Research Article

The clinical effectiveness assessment of proposed digital dental planning and digital smile prototypes design

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Abstract: Background: Modern technologies in dentistry are one of the effective methods to obtain results that are acceptable to the patient, as well as reducing time, effort, and cost. Materials and Methods: The effectiveness of the developed digital dental treatment planning was evaluated by assessing the results of a survey of 50 patients in need of dental implant prosthesis for aesthetic faults of the anterior teeth at the prototype stage. The Oral Health Impact Profile-14 (OHIP-14) was created to measure the impact that oral health issues can have on a person's life. Results: after the mockup the relative occlusal load distribution between the right and left sides was 50.40 ± 0.90% with balanced occlusion.The dental closing time was 0.17± 0.07 s; and the dental opening time was 0.19 ±0.04 s. The difference in timing between the left and right laterntrusions is -0.030 ± 0.03. During protrusion, the opening time was less than 0.6 s. (0.170 ± 0.07). The time required to close the teeth to reach the maximum intercuspation was 0.20 ± 0.02 s, where the time required to open them was 0.170 ± 0.02 s. Conclusion: Prior to the mock-up, the patients' average relative occlusal load distribution was 51.5±1.20% on the left and right sides. After the mock-up, it was found that the relative occlusal load distribution between the left and right sides was 50.40±0.90%. These results point to stable and successful occlusal balance restoration following mock-up. After using the OHIP-14 questionnaire to summarize the survey results, we can say that patients' quality of life has enhanced by a factor of two.

Keywords: digital dental planning, virtual smile prototype, digital smile design, clinical effectiveness, oral health

Introduction

In the last two decades, digital dentistry has improved dramatically due to the rapid development of CAD/CAM systems, grinding systems, rapidly automated prototypes, and 3D printing of dental biomaterials, bringing about a new paradigm for the dental industry [(1)]. In the field of dentistry, the technique known as "rapid prototyping" (RP) has proven to be highly feasible. This technique can be advantageous in various dental practices, especially when it comes to the implementation of dental prostheses for various purposes [(2)]. A digital record is secured with the aim of designing and producing repairs by capture of a negative image through digital imprint[(3)]. The new comprehensive 3D digital planning methodology is a predictable and minimally invasive method that facilitates simple diagnosis, improves patient communication, and reduces the amount of time spent on treatment and the mistakes that are typically related to the manual prosthodontic stage [(4)].

Patients' treatments are evolving as a result of the use of contemporary computer-aided design and manufacturing technology in diagnosis, therapy planning, and device production [(5)]. The dental profession is undergoing rapid transformation due to the rapid advancement of digital technology. To improve patient outcomes and experiences in general, dental professionals are replacing antiquated methods with digital technology, streamlined workflows, and precise, high-strength materials[(6)]. Bringing new methods,

systems, and interactions that have improved dentistry, digital dentistry has disrupted the dental industry in numerous ways. Innovation has created opportunities for future study of material science [7].

Intraoral scanners (IOS) generate the upper and lower digital model articulations using specific algorithms[8]. Patients can be educated and motivated with the use of the Digital Smile Designing (DSD) technique. A patient can digitally design and modify their smile with DSD, a technology tool that allows them to see the possible results before the therapy actually starts[9].

The successful outcome of any prosthesis should be based on appropriate occlusal design. For long-term advantages, occlusal stability must be attained, even though the masticatory function may not be viewed as the main function of an aesthetic restoration. Problems have been noted to arise from incorrect occlusal connections[10]. The approach to patient care has been completely transformed by digital dentistry today. In dentistry, it refers to the application of digital technologies to diagnosis, treatment planning, and restoration [11]. It is important to view artificial intelligence as a tool to improve efficacy and effectiveness[12]. The advent of computer-aided manufacturing and digital workflow, which made novel techniques and materials accessible for dental application, were the most revolutionary developments in digital dentistry [13].

