Efficacy and patients' satisfaction with the ORCAM MyEye device among visually impaired people: a multicenter study

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Abstract

Objective

To evaluate usability of and satisfaction with OrCam MyEye, a finger-size wearable assistive technology device for visually impaired during real-world tasks.

Methods

This prospective multicenter study was conducted on visually impaired people recruited from 5 vision rehabilitation centers. Patients performed real-world tasks such as near and distance reading, money handling, colour identification and faces recognition in 2 different scenarios: without using any low vision aid and with OrCam. System Usability Scale (SUS), Patient's Global Impression of Change (PGIC), the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) and the Psychosocial Impact of Assistive Devices Scale (PIADS) were administered after the use of the OrCam device.

Results

Among the 100 participants, use of OrCam MyEye device improved many daily-living tasks ($F = 1.67$, $P < .05$), and in particular reading and face recognition. Multivariate logistic regression showed that age and visual field defect explained 89% of the variation in efficacy of the device. Nearly half (45%) of the participants indicated a positive rating with the SUS. The PGIC rates showed a minimal improvement with a mean score of 4.2 (SD:1.8). The most highlighted parameter with the QUEST 2.0 test was "ease of use" in 58% (48 subjects). The PIADS indicator showed that the device positively impacted on the daily-living tasks of users ($r^2 = 0.72$, $P < .05$). Regression modelling demonstrated a good relation between the questionnaires scores and demographic, disease and visual factors ($P < .05$).

Conclusions

OrCam MyEye allowed visually impaired people to read, handle money and face recognition independently. This device may offer to these subjects to be independent.

Background

Low vision and vision loss are disabling conditions due to various eye diseases. It is estimated that over 250 million people worldwide live with visual disability resulting in extensive social, economic, and psychological handicaps.[1] With current population trends moving towards a more geriatric distribution and the continued high presence of chronic diseases affecting vision, prevalence of disabling ophthalmologic disease is estimated to double by 2050.[2]

Vision loss is the source of severe and ever-growing disabilities affecting quality of life. Visual disability impacts daily life with a loss of independence in activities such as reading and face recognition. Assistive technologies are viewed as efficient for reducing both the consequences of the functional decline and the dependence on others.[3,4]

OrCam MyEye is a new version of an existing optical-digital assistive device developed to integrate video-audio processing of information. A study, in a small sample of 12 low vision patients, has demonstrated that OrCam is an effective low vision aid and it is simple to use.[5]

While a number of low vision assistive tools are available, our understanding of the impact and the satisfaction with assistive technology of this population is still poorly understood. For instance, there has been no systematic analysis of the satisfaction of these individuals; in addition, whether demographic characteristics such as gender or the degree of vision loss affect the needs of them is unknown. Hence, the aim of this study was to evaluate OrCam MyEye on real world tasks in visually impaired, providing real-world tasks and insight into needs that are not being addressed in other studies. Moreover, patients' usability and satisfaction have been evaluated by administering specific questionnaires.

Methods

Settings and Participants

This prospective case series study was conducted on visually impaired patients from various ocular diseases. Recruitment was conducted at the National Centre of Services and Research for the Prevention of Blindness and Rehabilitation of Visually Impaired (NCI) – Fondazione Policlinico Universitario Agostino Gemelli (FPG) IRCCS – Roma Italy, Ophthalmic Clinic, Department of Medicine and Aging Science, "G. d'Annunzio" University of Chieti-Pescara, Chieti, Italy (OCI), Toronto Western Hospital, University of Toronto, Ontario, Canada (UTC), Departamento de Oftalmología, Instituto Nacional de Pediatría, Secretaría de Salud, Mexico City, Mexico (DOM) and Clínica Oftalmológica Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, in Brasil (COB). Each center was instructed to include only subjects who met the inclusion criteria. Patients were eligible if they were older than 18 years and were visually impaired or partially/totally blind with a best corrected visual acuity (BCVA) less than 0.7 LogMAR and/or a visual field less than 30%, according to WHO classification. Subjects were be excluded if they had neurophthalmologic diseases or cognitive/psychiatric impairment, severe hearing impairment and any health conditions that would preclude the tests. All participating centers were provided with a uniform spreadsheet for compiling the requested data and specific instructions regarding the questionnaire to administer.

