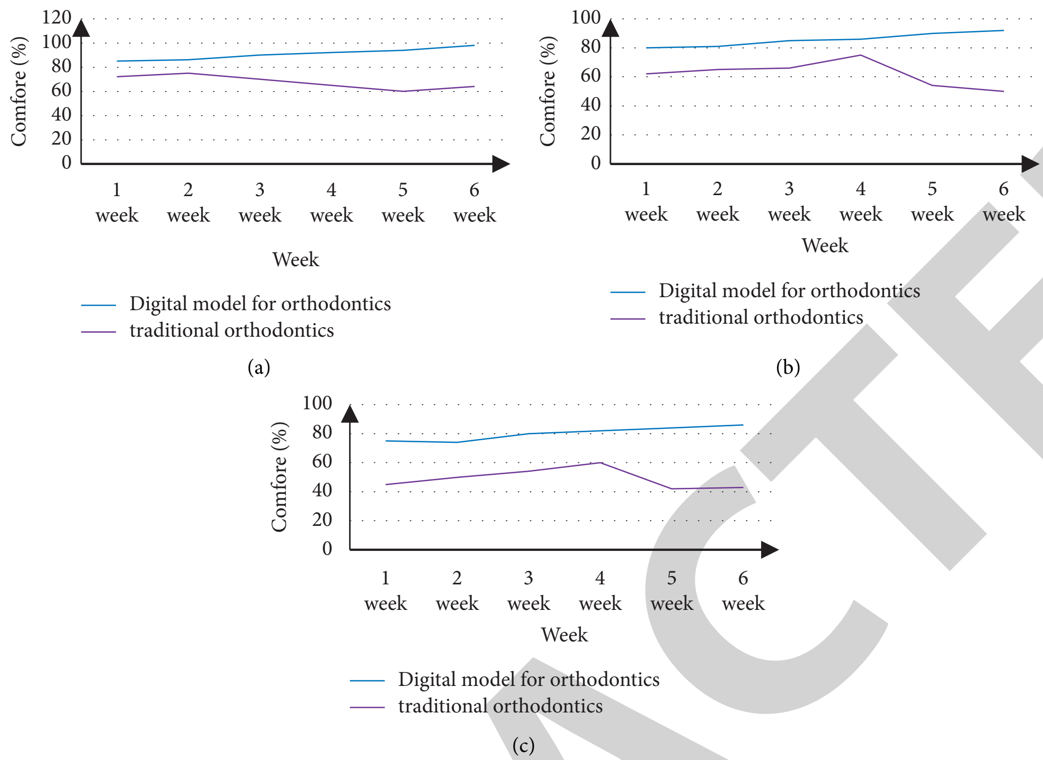

Figure 6: Comparison chart of orthodontic comfort (a) Orthodontic comfort map of young people (b) Orthodontic comfort map of middle-aged people (c) Orthodontic comfort level of the elderly.

teeth. All in all, it is to improve the aesthetics of teeth and face after orthodontics. The same experimental population selected 30 young people, 30 middle-aged people, and 30 elderly people. Since it takes about half a year to adjust teeth and improve facial contours, it is carried out every other month within one year after orthodontic treatment, and the increase in aesthetics after orthodontic treatment is counted. The two methods of orthodontic aesthetics experiments are shown in Figure 7.

From the data analysis of Figure 7, it can be obtained whether it is young people, middle-aged people, or the elderly, the three groups of people have received corresponding improvements in aesthetics after the two methods of orthodontics. And with the increase of age, because the structure of the body can no longer be greatly adjusted, the older the age, the more space for the aesthetics after orthodontic treatment will become smaller and smaller, which is most obvious in the elderly. Although the orthodontics analyzed by the mathematical model is better than the traditional orthodontics, the difference is only 7% after 6 months. In young people, the orthodontic aesthetics analyzed by the model are very obvious, and the aesthetics can be improved by 65% in 6 months, which greatly improves the problem of unsightly facial contours.

