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Increasing Functional Task Performance in Adults with Low Vision

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A Critically Appraised Topic: Increasing Functional Task Performance in Adults with Low Vision of Light Perception or Less through the Use of a Tongue Display Unit

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Abstract

This critically appraised topic explores the functional task performance of adults with low vision utilizing tactile vision substitution systems, specifically tongue display units (TDUs). TDUs are a novel assistive device that functions to provide artificial vision to those with low vision. TDUs pixelate images captured on a camera the person wears and the images are translated via electronic stimulation on the tongue to paint a picture. Two studies that measured functional task performance utilizing a TDU with adults with low vision were explored. Examples of functional tasks measured include word recognition, object recognition, and orientation and mobility tasks. The studies concluded that with skilled training, the TDU may significantly improve functional task performance in tasks previously impossible for the participants. Use of technology such as a TDU can improve functional task performance to enhance overall quality of life for adults with low vision of light perception or less. The results indicate the need for skilled training by professionals such as occupational therapists to best utilize a TDU.

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CRITICALLY APPRAISED TOPIC

TITLE

Increasing Functional Task Performance in Adults with Low Vision of Light Perception or Less through the Use of a Tongue Display Unit

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CLINIAL SCENARIO

Low vision consists of a spectrum ranging from impaired vision to blindness. The definition of low vision is "having 20/40 or worse vision in the better eye even with eyeglasses' (Blindness and Vision Impairment, 2011). Light perception is the ability to determine light from dark and the general direction of a source of light (Duffy, 2016). Assistive devices exist to facilitate functional task performance for adults with low vision. In a study by Fok, Polgar, Shaw, & Jutai, participants identified 124 low vision assistive devices (2009). Types of assistive devices for low vision include lighting and filters, prisms and other field-enhancement devices, adaptive computer technologies, optical devices and electronic vision-enhancement systems, and mobility devices for vision rehabilitation (Fok et. al, 2009).

While there are many assistive devices for low vision, devices for reading tasks and for finding items are the most commonly utilized devices (Stelmack, Rosenbloom, Brenneman, & Stelmack, 2003). Optical technologies currently available include electronic magnification systems, closed circuit television, magnifying glasses, monoculars, and telescopes (Fok et. al, 2009). Existing optical technologies can be very effective for adults with low vision, but are not effective for adults with visual acuity of light perception or less (Fok et. al, 2009). Optical assistive devices also are not always portable and able to be used during mobility tasks.

Moreover, adults who utilize an assistive device for mobility may still have difficulty with tasks that require reading or interpretation of signs to navigate the environment successfully (Fok et al, 2009). A modern assistive device called a tactile vision substitution system provides portable sensory substitution for adults with low vision. The tactile vision substitution system does not require an intact optical nerve pathway and is a noninvasive device consisting of a camera on a pair of sunglasses and a wire to a square that is placed over the tongue. This critically appraised topic explores the impact of tactile vision substitution systems, specifically the tongue display units (TDUs), on functional task performance of adults with low vision of light perception or less. A TDU is comprised of a camera mechanism that sends varying levels of stimulation to an adult's tongue via a tongue array in order to paint a picture of objects in the adult's field of view.

The purpose of this CAT is to determine whether there is evidence to support the use of TDUs in improving occupational performance in adults with low vision with documented visual acuity of light perception or worse bilaterally.

FOCUSSED CLINICAL QUESTION

Do tactile vision substitution systems, specifically the tongue display units (TDUs), significantly improve occupational performance for adults with bilateral low vision of light perception or less?