An individual's life might be affected by oral health issues, and this can be evaluated with the help of the Oral Health Impact Profile-14 (OHIP-14). Many theoretical frameworks were established to assess the findings[14]. The most widely used tool to assess adult oral health-related quality of life (OHRQL) is the 14-item Oral Health Impact Profile (OHIP-14) [15]. The original Oral Health Impact Profile (OHIP) instrument and its short-form variations work well to evaluate these four OHRQL characteristics[16]. Oral function, oral pain, oral appearance, and Psychosocial Impact—the four dimensions of OHRQL - have developed in the psychometrically sound and clinically more realistic form of OHIP [17]. Using the Oral Health Impact Profile-14 (OHIP-14) for people with temporomandibular joint disorders (TMJD), Oscar Gabriel et al. investigated the association between elements of the oral health-related quality of life related to oral health [18].

A real model can be digitally transformed into a 3D computer-aided design (CAD) file using 3D scanning technologies. When using additive manufacturing (AM) technology to design and fabricate unique parts, this digital output works well [19]. There was a noticeable variation in accuracy in the tested IOS, and the kind of finishing line design significantly impacted the accuracy of the IOS[20]. One tool that appears for be essential to contemporary digital dentistry is the scanner. It is impossible to overstate its importance in implantology, CAD/CAM planning for current prosthetic therapies, and orthodontic therapy with overlay appliances [21]. Digital dentistry will affect therapy, diagnosis, and prevention, which will affect patients' dental health and, in turn, their quality of life related to oral health [22]. Standardized Patient-Reported Outcome Measures (PROM) reporting is desperately needed in the field of implant dentistry[23]. For example, clinicians in the medical and dental fields know very little about the experiences and satisfaction levels of their patients. However, it is imperative that surgical sciences adopt a patient-reported outcome measures (PROM) research practice. Therefore, the objective of this article was to learn more about how satisfied individuals were with their dental and medical care [24].

The purpose of this research is to study, in terms of quality of life by improving the occlusion of the patiants, evaluating the patient satisfaction with the results of dental treatment planning using digital treatment at the stage of manufacturing a prototype of aesthetic restorations.

Materials and methods

The present study involving 50 patients, who were randomly divided into experimental and control groups (25 participants each), was conducted in accordance with the ethical standards of the Belgorod State National Research University Ethics Committee and the principles outlined in the Declaration of Helsinki. Prior to participation, all patients were informed about the study objectives, procedures, possible risks, and benefits. The inclusion criteria ensured the selection of participants with missing one or two

anterior teeth of the upper jaw, the presence of occlusal bite, and no history of destructive periodontal diseases, neuromuscular-articular dysfunction, oncological diseases, or mental disorders. Confidentiality and anonymity of patient data were strictly maintained throughout the research.

Criteria for not being included in the study: complete absence of teeth in the upper and (or) lower jaw; presence of a history of destructive forms of periodontal diseases; presence of neuromuscular-articular dysfunction and pathology of emergency situations; presence of a history of oncological diseases; presence of a history of mental disorders.

Exclusion criteria from the study: Refusal of the patient during the research process; Development in patients during the study of acute inflammatory processes in the maxillofacial area.

The effectiveness of the established digital dental treatment planning and digital smile prototyping technique was evaluated by assessing the results of a survey of 50 patients in the prototype stage who required prostheses of the anterior teeth. The occlusal load of the patient was measured before and after the mock-up using the scanning procedures "Multi-Bite", “Right / Left Excursion” and "Protrusive Excursion". The average distribution of the relative occlusal load between the right and left sides in patients before the mock-up was 51.5 ± ,%1.20with unbalanced occlusion in the closing and opening the teeth, as in well as regions of high load. Following the mock-up, it was discovered that the left and right sides have a relative occlusal load distribution of 50.40±0.90%.

These investigations were carried out in Belgorod, Russia, to achieve the objectives. Research with different cultural features is an intriguing possibility since it can support the validity and trustworthiness of the data collected as well as the proof of OHIP-14's operation [15]. It should be made known that Belgorod was chosen for the study mostly due to the researchers' preference for the city and the fact that their offices are there.

The survey was conducted to determine the quality of life of patients before and after mock-up of restorations using the OHIP-14 questionnaire. The results of a survey were assessed in points according to the answers: never – 1; almost never – 2; Usually – 3; rarely – 4; very often – 5 (in terms of quality of daily life, chewing food, ability to communicate). The average numerical values of responses to the OHIP-14 questionnaire of the experimental and control groups are presented in table below. The following is a description of these studies.

Contrasting the experimental group's with the control group's overall answers to each question. We will tally the total quantity of "Yes" answers received by each group and compile the differences. The overall number of "Yes" answers for each group.

