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APP FOR OLFATORY FUNTIONS REHABILITATION IN POST COVID-19 PATIENTS.

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Abstract. Anosmia, defined as complete loss of smell, is one of the clinical manifestationsmost common of COVID-19. Providing planning and organization in an effective treatment, in relation to the sequel caused by infection, being the focus and main sense of the research, the loss of smell caused by theCovid-19, SARS-CoV-2 virus, common observed feature when patient is exposed to virus, being considered a common symptom in clinical picture. Data will be presented to emphasize the time of rehabilitation that can take up to a year to total recovery of the sense. Techniques and procedures in accomplishment of treatment for olfactory rehabilitation, along with a formalized explanation of how it is affected the olfactory sense when virus contacts patients. The application will address an interaction with patient through indicators and graphs, thus bringing information to patient to know the evolution during the treatment. It will be classified into groups possible classifications of odors. The data obtained will bestored internally in order to help build indicators that are increasingly accurate, to show the patient, focusing on knowing what the total period will be approximately the olfactory rehabilitation treatment. The economic Brazilian scenario was positive for Startups with an emphasis on Covid-19 rehabilitation treatment. Due to this great scenario, the development of a software to assist patients in treating the loss of smell is the focus of present project.

Keywords: Olfactory loss, Treatment, Covid-19, anosmia, software.

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INTRODUCTION

World Health Organization (WHO) declared Covid-19 a pandemic on 11 March 2020 due to rapid global spread. In Brazil, the first cases were confirmed in February 2020, and several actions were implemented in order to contain and mitigate the spread of the disease. On February 3, 2020, the country declared a Public Health Emergency of National Concern (ESPIN), even before the confirmation of the first case. Brazil is the country with the most cases and deaths caused by the new coronavirus in South America, the second country with the most deaths in the world.

Some of the most common symptoms of SARS-CoV-2 are: fever, cough, tiredness, loss of taste or smell. Among the less common symptoms are: headache, throat, muscle pain and discomfort, diarrhea, skin irritation or discoloration of the toes and hands, red or irritated eyes. COVID-19 is known to target cells that express the enzyme receptors converting angiotensin 2 (ACE-2), which are found mainly in the epithelial cel of the lung, intestine, kidney, heart and blood vessels. The lung parenchyma is the main organ affected by SARS-CoV-2. However, this does not seem to be the only way for the virus to enter cells, as the liver, which does not have many ACE receptors 2, is already heavily affected. Given that COVID-19 traditionally causes the symptoms expected from the common cold, and that anosmia can occur, initial reports from the China have not identified anosmia as one of the possible symptoms of COVID-19 [1, 2].

Today, Doctors are increasingly concerned due to an increase in reported cases of anosmia in patients with COVID-19, as they demonstrate direct viral damage to the olfactory receptors and retrograde neuronal degeneration of central conduction pathways. Unlike other diseases such as rhinitis, sinusitis, colds, in Covid-19 this failure occurs suddenly and intensely in the olfactory area. Sensors located in the olfactory epithelium capture molecules contained in substances and, when captured, generate impulses nerves that reach the olfactory bulb (the area of the brain responsible for receiving information and send it to other areas of the brain where the information will be interpreted) [3]. This region of the olfactory epithelium is highly damaged with the presence of virus in the human body. Data released in August from the Study on the Evolution of Prevalence of Infection by Covid-19 in Brazil (Epicovid19-BR), conducted by the Federal University of Pelotas (Ufpel), showed that 57% of those infected showed changes in the ability to feel smells and tastes. Scientists had interviewed nearly 90,000 people across Brazil. Already an analysis carried

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out in hospitals in China, France and Germany, with 394 individuals who caught Sars-CoV-2, revealed that 41% (161) suffered from this situation [4, 5].

Analyzing the treatment done to reverse this action caused by the virus. the rehabilitation olfactory is a proven technique to regain the ability to sense odors. The lost sense of smell that strikes some COVID-19 patients can last up to at least a year after the diagnosis, varying the time according to the rehabilitation response of each patient [6, 7].