SUMMARY OF SEARCH

- A comprehensive online search resulted in three non-randomized prospective studies and one non-randomized controlled trial. Two studies were chosen for appraisal as both are the most relevant to the focussed question.
- The first study (Nau, Pintar, Arnoldussen, Fisher, 2015) evaluated the effectiveness of a TDU on performance of functional tasks among adults with visual acuity of light perception or worse bilaterally. The second study (Grant et. al, 2016) evaluated the impact of a TDU on functional task performance among adults who were profoundly blind (little or no light perception).
- The remaining studies were not chosen for appraisal as they did not specifically answer the focussed question.
- The first selected study (Nau, Pintar, Arnoldussen, Fisher, 2015) found that after completion of the TDU training protocol, participants were able to complete object identification and word identification tasks with moderate success.
- The second study (Grant et. al, 2016) found that after completion of the 10-hour training protocol and over a 12-month period of using the TDU, participants performed object recognition with 91.2% success rate and orientation and mobility tasks with 57.9% success rate beyond chancel level.
- Overall, there is sufficient evidence to support the use of TDUs to significantly improve occupational performance for adults with bilateral low vision with visual acuity of light perception or less after extensive skilled training.

CLINICAL BOTTOM LINE

There is sufficient evidence to state that TDUs can significantly improve occupational performance for adults with bilateral low vision with visual acuity of light perception or less after extensive skilled training.

SEARCH STRATEGY

Terms used to guide the search strategy
• Patient/Client Group: adults with low vision • Intervention or assessment: artificial vision, TDUs • Comparison: N/A • Outcomes: improved occupational performance

Databases and Sites Searched	Search Terms	Limits Used
• **CINAHL** • **Cochrane Library** • **Iceberg** • **PsycINFO** • **Research Gate** • **RefWorks** • **PubMed**	• **Low vision** • **Blind** • **Assistive technology/device** • **Sensory substitution device** • **Tactile display unit** • **Mobility**	• **Years 2006-2016** • **Peer reviewed study**

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria
• Study population were adults older than 18 with low vision • Peer reviewed study • Published within the past 10 years
Exclusion Criteria
• Level of evidence >4 • Assistive devices other than tactile display units

RESULTS OF SEARCH

A total of 4 relevant studies were located and categorized as shown in Table 1 (based on Levels of Evidence, Centre for Evidence-Based Medicine, 2011)

Table 1: Summary of Study Designs of Articles Retrieved

Study Design/Methodology of Articles Retrieved	Level	Number Located	Author (Year)
Prospective, multi-center, within-subjects, repeated measures	**3**	**2**	• Grant et al. (2016) • Nau, Pintar, Arnoldussen, & Fisher (2015)
Prospective, single-center, unmasked, within-subjects, repeated measures	**3**	**1**	• Lee, Nau, Laymon, Chan, Rosario & Fisher (2014)
Non-randomized controlled trial	**2**	**1**	• Chebat, Schneider, Kupers & Ptito (2011)

BEST EVIDENCE

The following studies were identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these studies were:

- Nau, A. C., Pintar, C., Arnoldussen, A., & Fisher, C. (2015). Acquisition of visual perception in blind adults using the BrainPort artificial vision device. The American Journal of Occupational Therapy, 69(1), 1-8. Retrieved from http://ezproxy.dominican.edu/login?url=http://search.proquest.com/docview/1644150627?accountid=25281
- Grant, P., Spencer, L., Arnoldussen, A., Hogle, R., Nau, A., Szlyk, J., & ... Seiple, W. (2016). The functional performance of the BrainPort V100 device in persons who are profoundly blind. Journal Of Visual Impairment & Blindness, 110(2), 77-88.
- Participants in both studies had documented acuity of light perception or worse vision bilaterally

➢ Both studies measured functional task performance with a TDU ➢ Chebat et al (2011) and Ptito et. al (2005) were not used as participants with blindness was compared to blindfolded sighted controls, which does not answer the clinical question of this CAT. ➢ Lee et. al (2014) article was not used because it measured cross-modal plasticity while using a TDU instead of functional task performance with TDU and did not answer the clinical focussed question.