In order to examine the data, we will give each result of the experimental group and the control group a paired t-test. Regarding the experimental group, before treatment: Mean $X_{main, before}$, after treatment: Mean $X_{main, after.}$ For the control group, before treatment: Mean $X_{control, before}$, after treatment: Mean $X_{control, After}$, then:

$$\text{For the experimental group: Difference}_{main} = X_{main, After} - X_{main, before}$$

$$\text{For the control group: Difference}_{control} = X_{control, After} - X_{control, before}$$

Statistical analysis was applied to assess and interpret the collected data. Various statistical methods were utilized to examine the results, ensuring accuracy, reliability, and significance of the findings. This approach allowed a clear understanding of the differences between the groups and provided a solid basis for evaluating the effectiveness and validity of the experimental outcomes.

Results

The patient’s satisfaction with the quality of the medical service provided by planning of dental treatment according to the proposed digital and traditional analogue protocol was compared. According

to a survey conducted among patients, examinations, and preliminary treatments using prototypes that were completed using digital dental treatment planning, compared to patients receiving traditional treatment with analogue methods, 68% of patients preferred computer methods due to their greater comfort, speed, ability to participate in their treatment, and greater compliance of the manufactured prostheses with their expectations, the virtual models that were chosen. The survey results are shown in Table 1.

Table 1: The results of a survey to assess the effectiveness of the digital dental treatment planning

			Frequency	Percent	Valid Percent	Cumulative Percent
The patient's appointment at the specified time.	**Control**	Yes	25	100.0	100.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Patient satisfaction with dentist's demeanor	**Control**	Yes	25	100.0	100.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Consultation of the material presented on the medical organization's official website before contacting them	**Control**	Yes	25	100.0	100.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Assignment an X-ray diagnostic study when applying to a medical organization.	**Control**	Yes	15	60.0	60.0	60.0
		No	10	40.0	40.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Patient comfort for the provision of services in a dental organization	**Control**	Yes	20	80.0	80.0	80.0
		No	5	20.0	20.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Patient satisfaction with the time taken to determine the shape, colour and location of the teeth when preparing future teeth	**Control**	Yes	12	48.0	48.0	48.0
		No	13	52.0	52.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Discomfort during oral cavity manipulation.	**Control**	Yes	14	56.0	56.0	56.0
		No	11	44.0	44.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
The shape, colour and location of the teeth in the teeth correspond to those agreed upon in the first step of visualizing the smile design	**Control**	Yes	12	48.0	48.0	48.0
		No	13	52.0	52.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Expectations consistent with the results obtained	**Control**	Yes	20	80.0	80.0	80.0
		No	5	20.0	20.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
The indication of the service for diagnosis and planning of dental treatment required a one-day presence in the clinic.	**Control**	No	25	100.0	100.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0
Patient's conviction about working conditions in the medical institution.	**Control**	Yes	20	80.0	80.0	80.0
		No	5	20.0	20.0	100.0
	Experimental	Yes	25	100.0	100.0	100.0

To determine the difference between the experimental group and the control group's total "Yes" responses:

Difference=Total "Yes" in experimental group−total "Yes" in control Group
Difference=275−188=87

This shows that, overall, across all questions, the experimental group received 87 more "Yes" answers than the control group. To calculate the proportion of "Yes" responses for each group:

Proportion of "Yes" responses in Experimental Group: 275 / 275+0 =1

Proportion of "Yes" responses in Control Group: 188 /188+87 = 0.68

This demonstrates that whereas 68% of replies in the control group were "Yes," 100% of responses in the experimental group were "Yes."

Across all measures—appointment attendance, demeanor satisfaction, material consultation, X-ray diagnostic assignment, comfort, preparation time satisfaction, lack of discomfort, agreement with initial design, consistency of expectations, and conviction about working conditions—the experimental group consistently reported 100% positive responses. The control group, on the other hand, had greater variability, scoring lower overall in a number of areas, including overall conviction about working conditions, agreement with the initial design, comfort, X-ray assignment, and preparation time satisfaction. This shows that the experimental group's patient experiences were considerably enhanced across all measured variables, regardless of the intervention that was applied.