Research, carried out by the Brazilian Association of Otorhinolaryngology and Cervical Facial Surgery (ABORL-CCF) and by the Brazilian Academy of Rhinology (ABR), showed that, of 253 analyzed patients, 90% (227) presented the symptom. Among them, 53% (121) are fully rehabilitated, 34% (76) had partial recovery and 13% (30) had meaning until the end of the evaluation. It is not yet possible to know how long the pandemic will last. of the new coronavirus will end. Although there are already several vaccines, it is not known why how long the immunity they offer lasts, or even if the new variants of the virus will be resistant to the immunizers already developed [8].

Based on the guidelines and guidelines, the protocol consisting of phases was selected of stimulation that last around a week each, to improve the quality of life of the patient affected by anosmia, through the stimulation of the olfactory epithelium.

MATERIALS AND METHODS

One of the symptoms related to covid-19 is anosmia, which is the loss of taste, this symptom reached about 86% of confirmed and mild cases. in patients who showed this deficiency, lasted an average of 6 days, but in many cases it It stopped being just a symptom and became a lasting condition.

The involvement of the olfactory system is not yet clarified, but in made of symptoms in mild and severe cases, large numbers of patients are shown that this condition lasted for about days or even weeks. For the most part, cases of anosmia related to covid-19, improve spontaneously in a short period. Still, other people's condition lasts for up to 12 weeks. In view of these analysis, a

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Functional Olfactory Training (TFO) was developed. The reference used was a Guidebook for Speech-Language Pathologists at SUS-BH developed by speech therapists from NASF-AB in partnership with the NASF-AB Coordination and Academies of City of the Primary Health Care Management.

To assist speech therapists in this olfactory rehabilitation, an application of support rehabilitation, based on the guidelines of the aforementioned booklet. The stimuli used are characterized by: fruity/floral, food, danger (burned papers, matches etc.) and chemicals. The technique consists of inhaling vials with the aforementioned stimuli previously without visual support. Inhalation should be done at a distance and time determined by each phase. Each workout lasts around 30 minutes and must be repeated. at least twice a day or under medical advice. Rehabilitation is divided into 4

phases with specific recommendations. The first stage is the Detection and Identification of odors which consists of detecting the presence or absence of odor and identifying it. the second phase is odor discrimination, which boils down to identifying whether odors are the same or many different. At this stage one can also have gustatory stimulation. The third stage is related to the characterization of odors with the help of other senses. The fourth and last phase consists of Identifying and recognizing odors through recall of situations reminiscent of the odor.

To develop the software prototype, we used Figma, which is a of collaborative design, which allows the creation of designs and interfaces for websites and applications, among other functions. It is an online and collaborative tool, that is, you can create teams for development where people can have editing access and visualization. Figma is one of the leading platforms for prototyping navigable, there are several extensions that allow extra functionality for creating the designs, making it a not so limited tool. There are pro and free versions (which

has some limitations). Widely used by UX/UI Designer professionals, Figma has become one of the main design platforms, collaborating in an easy way to integration between professionals.

The application developed was a prototype, so it was not tested on patients, who would be one of the steps towards the completion of this project. Steps 3 and 4 are more complex which would have to be developed with the help of other areas and software.

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RESULTS AND DISCUSSION

Within the current scenario, where there was the creation of several Startups focused on SARS CoV-2, being able to highlight laboratories, research centers, manufacturing of various PPE's for large-scale production due to the demand required. Analyzing the scenario, we were able to identify a common indicator among patients infected with the SARS-CoV-2 in relation to loss of smell, i.e. the ability to smell and power identify the source of the odor.

The app that was named OlfaTech, a set of the words Smell and Tech in Portuguese (Technology), has the function of assisting the rehabilitation process called Training Function of Smell. This type of rehabilitation is done with the help and prescription of speech therapists, who can use the application to facilitate and have a follow-up effective training in processes that often just being explained don't have much effect. At first, a logo was created to identify the brand, with colors that they convey credibility Figure 1 - OlfaTech logo, an image that links rehabilitation with the app.

Figure 1- OlfaTech logo

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The application was developed by interfaces that connect each other with each interaction, focusing on accessible usability for diverse audiences. One of its main impressions is the ease of identification of items so that there is, in addition to rehabilitation, a good user experience, Fig 2 and 3.