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Acquisition of Visual Perception in Blind Adults Using the BrainPort V100 Artificial Vision Device (Nau, Pintar, Arnoldussen, & Fisher, 2015)

Aim/Objective of the Study/Systematic Review:
To determine the effectiveness of a TDU on functional task performance of selected tasks previously impossible for the participants with visual acuity of light perception or less.
Study Design
This study was a single-center, prospective, unmasked, within-subjects repeated-measures design.
Setting
Sensory substitution laboratory, at home, and within the participants' everyday environments.
Participants
The sample was purposive and participants were recruited from the sensory substitution laboratory research registry. Eighteen adults with low vision who had measured visual acuity of light perception or less bilaterally were included in the study. Eight participants had congenital low vision and the other ten had acquired low vision. Ten participants were male and eight participants were female. The mean age of the participants was 52 and the age range was from 28 to 69. Participants were excluded if they had any cognitive impairment or other condition that prevented them from understanding how to utilize a TDU. Any residual vision was tested using the Freiburg Acuity Test to disqualify participants with low vision of more than light perception. Six participants dropped out throughout the duration of the study. The number of participants decreased to 17 at the 3-month follow up, 14 at the 6-month follow up, and 13 at the 9-month follow up. Thirteen participants completed the study.
Intervention Investigated
All participants were tested at baseline, then received 15-20 hours of training to use the TDU and were tested again post-intervention. Participants were trained by the optometrist and the occupational therapist who authored the study. Each participant was trained in the

same way in the same controlled laboratory setting. Tasks completed with the TDU include object identification and word identification. After training, participants returned home with the device for one year. The participants were required to log a minimum of 300 minutes a month on the TDU to remain in the study. Participants received monthly phone call check ups from the researchers.

Outcome Measures

Two functional task performance outcome measures were utilized in this study: object identification and word identification. Functional task performance was measured at baseline, after training, and at 3-month, 6-month, 9-month, and 12-month follow-ups.

For object identification, four objects were placed on a table with a black cover to provide a contrasting background. The objects were spaced approximately 10cm from each other and placed 50 cm in front of the participant. The four objects included a plastic banana, a softball, a coffee mug with a handle, and a yellow highlighter marker. Order of the objects was randomized throughout 20 trials. The participants had two minutes to select the target object. A failure to respond within the allotted time was marked as incorrect.

The words presented for identification were displayed on a 17-inch computer screen in 95-point Century Gothic font with a black background and white letters. The words were 3.5cm tall and were all between three and five letters long. The words selected include plant, bread, dress, tree, dog, bus, cup, moon, farm, and ring. For a total of 10 trials, the words were presented in a random order. Participants were given 3 minutes to identify each word. Failure to answer within the time limit was marked as incorrect. The functional task performance outcome measures were all administered in the laboratory setting by the same researchers who provided the training.

Main Findings

All participants improved in the functional performance measures of object identification and word identification after training. At baseline, participants were unable to complete both measures because they could not see the objects or words. Participants were able to successfully identify a range of 5-19 objects correctly in a span of 15-20 trials after the one week of training. Participants were also able to read an average of 1.5 of 10 words presented, with a range of 0-10 correct immediately after training. The dark line in Figure 1 signifies the mean score.