4.2.3. The Matching Degree of the Aligner. Traditional orthodontics is based on the experience of the attending physician for diagnosis and treatment. The doctor observes the patient by taking pictures, judges the severity of the patient's oral cavity according to the doctor's experience, and makes orthodontics according to the picture to perform orthodontics on the patient. Orthodontics analyzed by the mathematical model can accurately find the positions of teeth, alveolar bones, jaws and other oral parts in patient images by extracting image features and using positive feedback image recognition of reinforcement learning, and then formulate precise aligners based on precise oral data. Due to gender differences, male oral bones are generally larger than female oral bones. Therefore, the experiment will conduct an orthosis matching experiment for a random population of 100 people, including 50 males and 50 females, for a total of 6 weeks. The matching degree experiments of two orthodontic appliances are shown in Figure 8.

From the data analysis in Figure 8, it can be seen that: Although boys and girls have a slight difference in the size of the oral bones, the matching degree of the orthodontic appliances of the two methods is not much different, but the matching degree of the orthodontic appliances of girls is generally a little better than that of boys. The orthodontic appliance analyzed by the mathematical model has a high degree of matching at the beginning, and both men and women are more than 80%. However, the traditional orthodontic aligners only have a matching degree of about 60% at the beginning, and as time goes by, the matching degree of the two modes of aligners has increased. However, the orthodontic appliance analyzed by the mathematical model can achieve a matching degree of about 95% in 6 months, while the effect of the traditional orthodontic appliance is much worse. This is due to the difference in the

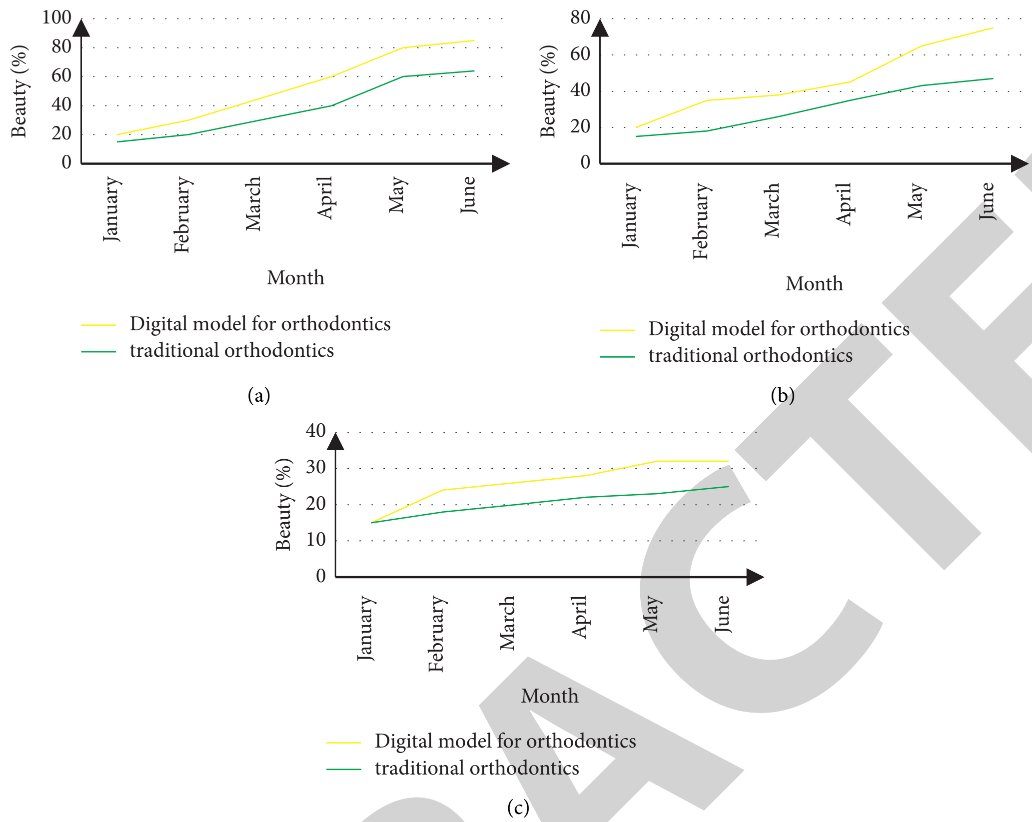

FIGURE 7: Comparison of orthodontic aesthetics (a) Orthodontic aesthetics map of young people (b) Orthodontic aesthetics map of middle-aged people (c) Orthodontic aesthetics chart for the elderly.

