Maximize Customer Satisfaction, Cost Efficiency, and Work Productivity in the Dental Clinic:

How a smart modeling technology can bring satisfaction, values, and productivity to dental professionals and their patients.

Minimizing trauma, fear, and dissatisfaction is the goal of every dental professional. It is the key to formulating trust and creating values in their patients. Smart and non-invasive tools allow dental professionals to be more productive and perform their job effectively while maximizing patients' experience. Smart modeling technology is the key to engage and communicate clinical procedures to patients that allows transparency to guide critical decisions.
Executive Summary:

The dental health industry relies on customer comfort and comprehension in order to acquire approval of dental and orthodontic procedures that makeup the backbone of its profits. This comfort and comprehension relies on effective communication about the procedures and patients mouths. Many of these procedures are improved with the creation of models of the patients mouths. These models are also useful in enhancing communication with the patient. Here we present a novel way of capturing high resolution fully three dimensional images of a patient's mouth that can be rendered and manipulated in VR. Our system, known as JawLogic, revolutionizes the communication between professional and patient, streamlining the process of approving and planning dental and orthodontics procedures.

Industry Wide Problem:

The industry of dental and orthodontic devices today faces a number of setbacks that hamper interaction with patients, creating communication that struggles to be effective and cheap. Communicating with patients about their mouths requires a mixture of strong communication skills including the ability to be precise, understandable, and reassuring. This ensures that patients will know what proposed procedures will accomplish and create the greatest sense of ease possible about these procedures. This makes it more likely that patients will agree to procedures and devices that are necessary for their mouth health.

Only so much can be accomplished by the interpersonal skills of a dentist or orthodontist. Accomplishing precision can mean sacrificing ease of comprehension and accomplishing comfort may compete with both other criteria. To better communicate with patients, and for other reasons, dentists and orthodontists may create a digital model of the mouth. This faces similar competing concerns. An ideal digital model must be precise, low cost, and useful for communicating with the patient.

Existing Solutions and Drawback:

As previously stated a dentist or orthodontist will often use a digital model regardless of if they use it in patient interaction. These models compete with each other primarily on the basis of precision, cost, and usefulness in patient communication.
Mouth Modelling:

1. Physical Molds/ Impressions

Physical molds are molds of one or both jaws and rows of teeth. They are made of a material called Alginate which is a powder derived from algae. This powder is mixed with water to produce a goo that fills a mouth tray that a patient bites into. As the patient waits the goo hardens, producing a cast of the jaw. This produces a model of the mouth, typical used for designing braces or other orthodontic devices that are in the category of headgear. These casts are cheap as they are low tech and require simple materials. A do it yourself dental impression kit costs in the range of 25 and 58 USD today. Additionally they can make good communication aids as they can be manipulated in 3 dimensions in front of the patient while also explored by the patient themselves. Their downsides include precision and detail. While impressions can be made at home it takes a skilled professional to produce a cast without small errors. Additionally the information captured is limited to the shape of the teeth, jaws, and palate. Finally the models cannot be dynamically altered to demonstrate change.

2. X-Ray

The typical dental X-Ray is the Bitewing X-Ray where a patient bites down on metal wing, holding their mouth still while an x-ray of one area of their mouth is taken. Often this is composed of a series of three X-rays of the left, right, and front of the mouth. X-rays, unlike molds, allow for an image communicating the health and quality of the inside of the teeth to be captured, allowing for greater precision in the models. They require professionals to read however and are not three dimensional making them poor communication aids. Additionally, they cannot, in this form, be used to create a three dimensional model of the mouth. Finally, they are relatively expensive methods of modeling.

3. Dental Cone Beam CT

This imaging technology takes a panoramic X-ray, sweeping along an arc around the face. This is interpolated to produce a three dimensional X-ray image of the
mouth, jaw, and additional parts of the frontal skull. This extends on the benefits of X-rays and produces a more patient friendly model. However this model is still more difficult for a patient to understand due to the modelling of the inside of bone tissue. Additionally a significant amount of radiation is used in this technique. Among the techniques described here the cost is the greatest.