Figure 1. Box Plots Illustrating Percentages Correct in Trials

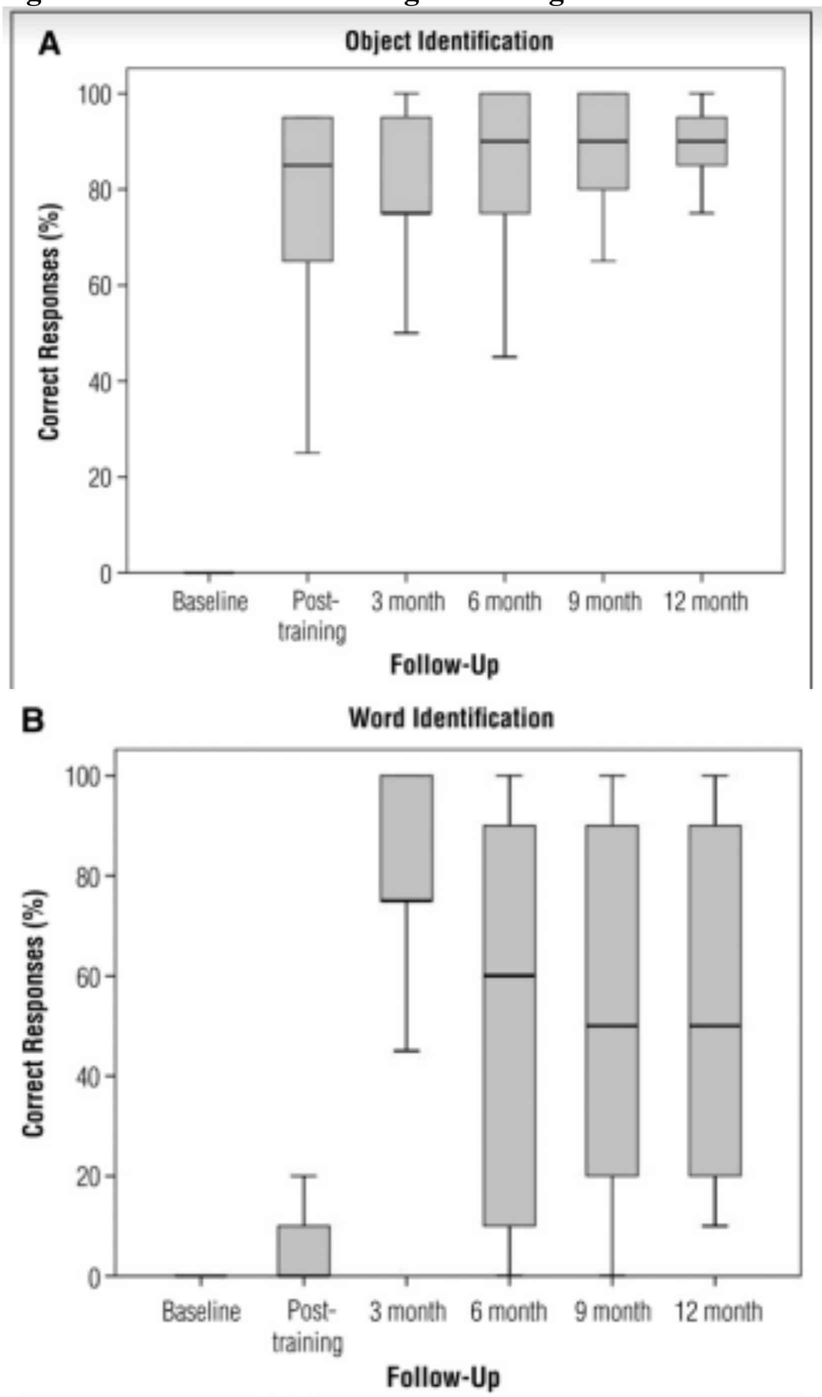

Figure 1. Adapted from "Acquisition of visual perception in blind adults using the BrainPort artificial vision device," by A. C. Nau, C. Pintar, A. Arnoldussen and C. Fisher, 2015, *The American Journal of Occupational Therapy, 69*(1), p. 6. Copyright 2015 by American Journal of Occupational Therapy. Reprinted with permission.