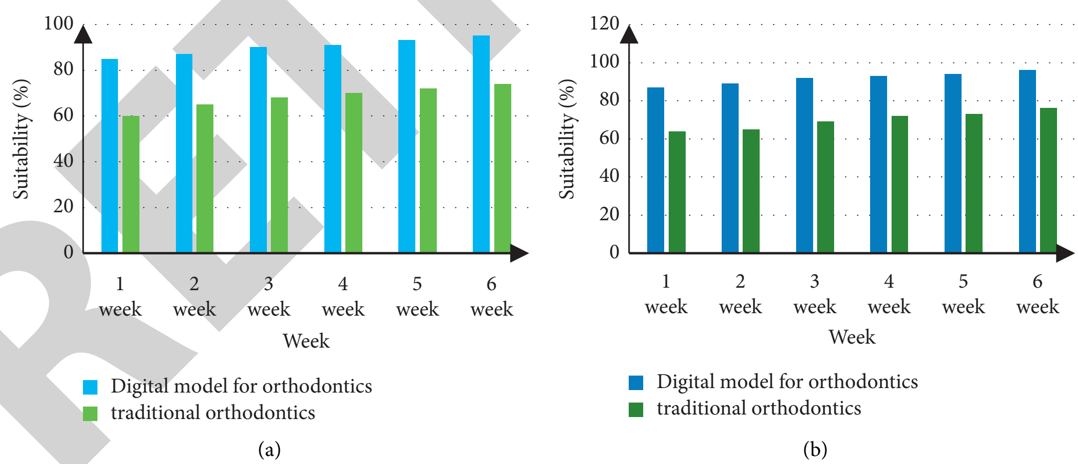

FIGURE 8: Corrector matching degree diagram (a) The matching degree chart of male orthosis (b) The matching degree chart of female orthosis.

accuracy of the data provided by the two when making aligners.

4.2.4. Stability of the Environment in the Periodontal Ligament. A very important criterion for judging the quality of an orthodontic surgery is the stability of the internal environment of the periodontal ligament. The stability of the environment in the periodontal ligament is the standard for judging whether the teeth and the tooth socket are stable. An unstable environment within the periodontal ligament causes the teeth to loosen and the socket to become non-plastic. Therefore, for the comparative test of the stability of the internal