Ethics approval and consent to participate

The study protocol was approved by the Ethical Committee/Institutional Review Board of the FPG - IRCCS of Rome – Italy. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. All participants signed an informed consent before inclusion.

Consent for publication

The Authors affirm that human research participants provided informed consent for publication. Study duration was 6 months.

Instrumentation

OrCam device consists of a 13 megapixel miniature camera, Bluetooth connectivity (to audio devices such as headphones and external speakers) and Wi-Fi connectivity, which is magnetically mounted on any spectacle frame (Figure 1).

The device unit includes 1 button for turning the device on and off and a slide bar, recognizable by touch, for managing volume, functions and settings. It can be activated by a hand gesture of pointing at a target item or by tapping the device's touch-sensitive slide bar. It takes a picture of whatever it is pointed at, which corresponds to where the user is facing. The device processes all images using Computer Vision, and optical character recognition technology to read text from any surface. Upon activation, it takes a picture and then reads aloud any text that is found in the image, and also recognizes people's faces, money notes and colors. The device's speech can be heard only by the user via the built-in mini speaker which is situated directly above the ear.

Study Procedures and Measurements

The evaluations were conducted in one visit. After an explanation of the device and a training aimed at best use practices, patients were asked to perform real-world tasks in two different scenarios: without using any low vision aid and with OrCam MyEye. Real-world tasks consisted as follows:

- reading a newspaper article, a book page and a digital screen.
- identifying and reading wall-mounted and distant signs at 4 meters.
- recognizing four different money notes.
- identifying colors of different objects presented.
- recognizing faces.

Moreover, for individuals who already were using a low vision aid, it was necessary to ask them an opinion once the tests with OrCam had been finished. The tests relative to real-world tasks activities lasted about 60 minutes and each patient was supported by orthoptist, for any technical or operational support.

Daily Activities Tests and Questionnaires

The patients' performances were monitored and registered on a sheet for data collection; a daily activity test was designed according to the applications of the OrCam MyEye. A score of 1 was given for each item successfully completed and 0 if not. The total score varied from 0 to 8. In order to evaluate the usability and patients' change perception: System Usability Scale (SUS) and Patient's Global Impression

of Change (PGIC) scale were collected. The Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) was also administered. QUEST 2.0 is a standardized form comprising 12 items that identifies the user's satisfaction and dissatisfaction in relation to assistive technology and service. Eight items are related to user satisfaction with the assistive devices, and the remaining four items, which assess service delivery, were omitted considering that they could not be adequately assessed. QUEST 2.0 uses a five-level response scale from 1 (not satisfied at all) to 5 (very satisfied). Another questionnaire used was the Psychosocial Impact of Assistive Devices Scale (PIADS), that has been factor analyzed and has yielded three distinct subscales which can clearly be considered as indices of Quality of Life (QOL). It consists of 26 items each measured on 7 points scales. Twelve of the items comprise the competence scale, six the adaptability scale, and eight the self-esteem scale. Both reliability and validity for the PIADS are high as has been reported by Day and Jutai.[6]

Statistical Analysis

Patients' personal characteristics, daily tasks tests, SUS, PGIC, QUEST and PIADS scales have been collected on an excel worksheet. Descriptive statistics were used to analyze the collected data describing means, standard deviations, frequencies and percentages. Categorical variables were presented as absolute (n) and relative frequencies (%). Efficacy to the use of OrCam was assessed against the following individual predictor variables: demographic factors (age and gender); disease factors (BCVA, near visual acuity, contrast sensitivity); visual metrics (visual field defect, visual impairment or blindness classification). For categorical variables, comparisons between data obtained with and without the device were made by using ^{2} test. For continuous variables, the 2-tailed Student's t-test was performed if assumptions of normality were achieved. Linear regression modeling was performed in order to highlight the variables that are predictive of satisfaction and usability. The coding for dichotomous dependent variables for regression analyses was as follows: 0 (no read or recognized) and 1 (read or recognized). The significance level was set at 0.05.

