



## Research articles

## Quantifying facial expression using artificial intelligence in class 1 molar relationship: a novel research protocol

Akshata Raut, Chaitanya A. Kulkarni, Waqar M. Naqvi\*

Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

**ABSTRACT**

Precise face detection analysis is a crucial element for a social interaction review. To the viewer, producing the facial features that correspond to the thoughts and feelings which succeed in arousing the sensation or enhancing of the emotional sensitivity. The study is based on Virtual Reality (VR), to evaluate facial expression using Azure Kinect in adults with Class I molar relationship. The study will be conducted in Human Research Lab, on participants with Class I molar relationship, by using Azure Kinect. 196 participants will be selected of age above 18 as per the eligibility criteria. This research would demonstrate the different tools and applications available by testing their precision and relevance to determine the facial expressions.

**Keywords:** Virtual reality, artificial intelligence, fascial expression, Kinect azure.

Received – 10/06/2021, Reviewed - 04/08/2021, Revised/ Accepted- 23/10/2021

**Correspondence:** Waqar M. Naqvi\*, ✉ [waqar.naqvi@dmimsu.edu.in](mailto:waqar.naqvi@dmimsu.edu.in)

Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

**INTRODUCTION**

Facial expression is a growing, efficient and nonverbal sign of emotional communication. <sup>[1]</sup> Facial expression recognition (FER) has been of interest to many researchers because of its different purposes and applications. Several researchers suggested the use of depth knowledge collected from 3D sensors, which are relatively posed and invariant for illumination. However, the majority of the researches on 3D sensors to date are centred on costly, high-resolution cameras, which might not be practical for certain implementations with considerable duration. <sup>[2]</sup> Physical appearance has a close correlation with facial features and affects self-esteem and aesthetic judgment. The interpretative face judgment is a participant's perception of the physical appearance and degree of attractiveness of another person. <sup>[3]</sup> In orthodontic diagnoses, an examination of the facial tissues involves the examination of both rigid and gentle tissues. Until recently, the classical orthodontic considered the examination of fierce tissue and cephalometric upper and lower jaws and teeth scales more important than the soft tissues. Moreover, the morphology of the sensitive facial tissue has been gaining heightened interest among clinicians. Currently, the treatment of orthodontic and maxillofacial surgery is not achieved without the use of accurate soft tissue measurements. You can also examine anthropometric facial features. <sup>[4]</sup>

Advanced RGB-D sensors such as the Kinect controller have been widely introduced to many 3-D-based systems recently. <sup>[5]</sup> The Kinect sensor and Kinect Face Basic API allow accurate monitoring of the facial recognition of the audience in real-time. Sensor range detects emotions such as expressions of pleasure and pain. Depth cameras are required to capture the emotion. Kinect Camera is one of the most advanced and prevalent devices serving the purpose of a depth camera. Kinect cameras capture facial expressions. Kinect is a high-speed camera that senses human face using the depth and facial points. It uses both 3D scanning equipment and RGB cameras. Kinect expenses less and is portable in size than other camera sensors. Photographic processing is being used to gain deflecting variables for national and international approximation aiming to measure in facial characteristics. Such photo-and video-based approaches offer only two-dimensional interpretation and are thus unable to thoroughly and reliably measure the dynamic essence of facial speech. Laser scanners with three dimensions (3D) are often used to record stable facial features. Stereophotogrammetry has indeed been utilised to image the face landmarks, and for 3D imaging representations that are accurate and consistent for daily healthcare practice application. <sup>[6]</sup> KINECT is an RGB-D system that provides colour and dimension pictures that are coordinated. It was originally

used in the Microsoft as only an authentication tool for something like the Xbox gaming consoles. The computer vision society recently noticed that Kinect's deep-sensing technologies could be applied much beyond gaming even at a significantly cheaper cost when compared to 3-D sensors. The equipment includes a standard RGB monitor, a depth sensor and a four-microphone system, capable of transmitting depth digital signal, RGB pictures, and at the same time, the visual signals. Such devices include a way of synchronizing picture patterns, recording individual 3-D expression, distinguishing facial features and understanding speech sounds as well as others. The depth signal of Kinect contributes substantial benefits to the better visualization, resultantly simplifying the issue of capably detecting and identifying the facial expressions in the image, profiting from catchment of emotion detection. And there are many possibly the best-established tool providing software groups that include the augmentation of Kinect, like the robot operating framework and the Windows development channel. With both the technical skills and IR modelling, Kinect IR and depth pictures of any scene can be easily designed to simulate by intently imitating the structure and the procedures which create the relevant actual pictures. [7].