Original Authors' Conclusions
Without training, participants scored no better than chance level using a TDU. After even brief training, performance significantly improved in the object identification task. When the participants returned home, they continued to improve their scores for both object identification and word identification. In particular, scores for the difficult task of word identification did not improve until 3 months into the study. Therefore, the authors suggested that more practice was required to identify the various shapes of letters, especially for participants who were congenitally blind and only had been exposed to braille before this study. To apply this research to adults in the community, a two-week intensive training program is recommended with ongoing support at home for six months to a year to teach adults to successfully utilize a TDU in their daily life.
Critical Appraisal
Validity
The study measured functional task performance of object recognition and word recognition with a TDU as an assistive device. Outcomes of this study were measured 6 times: at baseline, post-training, 3-month follow up, 6-month follow up, 9-month follow up, and 12-month follow up. The measures used include word identification and object identification tasks in a controlled laboratory environment to provide reliable data. The outcome measures were reliable and valid. Participants attended training in the sensory substitution lab at least two times a day for three hours of supervised training for three days. The training could be spaced out to as long as 2 weeks total, depending on participants' preference. The lead researcher, Nau, who is an optometrist, and Pintar, a research assistant and occupational therapist, provided the intervention. Participants were required to log a minimum 300 minutes of TDU use per month at home to continue in the study. The intervention was described in detail and contamination and cointervention were avoided through the structure of the study. Contamination is not possible in a single group study design. Cointervention was avoided as it is unlikely that participants used other assistive devices at home that could have potentially influenced performance of outcome measures in this study.. The improvement in functional performance was significant because it was higher than chance level, but was not analyzed for statistical significance. Chance level was set at 25% for objects and word recognition was nearly impossible. Chance level for word recognition was set at nearly impossible because without any assistive device, it is a very low chance to successfully guess the word displayed with no way to read it. After training, participants correctly identified objects 15 of 20 trials on average and identified 1.5 of 10 words correctly directly. The results were that the TDU was ineffective without skilled training because participants scored no better than chance when using the TDU before training. Even after short amounts of training, participant performance significantly improved in object recognition. Scores of participant functional task performance continued to improve after they returned home with the device. Notably, word identification functional task performance did not improve until the 3-month follow up due to the complex nature of the functional task of letter and word identification. Also,

some participants were congenitally blind and did not have the life experience of reading words other than braille. The clinical importance of the results is that the TDU can facilitate occupational performance in adults with low vision if they receive skilled training to utilize the TDU successfully. The results also implicate the necessity of skilled intervention from professionals such as occupational therapists to facilitate use of new technology that can increase occupational participation and quality of life. Five participants dropped out of the study at different points for reasons such as disinterest or family emergency. The largest group of dropouts were the two participants who dropped out from disinterest. The other dropouts in the study were due to family emergency (1), personal illness (1), and possible allergic reaction (1). Therefore, it is necessary to consider how the home program could have caused loss of interest and take steps to make the intervention more engaging in future studies to prevent future dropouts from disinterest.
Interpretation of Results
The results support the need for skilled intervention to successfully utilize a new assistive device. The TDU significantly improved functional task performance through significant success in tasks previously impossible beyond chance level for the participants. The study is clinically important to occupational therapy by highlighting the need for skilled intervention to train participants to successfully utilize a new assistive device for object recognition and word recognition.
Summary/Conclusion
The results of the study demonstrated that TDUs can positively influence functional task performance of the tasks of word recognition and object recognition. Further research is necessary to determine if the findings can be applied to the greater low vision community because the participants in this study were recruited from the sensory substitution laboratory research registry. To generalize the results of this study, future studies should recruit from the low vision community at large. Future studies should also consider ways to make the home program more engaging to decrease the number of dropouts from disinterest.

Table 3: Description and appraisal of The Functional Performance of the BrainPort V100 Device in Persons Who are Profoundly Blind by (Grand et. al, 2016)

Aim/Objective of the Study/Systematic Review:
To assess performance of functional tasks including object recognition, orientation and mobility, and word recognition using a TDU in participants with profound blindness.
Study Design