Results

One-hundred subjects with a mean (SD) age of 59.1 (18.8) (range 19 to 90) were enrolled; 60.7 (14.2) years for partially or totally blind subjects and 56.3 (21.5) years for visually impaired subjects. Gender distribution was balanced (51 male and 49 female). Fifty-three patients were enrolled at the NCI, 18 at the DOM, 11 at the COB, 9 at UTC and 9 at the OCI center, respectively. Mean (SD) BCVA of the best eye was 0.98 (0.38) LogMAR (20/180; 6/56) and 1.4 (0.51) LogMAR (20/500; 6/120) with a range of 0.3 LogMAR to no light perception. Thirty-seven participants had central field loss, 23 had peripheral field loss, 34 had both central and peripheral field loss and for 6 subjects it was not reported. Twenty-three participants had Age-related macular degeneration, 17 had high myopia, 13 had glaucoma, 12 Stargardt's disease, 8 had retinoblastoma. For retinitis pigmentosa, other retinal hereditary dystrophy and optic atrophy we had 5 participants each. Three subjects had retinal detachment and for diabetic retinopathy and central retinal vein occlusion we had 2 subjects each. Moreover, for albinism,

meningioma, retinopathy of prematurity, nystagmus and Noonan syndrome we collected data for one participant each.

Efficacy

Real-world tasks were significantly different between the two conditions (F=1.67, P < .05); post hoc analysis revealed a significant difference between without and with OrCam use (P < .05), indicating that participants with OrCam were able to carry out more tasks than without. Daily-living tasks (DLT) improved for 87% of participants while they were unchanged for 9% of sample. Four participants reported a worsening on the tasks. Mean (SD) number of executed tasks without OrCam was 2.76 (2.1) while 6.48 with it (1.6) (P < .005) (Table1).

The potential effect of age was examined by correlating age with the change score for each test: reading and recognizing tasks. The analysis indicated a poor negative correlation between the scores with OrCam and participants' age (r=-0.02, P < .05). Younger age was weakly related to higher scores with OrCam; therefore, age did not seem to strongly influence its use. The potential effect of diagnosis was explored by creating three diagnostic group: central, peripheral and general defects. Comparison of these three groups on study dependent measure revealed that a statistically significant difference was found: type of visual field defect seems to influence the scores obtained with OrCam indicating that participants with central visual field defect gained more tasks than individuals with peripheral or general defect (r=-0.1, P < .05). Moreover, weanalyzed the potential effect of visual impairment by creating five categories: not reported visual impairment, mild/moderate, severe, partially and totally blind. Regression analysis indicated that real-world tasks scores were significantly influenced by the type of visual impairment: partially or totally blind groups had lower scores than severe visual impairment or mild and moderate low vision groups (r=0.1, P < .05). According to the multivariate linear regression analysis, the enhancement of total score for real-world tasks with OrCam was related to the age of participants (P < .05). Moreover, we found that the visual field defect was significant determinant of the scores (P < .05). The multivariate analysis model confirmed that patients with central vision loss obtained better scores when using OrCam than patients with peripheral field loss who achieved lower scores.

Qualitative Descriptors: Questionnaires

The mean SUS score was 62.5 (15.2) (range: 87.5-32.5). The average score and level of acceptance was high, indicating that the patients were generally satisfied with the performance of the device (Fig. 2).

The correlation between SUS questionnaire and summary of DLT was good (r=0.91, P < .05) (Fig 3). As the value of the summaries of DLT scores increased the mean of the SUS scores also increased.

The mean of PGIC was 4.2 (SD:1.8), indicating a minimally improvement; more specifically, 32 subjects indicated improvement (score 1 or 2) while a no change (score 6) was reported by 10 participants (Fig 4). Correlating results obtained from PGIC and summary of score with OrCam, showed the absence of relationship (r^2=0.07, P <.05).