The purpose of the research is to evaluate the facial expressions in adults above age 18 with Class I molar relationship using Azure Kinect, which is one of the most recently developed by Artificial intelligence technology. This study will evaluate the facial expression in adults with Azure Kinect according to the principles of anthropometry.

## METHODOLOGY

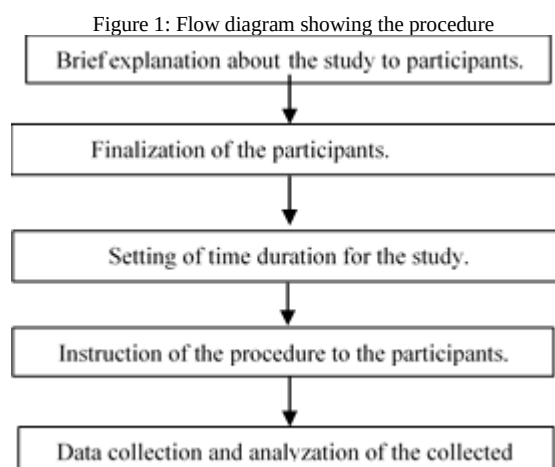
The study will be carried out in the Human Research Laboratory, Datta Meghe Institute of Medical Sciences (DMIMS), India after the approval from Institutional Ethics clearance committee of DMIMS University. This is a study protocol of an observational study. The sample size for the research will be calculated by the analysis of previous power using G\*Power. For this study, the inclusion criteria for the participants will be college students of either gender, the participant should be above the age of eighteen, the participant should be healthy, class I molar relationship and Class I skeletal relationship, the participant who is willing to volunteer for the research, and can understand, respond and cooperative. The exclusion criteria will be participants who are not willing to perform an activity and participants underwent any previous orthodontic treatment and malocclusion Class 1 and Class III. The discontinuation criteria of the study will include unwilling participants and those who are experience nausea during the activity. Each Participant will be required to undergo evaluation for the duration of 1 to 1 and a half hour to complete the procedure of the

evaluation by Using Azure Kinect. The evaluation will take place under the supervision at baseline.

## Procedure

The study will use Azure Kinect, Projector, LED screen, and Computer system. We will recruit the college students for the study after obtaining informed consent. We will provide a short introductory talk about the research to the participants priorly. Participant's eligibility will be screened according to the inclusion and exclusion criteria. They will undergo fitness verification following which a final list of the participants will be prepared. Particular time duration will be decided to perform the study as per the availability of the quantity of the participants. The participants will be instructed about the procedure and queries will be resolved.

The Participants will sit on the chair and maintain their face with normal expression. Then the Kinect Azure device will be used to obtain a 3D analysis of the participants' face. Furthermore, the participants will perform expressions such as social smile, maximum smile, cheek puff, and pursed lip. The expression evaluation will be taken with reference anthropometry measurements. Data collection will be done simultaneously, and the collected data will be analysed after the completion of the study.



## Recruitment

The college students studying in the DMIMS University will be recruited as per the inclusion and exclusion criteria. Routine evaluation of the subjects participating in the research will be carried out for eligibility. Individuals with good adaptability to the Kinect Azure device will be recruited for the study. The proper consent of the participants will be obtained after explaining the purpose, methodology, advantages, and health consequences of the study.

## Implementation and blinding

The chief investigators will supervise the character customization. They will obtain the enclosed enrolment community allotment from the respondents. Participants must be required not to reveal anything to ensure that they are valid.

