The recent development of technologies at a very low cost (either hardware devices like androido, teensy, raspberry pi, or software tools), the public’s enthusiasm for the “DIY” (Do It Yourself – Do It Yourself own) (Hurst, 2011) and dissemination of knowledge in human-computer interaction (HCI) show that it is possible to design “customized and personalized” assistive technologies. Moreover, empowering disabled users with development of such aids may improve the adoption and diffusion of these technologies.

In HCI, one of the goals of rapid prototyping is to test a number of innovative solutions that can be useful to users. The feedback process can then be used for example to guide further developments. We believe that this process is adequate to design useful systems for deficiencies. We illustrate this process through an experiment conducted for the design and the implementation of assistive technologies for quadriplegics.

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CO30-005-e

Nanostructured flexible implantable microelectrodes for stimulation and recording neural activity

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Many people severely disabled following a stroke or a lesion of the spinal cord, remain totally immobilized. In most severe cases, as in the case of locked-in syndrome (LIS), patients are completely deprived of means of communication and action, while their cognitive abilities are preserved. BCI devices, based on functional connections between brain and machine, are employed to direct a cursor on a computer screen in order to use software, to type text... The new assistance systems are based evidently on knowledge of brain functioning but also on the design of adapted machines (robots, computers, etc.). The physical interface between the brain and the system, composed usually by implantable microelectrodes, is a third fundamental element of the device whose properties directly affect the quality of the recording and stimulation.

Currently, whatever the kind of employed microelectrodes, two critical aspects very disadvantageous for long-term implementations concern the lifetime of electrodes, not exceeding a few months after implantation in general, and their biocompatibility with a high rejection rate for many implants. Our work combines the surface nanostructuring of electrodes and the use of flexible substrates promoting intimate contact electrode-neurons. These complementary approaches favor the growth and adhesion of neuronal cells. The modification of the electrode by electrochemical deposition of conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices. Also doping of PEDOT by conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices. Also doping of PEDOT by conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices. Also doping of PEDOT by conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices. Also doping of PEDOT by conducting polymers (PEDOT) results in an increase of electrode lifetime/stability and improved biocompatibility of devices.

Reference


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Proposed method to assess walking aids in the elderly with observation and simple timing parameters

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Keywords: Geriatric physical medicine; Preclinical stage; Robuwalker; AAL DOMEO; ANR/CNSA

Smart walking aids with robotics, adapting to the person and the environment, are most relevant for walking difficulties in the elderly (adding motor, visual, cognitive, hearing impairments...). Such devices don’t cope with the French refunding agreement scheme. A trial-based medicotechnical evaluation is required, prior to medical-trials, to check that the device, used by the volunteer, provides the expected service.

Method.-- Four healthy aged volunteers (H) and 4 patients (P) with walking (v < 1 m/s, Timed Get Up & Go > 15s) and cognitive (MMSE < 26) impairment had 3 tries at 4 M straight-line walk (4 M) then modified TUG (including going round the chair before seating again) with their usual way (U), then a regular walker (S), then Robuwalker (rW) motorized automat with command buttons on the handles, tests were filmed by a single camera.

Results.-- In both H and P: there is no big difference on 4 M between U and S, with rW time is more increased in the healthy subjects (X5 to 10 vs. 2 to 3). One patient failed using the interface even during 4 M. Steps average duration is increasing 1.8 to 3.4x between S and rW, for H, vs. 1 to 1.5x for P. The duration of double contact is increasing in H with a median of 15% (extremes 3 to 18%) vs. only 5% (3 to 11%) in P. Some P and H failed to turn smoothly in front of the wall with rW or to use it to stand.

Discussion.-- Increased duration of tasks and steps in H are a clue of a lesser benefit for them in terms of stability. The trend towards an increased proportion of double contact could mean a push of healthy subjects against rW (fixed max speed). This fits with the variations of trunk to vertical and to the shoulder-wrist axis as clinically observed. The failure of two patients, the difficulties at turns and to stand with rW imply a human robot interface (HRI) problem. We propose that the speed should adapt to the user and the HRI be improved.

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Communications affichées

Version française

PQ89-f

Prise en charge multidisciplinaire d’un cas complexe de positionnement

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Mots clés : Positionnement au fauteuil ; Multidisciplinaire ; Déficiences multiples ; Subluxation hanche

Introduction.-- La démarche de positionnement est le processus clinique visant à placer une personne ayant des troubles posturaux, dans une posture requise au moyen d’une aide technique à la posture. La complexité de certaines situations cliniques associant des déficiences multiples, des limitations d’activité variables et devant être maintenues ainsi que la prise en compte de l’environnement, impose des stratégies multidisciplinaires structurées dont voici un exemple.