The QUEST was administered in 82 subjects (age 60.1, SD: 16,2; F=41, M= 41). The average total score was 3,6 (SD: 0.6). The mean scores of the two scales were 3,7 (SD: 0.8) and 4,2 (SD:0.6) for assistive device and services items respectively. The parameter selected the most was “ease of use” (58%), followed by weight (58%) and dimension (57%). Regression modeling highlighted an excellent relationship also between the scores of QUEST and those obtained with OrCam (r^2=0.68, P < .05). The PIADS analysis included 69 subjects: their age ranged from 28 to 84 and averaged 61 (SD:14.6) years. Scores on all three subscales were in the positive direction indicating that the QoL of the adopters of the assistive device was positively impacted. Regression modeling demonstrated a good relation between all the three domains of PIADS and the scores obtained with OrCam (r^2=0.72, P < .05; r^2=0.52, P < .05, for competence, adaptability and self-esteem respectively).

Influences of the patients’ characteristics

Patients with central vision loss and a severe reduction in BCVA had the best chance for improvement in the PGIC: the logistic regression model with the PGIC (0 = no improvement/PGIC score 3–7; or 1 = improvement/PGIC score 1 or 2) revealed that visual field defect (P = .005, CI:1.61-9.1) and BCVA of the worse eye (P=.004, CI:0.5-27.84) were the factors that significantly influenced patients’ perception (r^2=0.79 for all variables). Age, gender, degree of visual impairment did not have a significant impact on self-perceived outcome. In the multivariate logistic model for the SUS (r^2=0.78, P <.05), the visual field defect and BCVA emerged as significant predictors. The multivariate regression model revealed also that age, gender and BCVA were significant predictors for the QUEST 2.0. (P < .05). For PIADS, the multivariate regression model indicated contrast sensitivity as best significant predictor for adaptability accounted for 46% of the variance, while age seems to significantly influence Self-esteem (r^2=0.33, P<.05). Concerning competence dimension, the variables included in the model had no influence on the score.

Discussion

This study investigated the efficacy and the satisfaction of the OrCam MyEye on visually impaired. As there are currently no large-scale studies documenting the efficacy of the OrCam reporting the usability and satisfaction level, data from this study provide a relevant resource for DLT and patients’ self-reported outcomes. The large amount of data provides a relevant clinical registry of visually impaired subjects, not available in other studies. Assistive technology for visually impaired people is an expanding field and it is driven by technology. OrCam provided significant improvements both in reading and in face, money, colors and product recognition. In addition to a previous study, our analysis highlights that both low vision and partially or total blind participants were able to perform almost all the DLT required.[5] We found a statistically significant increasein the patient’s ability when performing the tasks with OrCam: almost all the subjects were able to accomplish reading a newspaper article (88%), reading on a screen (87%), reading a page from a book (97%) and reading a distant sign (77%). These results are encouraging as they indicate that individuals with any form of visual impairment using OrCam can read independently. Reading is an important task that most adults enjoy and difficulty with that is one of the main reasons of