## Data Collection

Data will be evaluated according to anthropometric

measurements, after the observation of the facial expression by Azure Kinect. The data will be statistically analysed. The data for the evaluation would be obtained from the fully re-established database of customizable comparison groups.

#### **Data management**

Collected data and reports should be carried out under the supervision of the chief researchers. The research reports must be carefully reviewed for reliability. Microsoft office spreadsheets, a randomised allotment will indeed be unveiled after the research for carrying out the detailed research, following what opportunity to gain of categories is going to be completed. Assessments would be used to help avoid incomplete information due to inadequate workplace procedures.

#### **Bias**

The analysis will have a low degree of prejudice in recruitment because the participants who would withstand the VR (Azure Kinect) will be included in the study. Measures will be adopted to avoid attrition bias by offering notification calls before every implementation and by supplying travel assistance for those who need it. We, therefore, expect less absenteeism.

#### **DISCUSSION**

This study will be the first study to observe the facial expressions in adults with a Class 1 molar relationship and skeletal relationship. This study will demonstrate the use of Kinect Azure device to evaluate the facial expression in the adults with class 1 molar relationship following anthropometry measurements. Azure will provide a three-Dimensional as well as two-Dimensional motion capture. Several studies performed on the evaluation of facial expression used techniques such as photogrammetry, stereo-photogrammetry, 3D motion capture and Kinect. In our study, we will evaluate the facial expressions by using Azure Kinect.

The results of this study will help to determine the suitability and usability of the Kinect Azure device and its software in various conditions involving facial deformities, such as Bell's palsy, Stroke, Malocclusion Class II and Class III, and in patients who underwent static orthodontic treatment. Besides, the results will determine the profundity, usability, availability, and quality of the devices and software. The study will also help to find out the superiority of one device over the other to achieve reasonable results. The comparison will determine the accuracy of the devices and software in evaluating the facial expressions, and the applicability of the relevant device and software during the clinical procedures and studies in various contexts. [8,9].

Jawade et al., (2020) suggested that the smiling face revealed theoretically important variations for RMS range from the rational expression together with the signs of frustration and anger. This establishes that smiling face is perhaps the most appropriate

facial element. The unhappy appearance upon the RMS range of the labial area was higher than same variable reported on the overall facial area. [10].

Erasmus et al., (2020) stated that there's no clinically based important variations in the average extent and intensity of the expressions. [11]. Highest resemblance involvement, however, had the greatest smile tone. The difference in the interpretability of the expressions in terms of magnitude among the two genders wasn't really important with the exception of the maximum smile, but it was also reported that even the gesture of the lip purse exceeded interpretation.

According to Ritschl et al., the analysed results of 3D development were conveniently feasible and helped us to create an optimized 3D data set for the growing midfacial area. [12]. Highly accepted method to capture image with various technologies and equipment for accurate, effective, secure and minimally - intrusive 3D authentication has been found to be more useful which is well defined in the literary works.

#### **CONCLUSION**

This study will illustrate the various devices and software available to evaluate the facial expressions by assessing their accuracy and applicability. The study will examine the changes in facial expression in Class 1 molar relationship, and open doors for prospective studies to evaluate facial expressions in other conditions as well. Our study will aid in improving and expanding the use of such devices and software in clinical practice, academics, and research.

#### **Ethical approval and dissemination**

The study protocol is prepared according to the Declaration of Helsinki 1964 and its later amendments. All participants signed written informed consent and departmental research committee. This result of the study will acknowledge the potency of VR-based physiotherapy to evaluate the facial expression using Azure Kinect in adults with class 1 molar relationship and will be published in a peer-reviewed journal and presented at an international conference. After the analysis is complete, the data will be deposited safely in the DMIMSU database server and the findings will be released. The participants of the study and the DMIMS University, who will finance this work, will have access to the analysis's key results.

#### **Participant's consent and confidentiality**

The principal investigators will get implied consent of the participant and one witness with signature verification on a written document with privacy evidence. However, in case of the need to disclose or share details for the report, the participant's permission will be obtained with absolute anonymity guarantee.