This study was a non-randomized, prospective, single arm, multicenter, within-subjects, repeated measures design.
Setting
Clinical setting, at home, and in participants' everyday environments.
Participants
Participants were recruited by referral from physicians and clinicians, clinic databases, and co-investigator's clinical practices. Flyers were also distributed to eye clinics and support groups for persons with blindness. Seventy-five adults met the eligibility criteria and were willing to participate in this study. All participants were profoundly blind, meaning that they have little to no light perception. Each participant underwent an ocular evaluation to document blindness, oral health examination, and assessments to identify levels of anxiety and depression using Beck Anxiety Inventory (BAI) and Beck Depression Inventory-II (BDI-II). The Freiburg Acuity Test was utilized in order to disqualify participants with any residual vision. Fifty-seven participants (ages 21-69) were included in the study, 25 women and 32 men. However, 18 participants were dropped or chose to drop out of the study for various reasons.
Intervention Investigated
Participants completed 10 hours of device training with an experienced TDU trainer. Participants were educated in device controls and learned to interpret tactile stimulation. After in-clinic training, participants were required to use the TDU for 300 minutes per month for 12 months while participating in daily activities in their everyday environments. Participants logged minutes spent participating in daily activities while using the TDU. Additionally, the TDU internally logged active minutes of usage. Participants were also given activities to practice at home including flash cards with letters and words, signs from the orientation and mobility (O&M) task, and games to play with a partner including playing cards and tic tac toe boards.
Outcome Measures
The three functional task performance outcome measures utilized in this study included object recognition, word identification, and orientation and mobility (O&M) tasks. Functional task performance was measured at baseline, after training, and at 3-month, 6-month, 9-month, and 12-month time points. Participants were required to use the TDU to locate and touch a target object within two minutes to successfully complete the object recognition task. The trial was scored as incorrect if participants failed to locate and touch the target object within two minutes. Four objects were placed on a table with a black surface, placed 18 inches away from

participants. Objects included a softball, coffee mug, highlighter marker, and a plastic banana. Participants completed 20 trials of this task with randomized object order and randomized target object.

Participants were required to correctly read a given word on a computer monitor in 3 minutes or less for the word identification task. Ten selected words were presented to each participant in a random order. The words included: bus, dog, cup, moon, ring, farm, tree, dress, bread and plant. Participants sat 50 cm away from the 17-inch computer monitor on which the words were displayed. The words were displayed as white text against a black background in 95-point Century Gothic font.

Participants were required to use the TDU to navigate through a 15-foot hallway to locate a specific sign on the wall within 10 minutes to successfully complete the O&M task. The task was scored as incorrect if participants did not touch the specific sign or place a hand within 5 inches from the edge of the sign. The signs used for the task were placed at different heights on the wall. The signs included Men, Women, Danger and Stairs. Participants were given one randomized trial to complete the task.

Main Findings

For data analysis, success rates were determined by participants' ability to successfully complete tasks at a rate higher than chance level. Wald asymptotic confidence limits were used to calculate confidence intervals for each measure. To successfully complete the object recognition task at greater than chance level, participants were required to correctly identify more than 9 out of 20 objects. For the word recognition task, participants were required to correctly identify 6 or more words to demonstrate success above chance level. To demonstrate success for the O&M task, participants were required to navigate and touch the specific sign on the first attempt. Performance goals were set for each task to determine the number of participants that were required to successfully perform tasks at the success rate in order to create statistical significance. The performance goals for object recognition and word identification were set to 50% (28.5 participants), while O&M task performance goal was 35% (19.95 participants).

At baseline, participants were unable to complete the object recognition, word identification, and O&M tasks without the TDU or other assistive devices. After 12 months using the TDU, 91.2% of participants performed the object recognition task at greater than chance level. The 97.5% lower one-sided bound (83.9%) exceeded the performance goal of 50% for this task, revealing that use of the TDU was statistically significant in improving participants' performance in object recognition tasks. In the word identification task, 57.9% of participants were able to perform at greater than chance level using the TDU. However, use of the TDU did not show statistical significance in task performance as the 97.5% lower one-sided bound (45.1%) was unsuccessful in meeting the performance goal of 50% for the word identification task. For O&M tasks, 57.9% of participants performed above chance level using the TDU. Use of the TDU showed statistical significance in this task as the 97.5% lower one-sided confidence bound (45.1%) exceeded the performance goal of 35%.