It is clear from the thorough study that the experimental group answered "Yes" to more questions than the control group did on each one. By examining the differences in the "Yes" responses for each particular question between the experimental group and the control group, the absolute difference and percentage difference for each question were computed to conduct the analysis (Figure 1).

These calculations give us data regarding the degree and direction of differences between the experimental and control groups' "Yes" responses to each question.

In all cases, the respondents' opinions were in agreement when it came to the following issues, all of which had positive responses: the patient's appointment time, the patient's contentment with the dentist's demeanor.

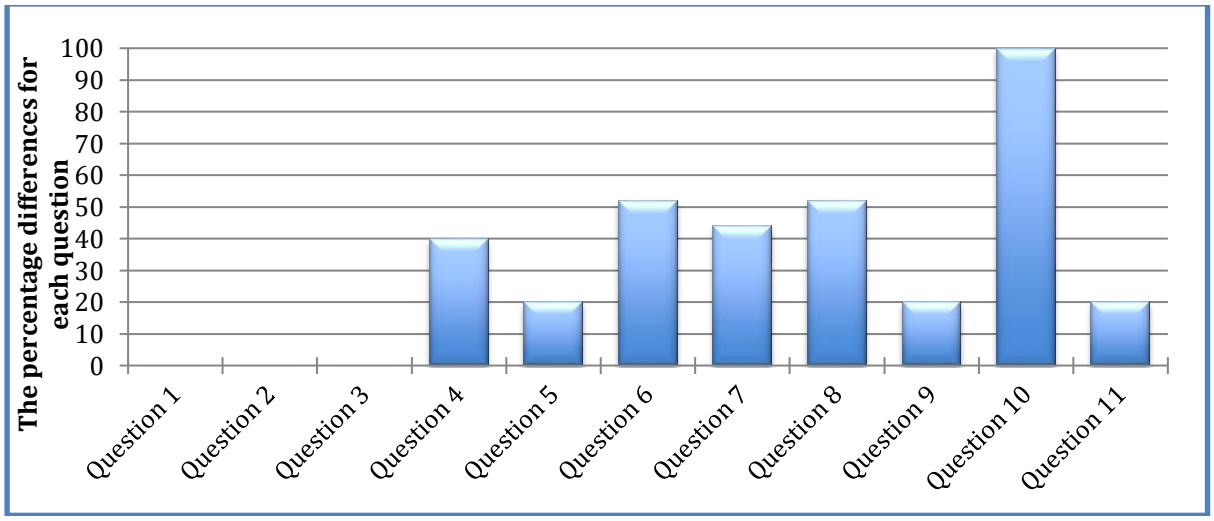

Figure 1: The absolute differences in "Yes" responses for each question between the main group and the control group

Positive responses to questions about delay in the appointment of a treatment plan indicate that the clinic has met the conditions of the dental treatment planning. The remaining questions confirm the relevance of the digitalization of medical institutions in the informing of patients by remote access methods. Additionally, all respondents noted a full-fledged visualization of options, examples of treatment results. The patient response on the other questionnaire items was less universal. Five patients in the control group responded negatively when asked if they were satisfied with the comfort of the circumstances for the

provision of services in a medical organization, whereas all patients in the experimental group responded favorably. Given that this contingent of citizens also answered negatively on the 9th question about the compliance of expectations with the results obtained, it can be assumed that this is a subset of patients who were dissatisfied with the outcome of the prototyping but were unable to share their dissatisfaction with a general understanding of the comfort of the conditions for the provision of services.

In addition, 14 respondents in the control group reported some discomfort during diagnostic procedures, compared to 25 patients in the experimental group who reported no discomfort throughout a similar procedure. Through personal conversation, it was discovered that this pain was caused by the repetitive removal of physical imprints, which led some people to vomit and worry of damaging their teeth while removing the impression after structuring. Ten people reported discomfort as a result of the unpleasant smell of plastic and the removal of its residues from the oral cavity after the model was fixed and while it was being ground and polished in the oral cavity.

The following difference in the opinions of the study groups' respondents might be regarded as 13 unfavorable responses of patients in the control group against. Positive patients from the experimental group on the eighth question on expectations and prototype results. A reasonable chat with these patients revealed that the form and location of the teeth agreed with the dentist during the wax modelling stage did not match to their beliefs about the shape and position of the dentition in the oral cavity based on the results of intraoral prototyping.