being referred to vision rehabilitation centres.[7,8] In addition, impairment in face recognition represents another complaint for visually impaired.[9,10] By using OrCam, most participants were able to recognize faces, demonstrating the efficacy and usefulness of the device. Examining predictor variables individually, we found a significant effect for efficacy of the device for younger patients, with visual impairment due to central field defect. The multivariate logistic regression confirmed only younger age and central field loss as predictors of the efficacy of the device explaining 89% of the variation in the data. Our results seem to be in accordance with others who reported that younger age could be a predictor of better compliance.[11-13] Likely, those diagnosed earlier adapted more to their sight loss and are more willing to seek assistance.[14] According to others, people with central vision loss benefit by using magnifying and voice reader through low-vision devices.[15] Therefore, OrCam seems to allow patients to perform near activities independently and with satisfaction. Moreover, visual field defect may play an important role in whether the device is used frequently. Low vision device abandonment is an issue; it may be that subjects with peripheral visual field loss might make abandonment of this low vision device more likely. Considering the improvement in visual performances and fulfilling visual needs of patients with central vision loss, our results contribute to our understanding of device recommendation effectiveness and the likelihood of abandonment. Moreover, this study examined patients' opinions on this assistive technology use across multiple dimensions: usability, impression of change, satisfaction, adaptability, competence and self-esteem by use of it. Our study shows that most of the patients were pleased to use the device and didn't experience problems. The majority of older adults experienced no problem with OrCam, which represents a valid rehabilitative solution for DLT difficulties. Therefore, it is important to introduce and implement such new technologies as a service for visual disables.[16] Moreover, this study showed that the patients rated positively the outcomes obtained with OrCam administering the PGIC. Global and domain-specific patient impression of change ratings could be influenced by the relatively small period of training. Nevertheless, PGIC score correlated well with visual field defect and BCVA; therefore, these factors significantly influenced the patient's view on change. Central field loss and highest visual acuity thereby indicated a better outcome. For the OrCam perception of outcome, age does not seem to be of importance, which suggests that rather the other aspects of patient satisfaction might differ dependent on age. The QUEST mean score was 3, which reveals good satisfaction. In particular, the mean score of assistive device item was almost 4, indicating a high level of patients' satisfaction. Moreover, the item with the highest score in our study was ease of use, which corresponds to the good compliance of participants. This is also confirmed by the regression model that showed an excellent relationship between the scores of QUEST and those obtained after the use of OrCam.

Conclusions

This study indicates that the use of OrCam MyEye has beneficial effects on a variety of daily living tasks. The improvements reported were registered immediately upon introduction of the device, without lengthy training for patients. This study also demonstrates a good degree of satisfaction for people with visual disability. Effectiveness and ease of use were the most highly rated characteristics of the OrCam according to the patients' self-reported outcomes.

Declarations

Availability of data and materials

Not Applicable

Competing interests

Not Applicable

Funding

No funding was received for conducting this study.

Authors' contribution

Conception and design of the study were performed by Filippo Amore, Valeria Silvestri, Margherita Guidobaldi and Marco Sulfaro. Material preparation was performed by Valeria Silvestri, Margherita Guidobaldi and Marco Sulfaro. Data collection was performed by Filippo Amore, Valeria Silvestri, Margherita Guidobaldi, Marco Sulfaro, Paola Piscopo, Simona Turco, Francesca De Rossi, Emanuela Rellini, Stefania Fortini, Stanislao Rizzo, Fabiana Perna, Leonardo Mastropasqua, Vanessa Bosch, Luz Ruriko Oest-Shirai, Maria Aparecida Onuki Haddad, Alez Haruo Higashi, Rodrigo Hideharo Sato, Yulia Pyatova, Monica Daibert-Nido, Samuel N Markowitz. Data analysis was performed by Valeria Silvestri. The first draft of the manuscript was written by Filippo Amore and Valeria Silvestri and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Not Applicable

Conflict of interest

The authors have no financial or proprietary interests in any material discussed in this article.

References

1. Bourne RRA, Flaxman SR, Braithwaite T, et al. (2017). Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. Lancet Glob Health, 5(9): e888–e897. https://doi.org/10.1016/S2214-109X(17)30293-0
2. Varma R, Vajaranant TS, Burkemper B, et al. (2016). Visual impairment and blindness in adults in the United States: demographic and geographic variations from 2015 to 2050. JAMA Ophthalmol. 134(7):802–809. https://doi.org/10.1001/jamaophthalmol.2016.1284