Significant differences in task performance were not found between participants with congenital blindness vs. participants with acquired blindness. Participant scores were not separated by congenital blindness and acquired blindness.

Figure 2. Performance Measures Over 12 Months

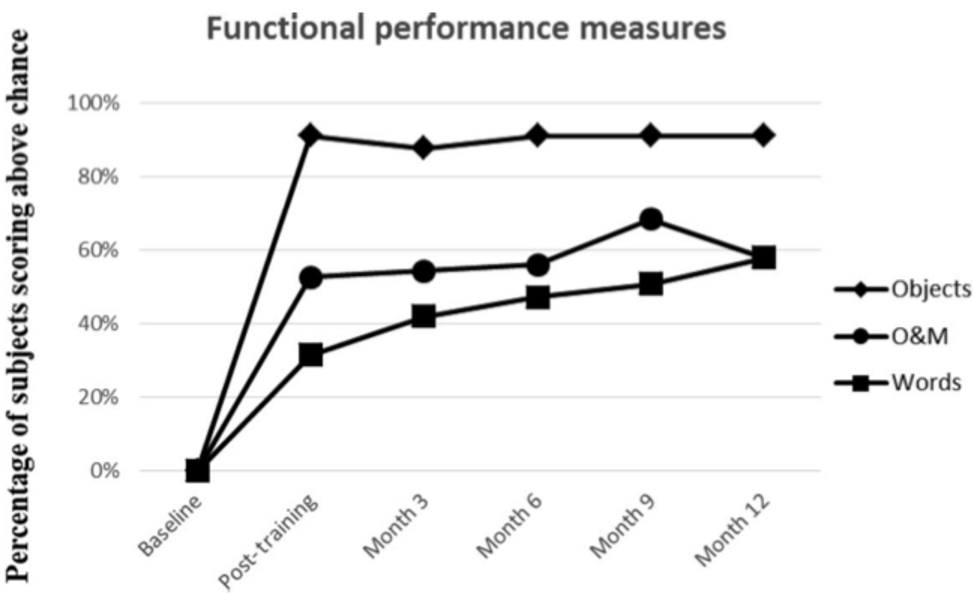

Figure 2. Performance measures over 12 months. Adapted from “The functional performance of the BrainPort V100 device in persons who are profoundly blind,” by P. Grant, L. Spencer, A. Arnoldussen, R. Hogle, A. Nau, J. Szlyk and W. Seiple, 2016, *Journal of Visual Impairment & Blindness, 110*(2), p. 84. Copyright 2016 by AFB. Reprinted with permission.

Figure 3. Performance on Functional Measures at 12-month assessment

Measure	Participant success* %N	One-side 97.5% lower bound, %	Performance goal, %	Performance greater than chance? (lower confidence bound > performance goal)
Object recognition	91.2 (52)	83.9	50	Yes
Word identification	57.9 (33)	45.1	50	No
Orientation and mobility (O&M)	57.9 (33)	45.1	35	Yes

Figure 3. Performance on functional measures at 12-month assessment. Reprinted with permission from "The functional performance of the BrainPort V100 device in persons who are profoundly blind," by P. Grant, L. Spencer, A. Arnoldussen, R. Hogle, A. Nau, J. Szlyk and W. Seiple, 2016, *Journal of Visual Impairment & Blindness, 110*(2), p. 85. Copyright 2016 by ABF. Reprinted with permission.

Original Authors' Conclusions

Without use of the TDU or any assistive device, participants were unable to perform any of the functional tasks in this study. Because task performance was successful immediately after TDU training, it showed that basic TDU skills can be learned within a short time frame of ten hours. After training and utilization of the TDU at home and in everyday environments, the authors concluded that TDUs can facilitate occupational performance of object recognition, mobility, and spot reading tasks.

Critical Appraisal

Validity

The outcomes for this study included performance of functional tasks utilizing a TDU and were measured at baseline, immediately after device training, and at 3 months, 6 months, 9 months and 12 months following training. Functional tasks included object recognition, word identification, and orientation and mobility (O&M) tasks in a controlled clinical environment. The outcome measures were reliable and valid.