**Patient Communication:**
There are three basic ways a dentist or orthodontist can communicate with a patient about the patient's mouth and a potential procedure. The first is to simply describe the mouth and the ways the procedure will change it in broad or specific terms. The effectiveness of this method is dependent on the communication skills of the dentist or orthodontist and the patient themselves. This method is limited by the requirement it places on the patient to visualize what the dental professional describes and the ability of information to be lost or warped in the process. This communication can be enhanced via reference of one of the models listed above. This can reduce the ability to mislead the patient. However the dental professional is still dealing with a static model and so the patient must visualize the way a procedure will change their mouth. Finally a dental professional can make use of models of other patients mouths at various points in the procedure(s) being suggested. This allows the patient to visualize the impact of the procedure with less room for error. However these models are based on other mouths and so can add a new source of error into the process of communicating with the patient.

**Improved Solution:**
The drawback of earlier model techniques is that they rely on physical material which has physical limitations, and on technologies like X-ray that are meant to detect fracture and abnormality within the body or on bones (“X-Rays,” n.d.). Physical mold can only capture the overall layout of the jaw, not the arrangement of the teeth, and modeling technology based on X-ray can only produce a skeleton model. The best solution is to integrate both the physical and skeletal models to create a realistic model of the jaw.
A Modeling method that uses a high resolution 360 camera to scan the mouth can capture a 3D image of the jaw with precision. AI technology can produce an accurate model of the jaw by analysis the 3D and filling the structure of the teeth inside the tissue based on the image, and identifying any cavities, disease, or health issue.

Modeling method that uses high resolution and AI technology is responsive and can be efficiently utilize and modify to meet the needs of dental professionals and patients, unlike physical mold or X-ray models that require to be remade or re-scanned. JawLogic is one of the first companies that uses AI technology and a high-resolution camera to produce an accurate mouth model.

This accurate mouth model can be easily translated into a VR landscape that patients can explore with their dental professionals, even visualizing the impacts various procedures will have on their mouths with a simulated change over time. This unprecedented level of visualization takes patient communication to new heights and overcomes the shortcomings of other methods.

**Case Study:**

Initial interviews with potential users of jawlogic showed promising results. 75% of the users interviewed thought being able to go on a virtual reality tour of their mouth with the dentist would be a positive learning experience. As shown in the graph below with a group of 12 patients it was found that 9 of the 12 users think it will be a positive experience.
Once we found that users were interested in the product it was time to shift our focus to dental professionals to ensure that not only the users want the experience but also that our dental professionals found the tool practical and useful. When surveying 12 dental professionals it was found that 10 of the 12 surveyed believed that JawLogic would make practicing easier. As shown in the graph below. Once it was clear that the dentist would like the product we felt it was important to ask the dentist what features that would make the tool the most effective. The concerns around how the model was created, as the current methods are lacking. Thus the team at JawLogic continued our study to discover the largest concern of all our dentists. With 8 out of the 12 dentists believing the camera modeling was the most important feature.

Will jaw logic make practicing dentistry easier
12 responses

With the creation of JawLogic these concerns and wants of users and dentists alike all of these wants are satisfied. The ability for users to take virtual tours of mouths to help users become better educated. The creation of the JawLogic camera allowed the dentists to create the models in
office to show the patients. With continued testing it was found that users would like new features like the ability to save their experiences. With these results in mind a simple tool was created. Many of our users report the simple usability of the application as well as all the features to save and export the 3d models of the patient's mouth. An example of the application is shown on the right.

**Conclusion:**

Dentists have been using the same technology to aid in examining teeth since computers first entered their offices in the 80s. While the graphics of these dental products, such as the one shown in the image below, have slightly improved over the last 40 years there is no doubt that the technology used in the dentist office is outdated compared to the progress seen everywhere else in the tech industry. Yes, there are other companies that provide dental software and mouth imaging systems, however none can compete with the standards set for the industry by Jaw Logic. Jaw logic combines new imaging technology with virtual reality to provide the most modern experience for dental professionals and their patients.

Example of non Jaw Logic software

**About Us:**

Jaw Logic’s goal as a company is to modernize dental care practice by bringing the dental industry into the next generation of technology and software used in the practice. Jaw Logic is mainly a software service offering both a professional and a personal version of our software. The company also offers a Jaw Logic Camera™ and a Jaw Logic VR Headset for use in a
dental professionals office. Since Jaw Logic’s founding in 2019, Jaw Logic’s software has been implemented in thousands of dental offices across the United States and recently has made its way into Canada as well. Jaw Logics next goal is to expand upon the personal version of the product and to add functions such as creating a game for children to be able to fight bacteria off their teeth while brushing using vr and the patent pending Jaw Logic Toothbrush. Jaw Logic intends to have this feature and more available by the end of 2020.
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