In the eighth question, all the patients in the experimental group were happy with aligning the form, size, location, and colour of the teeth. Furthermore, in our opinion, this characteristic is critical to a satisfactory assessment of the suggested digital dental treatment planning procedure. Due to a lack of time, 12 patients in the control group claimed that they could not fully understand and envision the shape and location of the teeth supplied by the doctor. The answers to the question regarding the number of visits to the clinic to provide the required service to plan dental therapy were diametrically opposed in absolute values. The experimental group just required one visit to the clinic.

In the next stage: assessment of the clinical effectiveness of the developed dental digital treatment was carried out using a questionnaire oral health impact profile (OHIP-14) to determine the quality of life.

Patients' responses to a questionnaire survey before and after restoration prototyping were rated as follows: never -1; almost never -2; frequently -3; seldom -4; very often -5. (based on daily life quality, eating habits, and communication abilities). Table 2 shows the average numerical values of the questionnaire responses of the experimental and control groups.

Regarding the experimental group, before treatment: Mean $X_{main, before} = 2.1$, after treatment: Mean $X_{main, after} = 1.9$. For the control group, before treatment: Mean $X_{control, before} = 1.9$, after treatment: Mean $X_{control, After} = 2.2$. To determine how the mean scores differed before and after treatment, see Figure 2.

The difference between the two groups is that the treatment in the control group was using traditional methods, while in the experimental group the treatment was using digital methods.

It is clear from Figure 2 that the behavior of the differences in the data for the two groups in general does not differ. But the experimental group is less negative than the control group. From this, we conclude that patients obtained better results in the experimental group using digital methods than in the control group, which used traditional treatment methods.

Table 2: the results of the patient survey in the questionnaire OHIP-14

№	Questions on the OHIP Questionnaire	Experimental group		Control group	
		Before	*After*	*Before*	*After*
1.	**Difficulty pronouncing words due to problems with the teeth, oral mucosa, or dentures.**	2.1±0.19	1.9±0.23	1.9±0.28	2.2±0.2
2.	**Feeling pain in the oral cavity.**	1.2±0.3	1.1±0.35	2.3±0.3	2.4±0.00
3.	**Discomfort due to problems with your teeth, oral mucous membranes, or dentures.**	2.6±0.36	1.2±0.15	2.1±0.3	1.9±0.5
4.	**Un comfortability due to problems with teeth, dentures.**	3.2±0.35	1.1±0.15	3.6±0.05	1.2±0.1
5.	**The problems with teeth , mucous membranes of the mouth and dentures making life less interesting.**	2.1±0.25	1.1±0.23	2.4±0.05	1.1±0.01
6.	**Problems with the mouth's mucous membranes, teeth, or prosthesis may be the cause of suicide.**	2.1±0.05	1.4±0.01	2.3±0.5	1.2±0.13
7.	**Losing taste for food due to problems with teeth, oral mucosa or dentures.**	1.4±0.35	1.3±0.3	2.3±0.1	2.1±0.1
8.	**Difficulty of eating could be due to problems with teeth, oral mucosa, or dentures.**	1.3±0.01	1.2±0.25	1.5±0.13	1.3±0.4
9.	**Unsatisfactory eating may be due to dental problems, oral mucosa or prostheses.**	1.3±0.25	1.1±0.30	1.4±0.03	1.4±0.10
10.	**Eating cessation may be the result of dental issues.**	1.2±0.25	1.1±0.45	1.1±0.15	1.1±0.18
11.	**Uncomfortable feeling communicating with people because of problems with teeth, dentures.**	3.1±0.33	1.3±0.14	3.3±0.15	1.3±0.15
12.	**Patient's discomfort brought on by issues with their teeth, prosthetics, or mouth .**	3.3±0.05	1.0±0.4	3.15±0.2	1.20±0.1
13.	**Increased irritability when interacting with people due to problems with teeth, mucous membranes of the mouth and dentures.**	2.8±0.25	1.1±0.05	3.2±0.3	1.2±0.01
14.	**Experiencing difficulties in normal functioning due to problems with your teeth or oral mucosa and dentures.**	2.8±0.05	1.2±0.01	3.6±0.25	1.4±0.25