3. Markowitz SN (2006). Principles of modern low vision rehabilitation, Can J Ophthalmol, 41(3):289–312. https://doi.org/10.1139/i06-027
4. Geruschat D, Dagnelie D. (2012). Assistive technology for blindness and low vision. CRC Press Low Vision: Types of vision loss and common effects on activities of daily life.
5. E Moisseiev, MJ Mannis. (2016). Evaluation of a portable artificial vision device among patients with low vision. JAMA Ophthalmol. 1;134(7):748 – 52. https://doi.org/10.1001/jamaophthalmol.2016.1000
6. Day H, Jutai JW. (1996). Measuring the psychosocial impact of assistive devices: the PIADS. Canadian Journal of Rehabilitation, 9: 159 ± 168.
7. Rubin G. (2013). Measuring reading performance. Vis Res. 90:443 – 51. https://doi.org/10.1016/j.visres.2013.02.015
8. Brown J, Goldstein J, Chan T, Massof R, Ramulu P. (2014). Characterizing functional complaints in patients seeking outpatients low-vision services in the United States. Ophthalmology, 121(8):1655–1662. https://doi.org/10.1016/j.ophtha.2014.02.03
9. Mangione, C.M., Gutierrez, P.R., Lowe, G., Orav, E.J. & Seddon, J.M. (1999). Influence of age-related maculopathy on visual functioning and health-related quality of life. American Journal of Ophthalmology, 128, 45–53. https://doi.org/10.1016/s0002-9394(99)00169-5.
10. Tejeria, L., Harper, R.A., Artes, P.H. & Dickinson, C.M. (2002). Face recognition in age related macular degeneration: Perceived disability, measured disability, and performance with a bioptic device. British Journal of Ophthalmology 86, 1019–1026. https://doi.org/10.1136/bjo.86.9.1019.
11. Taylor DJ, Hobby AE, Binns AM, Crabb DP. (2016). How does age-related macular degeneration affect real-world visual ability and quality of life? A systematic review. BMJ Open, 6: e011504. https://doi.org/10.1136/bmjopen-2016-011504
12. Lorenzini MC, Wittich W. (2019). Factors related to the use of magnifying low vision aids: a scoping review. Disabil Rehabil. 23:1–13. https://doi.org/10.1080/09638288.2019.1593519
13. Crossland MD, Starke SD, Imielski P, Wolffsohn JS, Webster AR. (2019). Benefit of an electronic head-mounted low vision aid. Opthalmic Physiol Optics, 39:422–431. https://doi.org/10.1111/opo.12646.
14. Crossland MD, Culham LE. (2001). Psychological aspects of visual impairment. Optom Pract. 1:21–26.
15. Virgili G, Acosta R, Bentley SA, Giacomelli G, Allcock C, Evans JR.(2018). Reading aids for adults with low vision. Cochrane Database Syst Rev. 17;4(4):CD003303. doi: 10.1002/14651858.CD003303.pub4.
16. Ehrlich JR, Ojeda LV, Wicker D, et al. (2017). Head-mounted display technology for low-vision rehabilitation and vision enhancement. Am J Ophthalmol. 176: 26–32. https://doi.org/10.1016/j.ajo.2016.12.021

Tables

Table 1 is available in the Supplementary Files section.

Figures

Figure 1

OrCam device, consisting in a miniature camera, Bluetooth and Wi-Fi connectivity, includes the button for turning on and off the device and a slide bar, recognizable by touch, for managing volume, functions and settings.