#### **Author's contribution**

The research architecture was proposed by WMN. The experiments were developed and planned by AR and WMN. AR and CAK composed the design of the original article. AR and WMN had the final draft ready and accepted for publishing.

#### DECLARATION OF INTERESTS

The author declared no conflicts.

#### FUNDING

There will be no direct funding for this study from any community entity and personal one. The Department of Physiotherapy under Datta Meghe Institute of Medical Sciences, deemed to be University, will include the content required for investigation.

#### REFERENCE

1. Phansopkar P, Naqvi WM, Kumar K, 2020. Musculoskeletal check in smartphone overuse in COVID 19 Lockdown phase, *Int J Res Pharm Sci*, 11(SPL1), 438–441.
2. Naqvi WM, Sahu A, 2020. Paradigmatic Shift in the Education System in a Time of COVID 19, *J Evol Med Dent Sci*, 9(27), 1974–1976.
3. Bais A, Bawiskar D, Naqvi WM, Sahu A, 2020. A case study on the impact of physiotherapy on unilateral foot drop after lumbar fusion and discectomy, *Medical Sciences*, 24, 103.
4. Phansopkar P, Athawale V, Birelliwari A, Naqvi W, Kamble S, 2020. Post-operative rehabilitation in a traumatic rare radial nerve palsy managed with tendon transfers, a case report *Pan Afr Med J*. 36, 141.
5. Awad MI, Palmer FL, Kou L, Yu C, Montero PH, Shuman AG, Ganly I, Shah JP, Kattan MW, Patel SG, 2015. Individualized Risk Estimation for Postoperative Complications After Surgery for Oral Cavity Cancer, *JAMA Otolaryngol- Head Neck Surg*, 141(11), 960–968.
6. Vaishnavi V Siroya, Waqar M Naqvi, Chaitanya A Kulkarni, 2020. Importance of Brain gym as exercise in physiotherapy and rehabilitation, *Int J Res Pharm Sci*, 11(SPL4), 1386–1389.
7. Sahu P, Phansopkar P, Kumar K, 2021. Screening for Lower Cross Syndrome in Asymptomatic Individuals- A Study Protocol, *Indian J Forensic Med Toxicol*, 15(1), 257–261.
8. Bhamra MK, Naqvi W, 2021. A Study Protocol for Checking Efficacy of Microsoft Kinect Azure for Evaluation of Spatial Parameters of Gait in Normal Healthy Population, *Indian J Forensic Med Toxicol*, 15(1), 1728–1731.
9. Shah PA, Nemade SV, Naqvi WM, 2020. Advance Physiotherapeutic Rehabilitation Approach for Hand Functions in a Giant Cell Tumor Patient- A Case Report on Palliative Physiotherapy, *J Evol Med Dent Sci*, 9(21), 1675–1678.
10. Jawade S, Naidu N, Vardharajulu GG. 2020. Efficacy of strength training program on muscle performance by determining 1 repetition maximum in adults, *Eur J Mol Clin Med*, 7(2), 1946–1954.
11. Erasmus A, Brunet TDP, Fisher E, 2020. What is Interpretability? *Philos Technol*, 1-31.
12. Ritschl LM, Rau A, Güll FD, diBora B, Wolff KD, Schönberger M, Bauer FX, Wintermantel E, Loeffelbein DJ, 2016. Pitfalls and solutions in virtual design of nasoalveolar molding plates by using CAD/CAM technology-a preliminary clinical study, *J Craniomaxillofacial Surg*, 44, 453–459.

#### How to cite this article

Akshata Raut, Chaitanya A Kulkarni, Waqar M Naqvi, 2021. Quantifying facial expression using artificial intelligence in class 1 molar relationship: a novel research protocol, *Jour. of Med. P'ceutical & Allied. Sci.* V 10 - I 6, 1351, P- 3802 - 3805. doi: 10.22270/jmpas.V10I6.1351