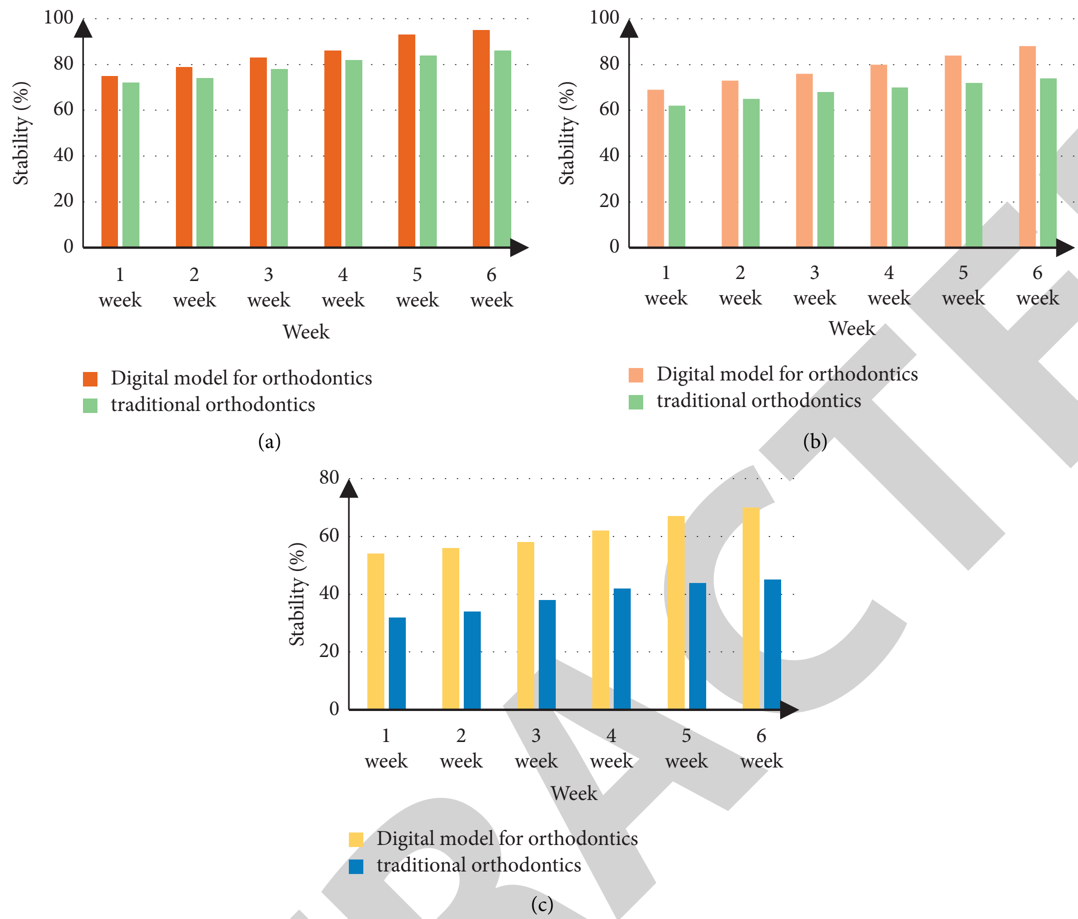

FIGURE 9: Stability map of the environment within the periodontal ligament (a) The stability diagram of the periodontal ligament environment in young people (b) The stability diagram of the periodontal ligament environment in middle-aged people (c) Stability diagram of the periodontal ligament environment in the elderly.

environment of the periodontal ligament, the experiment selected groups of different age groups, which were still 60 young people, 60 middle-aged people, and 60 elderly people. The stability monitoring of the environment in the periodontal ligament was carried out for 6 weeks for the three groups of people. The stability experiments of the periodontal ligament environment in two ways are shown in Figure 9.

From the data analysis of Figure 9, it can be obtained the periodontal ligament environment after orthodontics analyzed by the mathematical model is much more stable than the periodontal ligament environment after traditional orthodontics in three different populations. Among them, the stability of the periodontal ligament environment after orthodontic analysis for young people can reach 95%, and with the increase of age, the stability of the periodontal ligament environment will decrease with it. However, the overall situation of the periodontal ligament environment in orthodontics analyzed by the mathematical model is more stable than that after traditional orthodontics.

4.2.5. Experimental Analysis of Two Kinds of Orthodontics. Through the comparison of two orthodontic methods in many aspects, the experimental results show that the orthodontics based on the mathematical model analysis has the comfort of orthodontics, the aesthetics of orthodontics, the matching degree of orthodontics, and the environment in the periodontal ligament. It is much better than traditional orthodontics in terms of stability. The specific orthodontic comparison data of the two methods are shown in Table 4.

5. Discussion

With the development of image recognition technology and artificial intelligence technology, mathematical model analysis is combined with multiple fields and disciplines. In recent years, due to the improvement of people's living standards, more and more attention has been paid to oral health. Traditional orthodontics is not only ineffective but also aesthetically pleasing. In order to solve the problem of traditional orthodontics, orthodontics is analyzed through

Table 4: Experimental comparison analysis table of two orthodontic methods.

Compare items	Digital model for orthodontics (%)	Traditional orthodontics (%)
Orthodontic comfort	85.6	59.6
Orthodontic aesthetics	64.0	45.3
The degree of matching of the orthosis	91.0	69.0
The stability of the periodontal ligament environment	84.3	68.3

mathematical models to achieve accurate data on orthodontics, thereby improving the efficiency and aesthetics of orthodontics.

6. Conclusions

The following conclusions are drawn from the comparison of orthodontics analyzed by mathematical models and traditional orthodontics: (1) The comfort level of the orthodontic process analyzed by the mathematical model is 85.6%, while the comfort level of the traditional oral machine is only 59.6%, and in terms of aesthetics after orthodontics, the aesthetics of orthodontics analyzed by mathematical models is 18.7% higher than that of traditional orthodontics; (2) The matching degree of the orthodontic appliance analyzed by the mathematical model is 22% better than that of the traditional appliance. In addition, in terms of the stability of the environment in the periodontal ligament, the orthodontic appliance analyzed by the mathematical model is also much better. All in all, orthodontics based on mathematical model analysis is superior to traditional orthodontics in terms of orthodontic accuracy and orthodontic aesthetics. However, the current orthodontics analyzed by mathematical models is still a process of machine-assisted orthodontics, which can be expanded in the field of fully automatic orthodontics in the future, which will be the reverse of future research.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no potential conflicts of interest in this study.

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