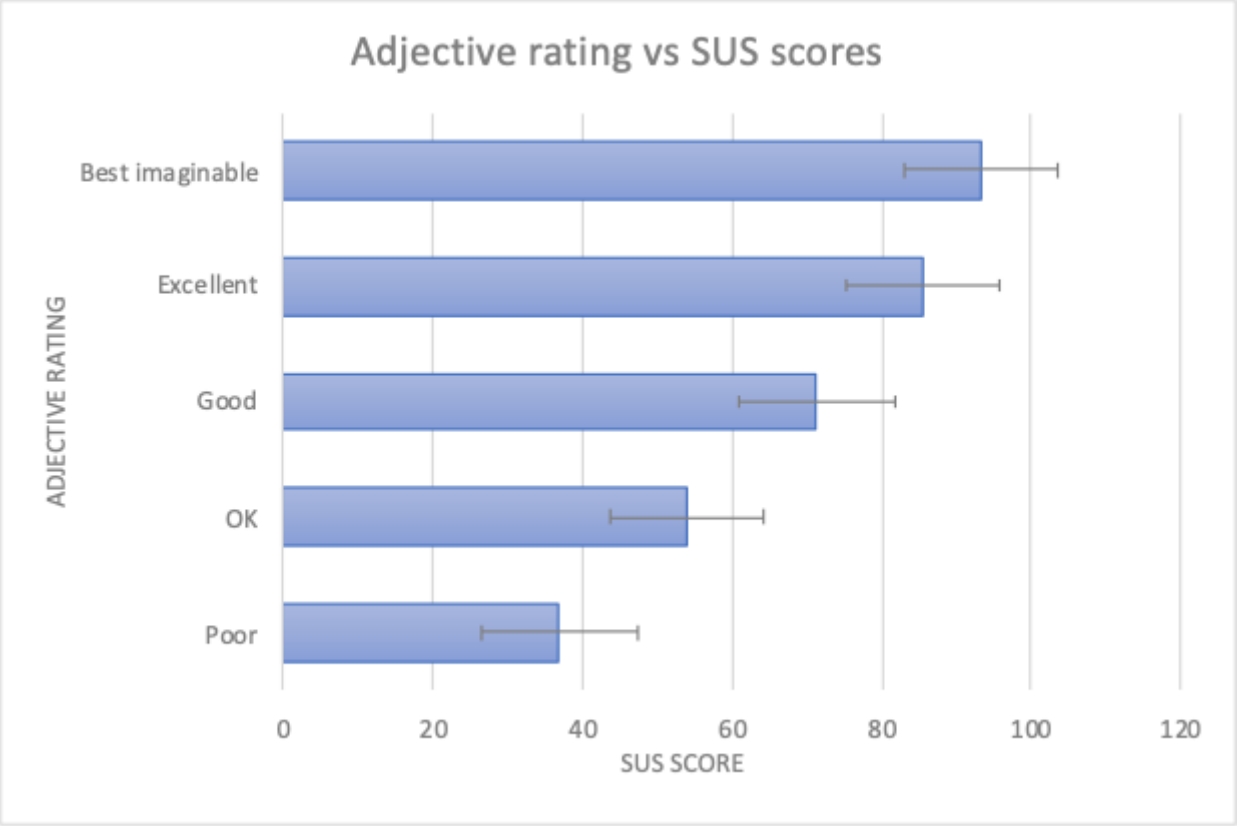

Figure 2

Mean SUS score ratings corresponding to five adjective ratings (error bars+/+ one standard error of the mean).