The intervention included 10 hours of in-clinic training where participants performed a training protocol at their own pace with instruction from an experienced TDU trainer. The focus of training was to teach participants how to operate the device and how to interpret tactile stimulation to promote use of the TDU in everyday environments.

Participants were then required to use the TDU during daily activities for a minimum of 300 minutes a month for 12 months following training. The intervention was described in detail. Contamination was avoided as this study was a one-group design. Authors avoided cointervention as they measured outcome areas using only the TDU and all participants were profoundly blind with visual acuity of light perception or less bilaterally. However, there is a possibility of cointervention for O&M tasks, as participants may have used separate assistive devices during the 12-month period that could potentially contribute to improved task performance. Participants' improvements in functional task performance were statistically significant for object recognition and O&M tasks. Results showed that with training, adults with profound blindness were able to complete object recognition and O&M tasks without use of other assistive devices. Although statistical significance was not shown for word identification tasks, 57.9% of participants were still able to read six or more words. Participants were unable to complete these tasks without the TDU or other assistive devices, and the majority of the participants were successful in these tasks immediately after 10 hours of device training. Subgroup analyses were conducted to assess age, gender and duration of blindness factors. No statistical significant differences were found among participants' performance measures considering these factors. Wald asymptotic confidence limits were used to calculate confidence intervals for each measure in order to determine success rates. Performance goals were set for each measure to show the minimum amount of participants required to perform tasks at the success rate. Analysis methods were appropriate for this study. The clinical importance of the results is that the TDU can assist adults with profound blindness to recognize objects, successfully navigate and complete mobility tasks, and spot read. Word identification tasks were more challenging for both congenitally blind and participants with acquired blindness. The results were not separated by congenital versus acquired blindness, but subgroup analyses did not find any statistically significant differences in performance measures among participants with different durations of blindness. The results imply that with training, adults who are profoundly blind are able to utilize new technologies to improve their performance of functional tasks. Eighteen participants chose to drop out or were dropped from the study for reasons such as disinterest or unwillingness to continue (8), health or life-related events (7), and time constraints (3).
Interpretation of Results
The results demonstrated that with training, TDUs can improve functional task performance among adults with profound blindness. Without any assistive device, adults with profound blindness were unable to complete these functional tasks.
Summary/Conclusion
This study showed that TDUs can improve functional task performance for specific tasks such as object recognition, word identification, and orientation and mobility tasks.

Although the results of this study are promising for single groups of adults with profound blindness, the research has not been applied to larger populations. In order to generalize the results of this research, future studies should apply the interventions to participants from the low vision community at large and with different age groups, such as older adults or children and adolescents.

Table 5: Characteristics of included studies

	Study 1 [Nau et al. 2015]	**Study 2 [Grant et al. 2016]**
Intervention Investigated	Artificial vision (TDU) for functional tasks	Artificial vision (TDU) for functional tasks
Comparison Intervention	N/A	N/A
Outcomes Used	Word identification and object identification tasks	Object recognition, word identification, and orientation and mobility tasks
Findings	Without training, participants scored no better than chance with a TDU. Immediately after training, participants significantly improved in the object recognition measure. However, word recognition did not improve significantly until the 3-month follow up. Participants continued to improve in both measures at home over the 12-month period.	Training to use the TDU significantly improved participants' ability to engage in object recognition, which was previously impossible. There was not a statistically significant improvement in word identification. Immediately after training, the participants also performed orientation and mobility tasks at a greater than chance level.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

These studies indicate the necessity of skilled intervention, such as occupational therapy, for successful use of new assistive devices. This novel technology has great potential to improve occupational participation and quality of life for adults with low vision with visual acuity of light perception or less. Further research using larger population size is necessary to determine if a TDU can be successfully used by the greater low vision population, as well as with different age groups such as children and adolescents or older adults with low vision.

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