

Vibrometer to Detect the Occlusal Force on Teeth Using Image Processing

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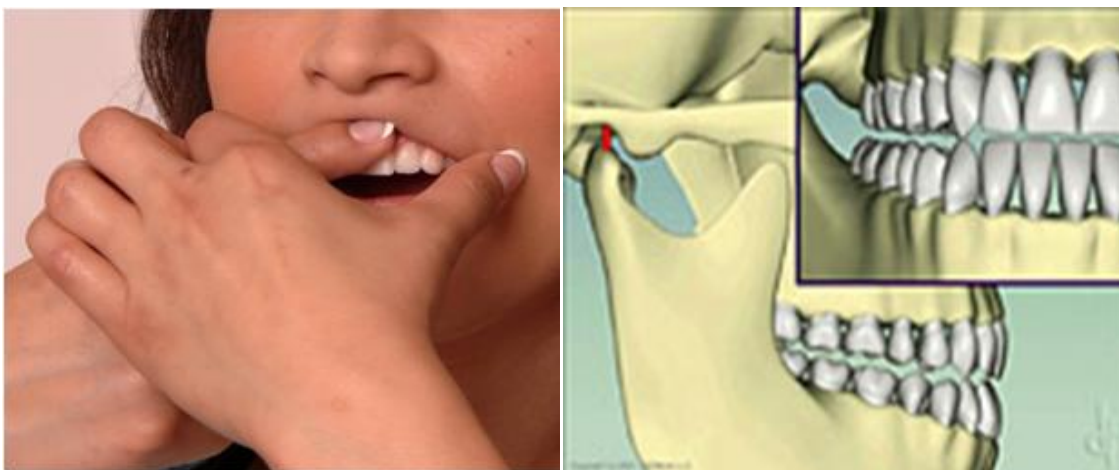
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Abstract: It is seen that there is decrease in the density of jawbone and the bone around the teeth over the years. As a result it creates the occlusal force on teeth. When the occlusal force exceeds the adaptive capacity of the tissues and tissues injury then it resultant injury is termed as trauma from occlusion. There is no such device to check the occlusal force on teeth. The doctors check this force by keeping their index finger on junction of the teeth and gums of the patient. However, the measurement results are not satisfied. From this observation it is eminent that there is a need of a device that can measure the vibrations of teeth as vibrations cannot be measured accurately with the help of a finger. To measure the force or vibrations there are vibration sensors available in the market. As these sensors are used to measure the vibrations of building etc. they are not completely feasible for measuring the vibrations of teeth. Therefore, a mechanical vibrometer is developed and designed by JRC members. In this paper, we have tried to develop a mechanical vibrometer consists of a vibration sensing probe which is used to measure the vibrations. This method is quite simple, direct, and convenient for both the patient and the dentist.

I. Introduction

Many efforts have been made over the years to measure occlusal force. Till now to measure the occlusal force the treatment was done by analyzing the frequency of vibration in teeth by doctor keeping his index finger on the gums of the patient and senses the vibrations manually. But it didn't give the satisfactory results.



It is also seen that during winters our hands get cold and loses its sensation. In this case if doctor checks the patient by keeping his index finger on the gums of the patient then he might not feel the actual vibration frequency. What happens is that in this type of cases the doctor asks his assistant to check the frequency and assistant feels the vibration. Then many times only by guessing from the analysis of doctor and assistant the medicines are given to the patient. But then patient don't feel any effect of the medicine. If the occlusal force on the teeth is high it also leads to injury inside the mouth.

There were many ideas presented to solve this problem. Miniature metallic bite forks, electromyography activity of the masseter, and even sound transmission on the forehead and chin were used to estimate occlusal force. However, the patients felt discomfort during the measurement process, and the measurement error was quite severe. Therefore, the proper treatment is very much necessary. Observing this

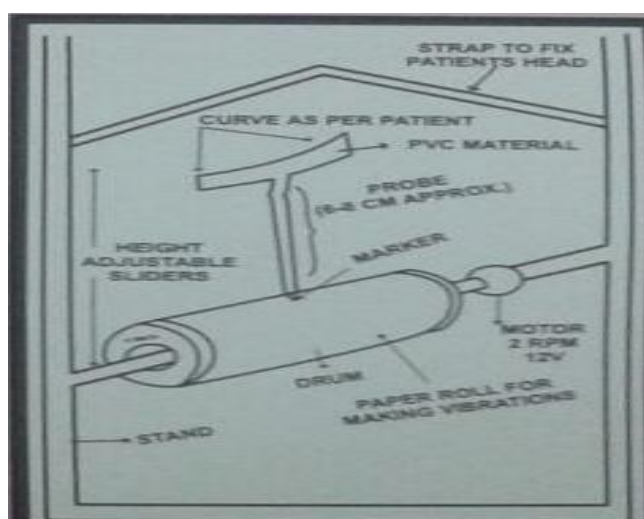
problem the idea of using vibration sensing probe came. But one vibration sensor strip costs almost Rs. 500 and for one patient one strip is used due to hygiene. That means a patient will have to pay for the sensor along with the doctors fee. Therefore, another idea of vibration sensing probe has come up.

II. Vibrometer

Vibration sensing probe has a felt strip made up of foam plastic sheet. The probe is disposable. It is flexible and hence it can be fitted to any shape of jaw. At the bottom of the probe marker is attached. This vibration sensing probe is able to assess the overall magnitude of vibrations in teeth. The parameters can be obtained from the response wave of the vibrating tooth.

This vibration system is very much suitable for clinical application because of its flexibility, softness, there are no worries of injury inside the mouth and it can give the accurate measurement. There will be no pain during the check up.

The strip is made up of PVC material. It can be fitted as per the curve of the jaw of a patient. The probe is 6-8 cm approximately in height. The holder or stand has a small drum on which the paper is rolled. The height of holder or stand is adjustable. A 12v small motor is connected to the drum so that as the motor rotates the drum also rotates in the same direction and the marker which is kept on the drum with the help of a probe draws the waveform.



The doctor will wear the glove which is attached to the probe. The complete mechanism is mounted on the holder or stand. After keeping the felt strip on junction of the teeth and gums of the patient the doctor can measure the frequency of vibrations. If the vibrations are detected then the probe attached to the felt strip will also vibrate and with the help of the marker the magnitude of the frequency can be drawn on the piece of paper which is placed on the drum. The frequency response characteristics are analyzed through image processing. The image of the magnitude of frequency will be taken and analyze using image processing software.

As the material used is very cheap and easily available the device is easy to use and very cost effective. Hygienically also it is very efficient. It is easy to use and throw. Therefore, the patient will not have to pay heavy fees.

III. Conclusion

This study was performed on an experimental basis and it is seen that it has clinical applicability. The biological responses and stress distribution can be assessed. The, further investigation by using this vibration sensing probe in humans is needed.

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