Observation.-- Une patiente de 20 ans présentant un syndrome cérébelleux bilatéral avec dystonies à type de myotonies prédominant au membre supérieur droit et hémiparésie gauche suite à l’exérèse d’un astrocytome pylocitique du cervelet est adressée. La principale doléance était l’apparition de douleurs de hanche gauche au fauteuil, limitant la capacité de transfert et de propulsion podale du fauteuil.

En position assise, on observait une rotation droite du bassin de plus de 25°, pas d’obliquité de bassin, un membre inférieur gauche plus court en rotation interne et en abduction. En décubitus dorsal : limitation de la flexion de hanche gauche à 60° avec une spasticité des adducteurs cotée à 3 (Ashworth). Les radiographies...
montrent une subluxation de la hanche gauche avec un défaut de couverture d’un tiers de la tête fémorale. Après concertation multidisciplinaire, il est décidé une prise en charge médicale par traitement de la spasticité première par toxine botulique sur les adducteurs et le droit antérieur et en deuxième intention une ostéotomie fémorale.


Discussion.-- L’évaluation et les propositions de thérapeutiques adaptées a nécessité une réflexion multidisciplinaire avant de pouvoir proposer des aides techniques à la posture répondant exactement aux déficiences neuro-orthopédiques et aux limitations d’activités.

Pour en savoir plus

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English version

P089-e

Multidisciplinary management in a complex case of postural positioning

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Keywords: Wheelchair positioning approach; Disabilities; Multidisciplinary; Hip dislocation

Introduction.-- Positioning is the clinical process which uses technical devices to achieve an appropriate body position for a person with postural disorders. The complexity of many clinical situations involving multiple disabilities, activity limitations and variables to be maintained together with a necessary consideration of the environmental factors requires the development of structured multidisciplinary strategies such as the following.

Case report.-- A 20-year-old patient was referred with a bilateral cerebellar syndrome, predominantly myotonia of the right upper limb and left hemiparesis after resection of a cerebellar pilocytic astrocytoma. The main complaint was the onset of hip pain when sitting, limiting the transfer capability and podal propulsion of the wheelchair. In the seated position, there was a right pelvic rotation greater than 25°, pelvic obliquity, and a shorter left leg in internal rotation and abduction. In the supine position there was a limitation of the left hip flexion at 60° with Ashworth 3 adductor spasticity. Radiographically there was a subluxation of the left hip with a third of the femoral was uncovered. After multidisciplinary discussion, medical treatment was decided, using botulinum toxin for the adductor and the rectus femorals followed by femoral osteotomy.

Results.-- Complete disappearance of pain with recovery of prior functional capacity. Forward displacement of the pelvis with hyperextension of the left leg at podal propulsion persisted. The guidelines for technical posture aids: stabilization of the left hip by limiting patterns in extension when moving, lowering the seat with slope to enable foot displacement without changing the sitting posture.

Discussion.-- The evaluation of proposals and appropriate therapy required a multidisciplinary reflection before proposing the appropriate technical aids for posture to match the neuro-orthopaedic impairments and activity limitations.

Further reading

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P090-e

A possible method of evaluation of smart walking aids at preclinical stage

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Keywords: Technical aids; Gerontology; Evaluation; Walking; AAL DOMEO ANR-CNSA

We are reporting an assessment method of usability and efficiency of walking aids designed for multihandicapped elderly people.

Method.-- Four healthy and 4 handicapped elderly people (speed < 1 m.s⁻¹ on 4 M in straight-line [4 M] timed get up & go > 13 s [TGUG] et MMSE < 26) walked the 4 M then modified TGUG (with a turn around the chair before sitting again), with their usual walking mode (U), a regular walker (S), then the Robuwalker automat (rW). Tests were filmed with a single camera. We studied: clinically the use of devices and interfaces, the position of limbs and trunk during movement; we timed the tests with a chronometer; measured on the videos (Windows Movie Maker) the duration of steps and double contacts. We averaged the time to test completion of each test condition for each volunteer. We chose for to assess the time parameters a video of a straight line walk, in one of the three trials of 4 M or TGUG, with at least 3 steps and 6 double contact periods with stabilized speed.

Results.-- One of the elderly patients failed the 4 M and others had difficulties to turn or stand with rW; clinical assessment showed the reason (could not use the control interface of the automate). We obtained the completion times. Duration parameters of steps were obtained but the focus of the camera didn’t always show properly the feet; either 4 M or a straight part of TGUG had to be used; this could induce a bias (acceleration or deceleration).

Discussion.-- Video is allowing gait analysis even with unsteady direction changes, analysis of the use of the interfaces, which are not possible with optokinetics. Two sets of cameras will, one, analyze the gait, the other focus on interface use. With a square view and special software we will measure the observed angles.

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