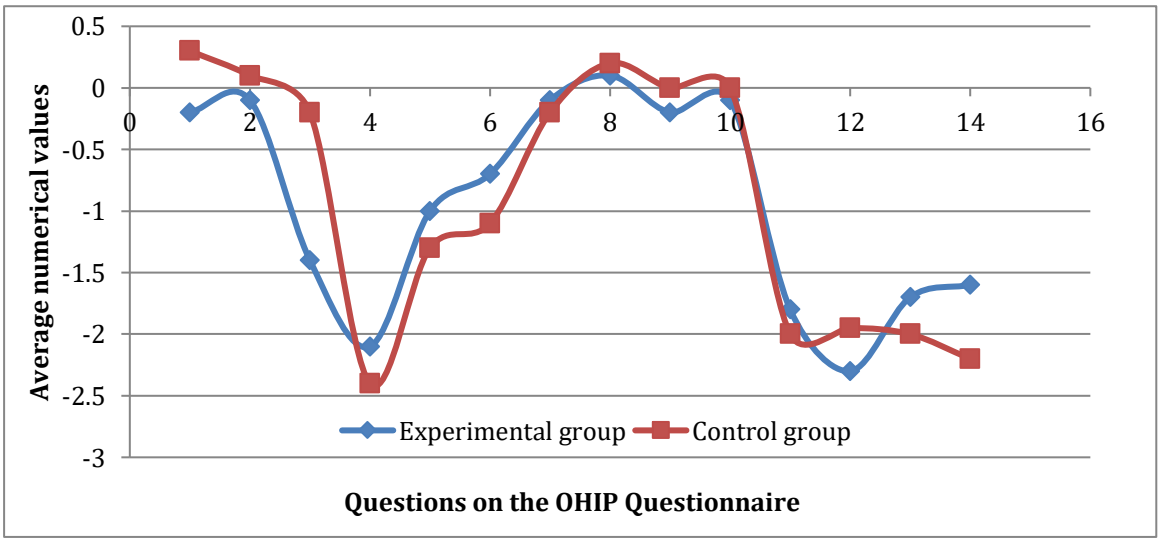

Figure 2: The differences between the mean scores before and after treatment for each group

Discussion

The computerized dental simulator is a new technology to understand the usability satisfaction of the dental education and evaluation system by dental students and dentists [25]. To attract students interested in learning and facilitate deep learning and retention, the profession of dentistry employs an increasing number of innovative apps for clinical practice, patient orientation, teaching, and learning [26].

Taking into account the data obtained, it is possible to infer that the respondents' starting condition in terms of quality of life was comparable and showed unhappiness in the social component of communication in everyday life, but discontent in the chewing function was not recognized. Which, of course, is related to cosmetic diseases of the smile, particularly the inclusion criteria in the research, fluorosis and hypoplasia of the enamel of the anterior group of teeth. According to the prototype findings, there were no significant variations in the responses of the experimental and control groups after 7 days. However, the findings tended to increase overall quality of life.

The results of a survey to assess the effectiveness of digital dental treatment planning show the variations in answers. The exact variations in "Yes" answers for every question: Question 1= 0 (0%), Question 2 = 0 (0%), Question 4:(25−15)=10 (40%), Question 5: (25 20) = 5 (20%), Question 6: (25−12)=13 (52%), Question 7: (25 14) = 11 (44%), Question 8: (25−12)=13 (52%), Question 9: (25 20) = 5 (20%), Question 10: = 25 (100%) , Question 11: (25 20) = 5 (20%). It is clear from the thorough study that the experimental group answered "Yes" to more questions than the control group did on each one. By examining the differences in "Yes" responses for each particular question between the experimental group and the control group, the absolute difference and percentage difference for each question were calculated in order to conduct the analysis, and we can see from these calculations how much and in which directions the experimental group's and the control group's "Yes" responses differed for each question.

Generally, the inconvenience criterion is related to the problems with the teeth decreased 2 times and correlated to the answer - never. The state of the respondent in the question - Do problems with teeth, mucous membranes of the mouth, or prostheses put you in an uncomfortable state? – improvised from the values of 3.3±0.05 to 1.0±0.4 in the experimental and from the values of 3.15±0.2 to 1.20±0.1 in the control groups.