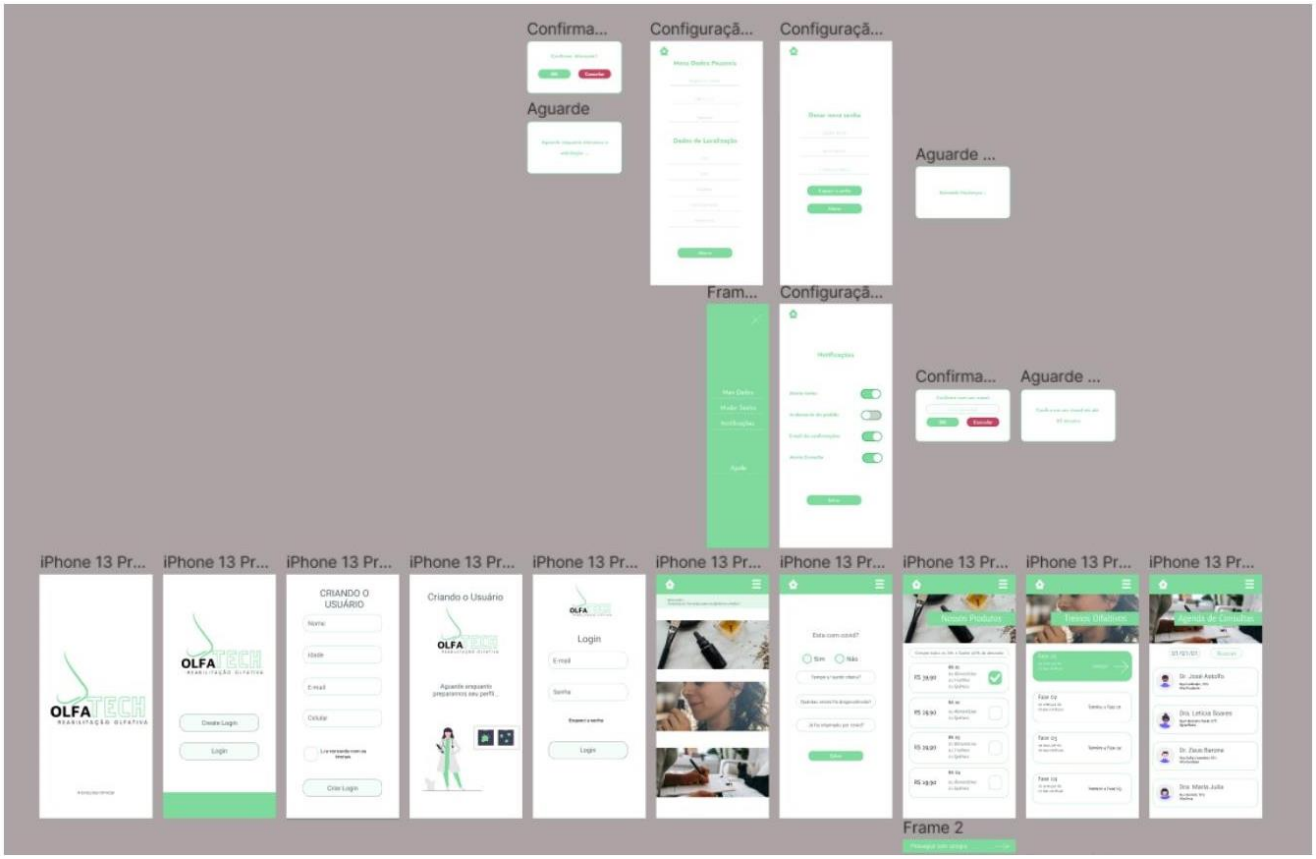

Figure 2- Application Interfaces.