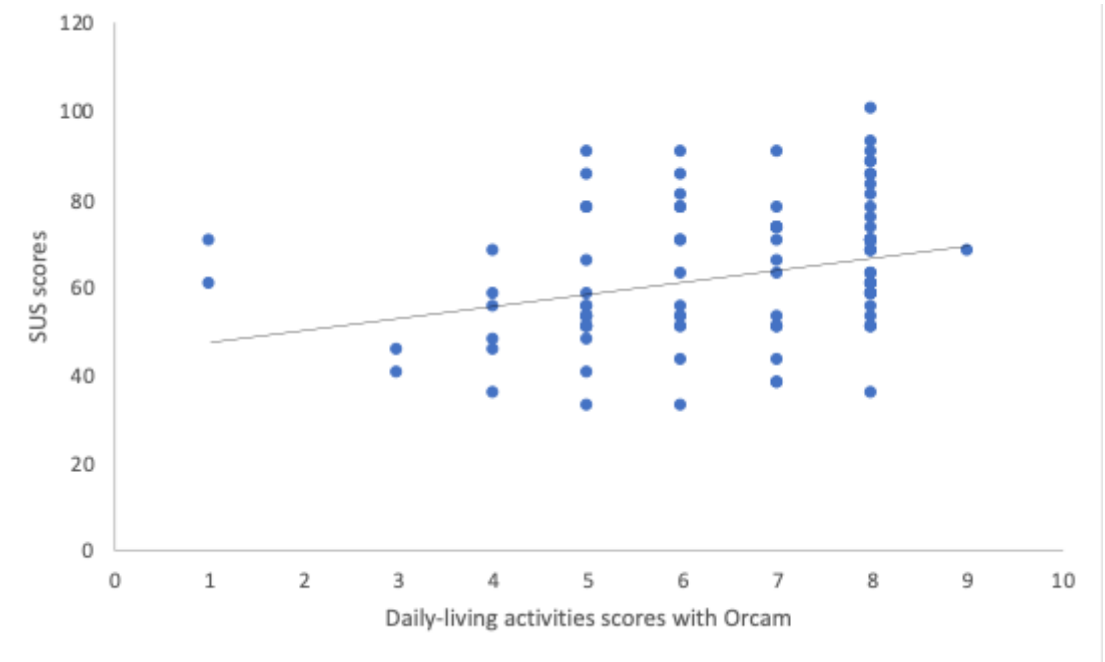

Figure 3

Scatter-plot presenting the relationship between DLT scores with OrCam and SUS score.

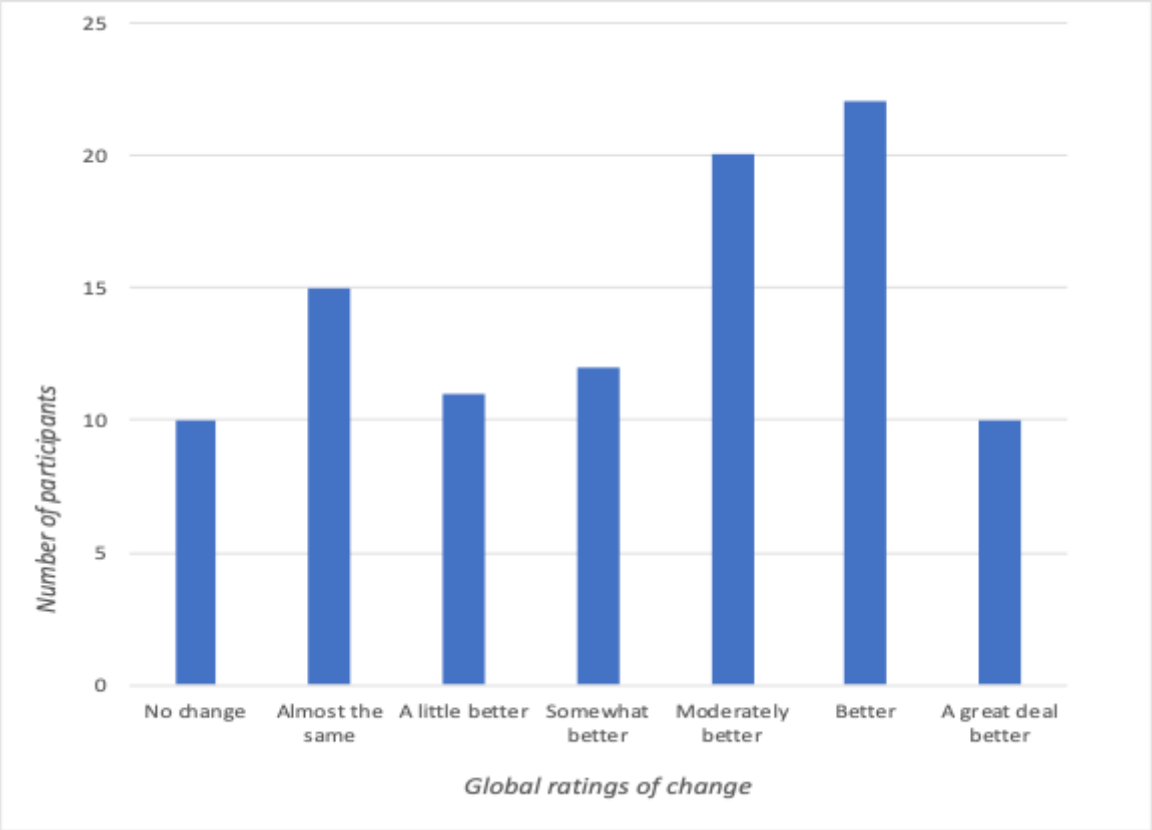

Figure 4

Number of scores on the patient global impression of change (PGIC).

Supplementary Files

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- Table1.jpg