The quality of life in questions (Experiencing difficulties in normal functioning due to problems with your teeth or oral mucosa and dentures, Increased irritability when interacting with people due to problems with teeth, mucous membranes of the mouth and dentures) increased by 2.3 and 2.5 times, respectively, and were generally corresponded to the answers - never. We may conclude from the survey results on the OHIP-14 questionnaire that the quality of life of patients has increased twice as a result of digital planning of dental treatment, with the result in the form of a smile mock-up. To summaries the examination of the survey results, it is possible to have an advantage over the analogue one in terms of positions.

The patient in the experimental group found that the comfort of dental procedures carried out when the proposed program for self-planning of teeth was two times greater than similar indicators of the patient in the control group. The absence of discomfort associated with oral interventions, the characteristic of the proposed digital smile plan, was 1.8 times greater than the traditional method.

Conclusion

The average relative distribution of occlusal load in patients on the left and right sides was 51.5±1.20% before the mock-up. After the simulation, it was discovered that the relative occlusal load distribution of the left and right was 50.40±0.90%. These results suggest that the restoration of the occlusal balance after mock-up is durable and effective. After a summary of the survey data using the OHIP-14 questionnaire, we can conclude that the quality of patient life has improved by two factors. The name suggests a person who has done this, a person who has done this, and a person who has done this.

The results of patient surveys, examinations and pre-treatment of dental implant prototypes using digital dental treatment plans and patient preferences for conventional methods (57%) showed that patients preferred computer methods because of increased comfort, speed, potential complicity, improved compliance with the patient's expectations of the selected virtual model and improved quality of life indicators based on six OHIP-14 criteria. The model was used to confirm the accuracy of the data on the impact of oral disorders on people's lives. OHIP-14 is good in dental samples, but limited in non-dental samples and affects cultural environments and ages.

Conflict of interest

The authors haven't any conflict of interest to declare.

Author contributions

The conceptualization and design of the study were aided by all of the writers. RMJ and VSL were in charge of material preparation, data gathering, and analysis. RMJ penned the first draft of the work, while the other writers provided feedback on earlier iterations. Each author reviewed and gave their approval to the finished work.

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نتائج تقييم الفعالية السريرية لتخطيط الأسنان الرقمي المقترح وتقنية نموذج الابتسامة الرقمية

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المستخلص :

تعتبر التقنيات الحديثة في طب الأسنان من الطرق الفعالة للحصول على نتائج مقبولة لدى المريض، بالإضافة إلى تقليل الوقت والجهد والتكلفة.

تم تقييم فعالية التخطيط الرقمي المتطور لعلاج الأسنان من خلال تقييم نتائج مسح شمل 50 مريضًا يحتاجون إلى زراعة الاسنان في المنطقة الامامية في مرحلة النمذجة. تم إنشاء استبيان عن تأثير صحة الفم -14 (**OHIP**-14) لقياس التأثير الذي يمكن أن تحدثه مشكلات صحة الفم على حياة الشخص. النتائج: بعد المحاكاة، كان توزيع حمل الإطباق النسبي بين الجانبين الأيمن والأيسر 50.40 ± 0.90% مع إطباق متوازن. وكان زمن إغلاق الأسنان 0.17 ± 0.07 ثانية؛ و زمن الفتح 0.19 ±0.04 ثانية. الفرق في التوقيت بين حركات الفك الجانبية اليسرى واليمنى هو -0.030 ± 0.03. أثناء حركة الفك للأمام ، كان زمن الفتح أقل من 0.6 ثانية. (0.170 ± 0.07). الوقت المستغرق لإغلاق الأسنان كان 170±04.0 ثانية، حيث أن الوقت المستغرق لفتحها كان 0.20 ± 0.02 ثانية. الاستنتاج: قبل النمذجة، كان متوسط توزيع حمل الإطباق النسبي للمرضى 51.5±1.20% على الجانبين الأيسر والأيمن. بعد النمذجة، وجد أن توزيع حمل الإطباق النسبي بين الجانبين الأيسر والأيمن كان 50.40±0.90%. تشير هذه النتائج إلى استعادة مستقرة وناجحة لتوازن الإطباق بعد النمذجة الأولية. بعد استخدام استبيان **OHIP-14** لتلخيص نتائج المسح، يمكننا القول أن نوعية حياة المرضى قد تحسنت بمقدار الضعف.