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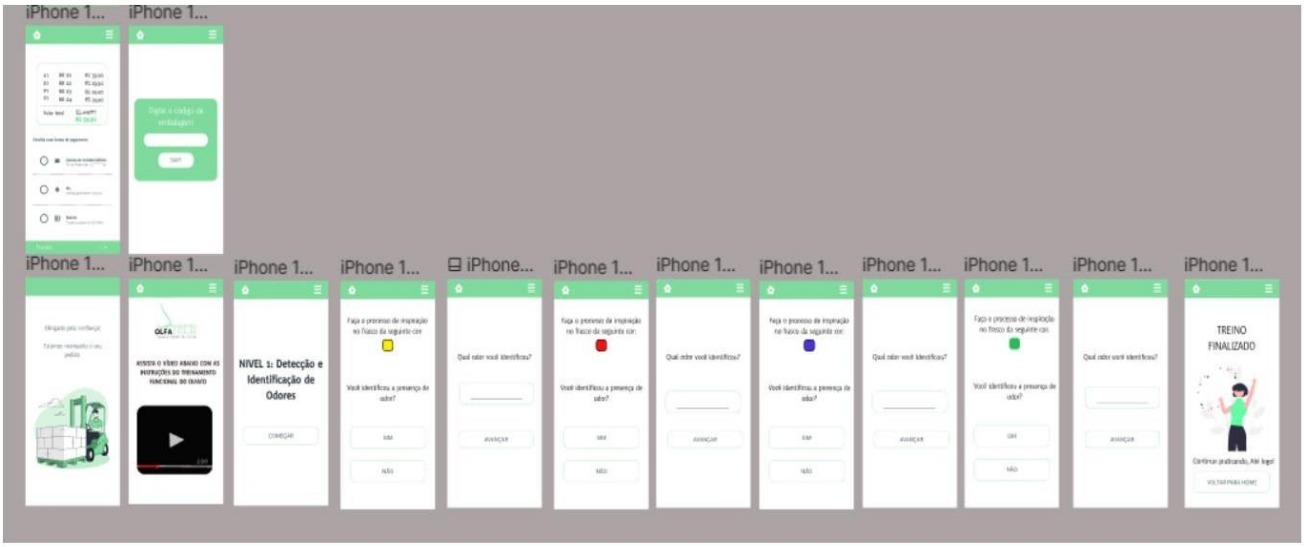

Figure 3- Application Interfaces.

On its Home screen, it is possible to identify an interface for creating a login and password, the data are necessary to have access control and to allow the user is able to log in with their account on multiple devices while maintaining the tracking information saved, Fig 4.

Figure 4- Login and password interface.

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After creating a login and password to navigate the application, the user will be forwarded to a home page where he will be directed to the pages that the application offers, one of which is the purchase of fragrance for the tests that will help the user to have a differentiated and guided experience for a better development of rehabilitation Fig 5.

Figure 5- Our treatment kits.

The olfactory training interfaces have a simple design, so you can facilitate the user experience, and so that it does not influence other senses through icons or images, Fig 6.

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Figure 6- Olfactory training.

It is only possible to identify the next phase when the previous one has been fulfilled, so that there is no interference in the process, where they are clearly specified in the image below, Fig 7:

Figure 7- phases of olfactory training.

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At the end of the olfactory training, it is possible to check the availability of speech therapists in an agenda, also available in the application, so that there is an incentive for consultation after the rehabilitation. OlfaTech issues a patient development report so that the physician has a greater effectiveness in his final diagnosis, which allows a total integration between patient, doctor and application, facilitating and cooperating for an effective patient rehabilitation Fig 8.

Figure 8- Scheduling appointments with speech therapists.

FINAL CONSIDERATIONS

In view of what has been presented, one of the consequences caused by the coronavirus is anosmia, which would be the complete loss of smell, or in some cases, partial loss, where a physiotherapy process will be necessary for a recovery faster performed with a speech therapist, and it is necessary to carry out a functional sense of smell, which for some people can take up to 12 weeks, to partial

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or total recovery of smell.

In view of this scenario, to facilitate the interaction between patient and speech therapy, and in the treatment of this problem, with the functional training of smell, we decided to develop a prototype of a software, which we call OlfaTech, where it comes with th objective to introduce an application to monitor the evolution of the patient in the olfactory treatment, making an interaction with the patient through the perceptions in the treatment that will be launched by the patient within the application, bringing a follow-up journey and results for the patient, which can be used for the treatment of that symptom.

In what was presented, it was possible to identify such importance in which the technology can help us in some treatments, specifically speaking in this case. although the application has not yet been tested on patients, we can see that it would help many patients, as it is a low-cost and easy-to-perform treatment and helping doctors to follow the evolution of an olfactory treatment.

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