# Obstetric Brachial Palsy

Subjects: Obstetrics & Gynaecology
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Obstetric Brachial Palsy (OBP) is defined as a partial or total flaccid paralysis that affects the upper limb of the newborn due to brachial plexus injury occurring in normal delivery, and, more rarely, in cesarean section, often associated with shoulder dystocia

Obstetric Brachial Palsy, quality of life, mirror therapy

## 1. Introduction

OBP results from injury to the cervical roots C5–C8 and thoracic root T1[1] with <1% of births. It is a serious complication, whose occurrence increases considerably to 6% in cases of fetuses weighing >4000 g[2][3].

There are different classifications of OBP in terms of anatomical location: upper, intermediate, lower, and total plexus palsy[1]. Upper plexus palsy involves C5, C6, and sometimes C7. Also called Erb's palsy, it is the most common type of brachial plexus injury (47% of all OBP cases reported) [1][4][5]. It presents with an adducted arm, which is internally rotated at the shoulder. The wrist is flexed, and the fingers are extended, resulting in the characteristic "waiter's tip" posture. Intermediate plexus palsy involves C7 and sometimes C8 and T1[6][1][7]. Lower plexus palsy involves C8 and T1[1][6][8]. Also called Klumpke paralysis, it is very rare, with 2% of all OBP cases reported[1]. The main clinical feature is poor hand grasp, whereas more proximal muscles are intact[1][6]. Total plexus palsy involves C5–C8 and sometimes T1[1][6], and it is the second most common type of OBP injury[8] [8]. It is the most devastating plexus injury: the infant is left with a clawed hand and a flaccid and insensate arm.

Clinical findings can be classified into four categories, according to Narakas[9][10]: Group I (C5–C6 paralysis of the shoulder and biceps brachii), Group II (C5–C7 paralysis of the shoulder, biceps brachii, and forearm extensors), Group III (C5–T1 complete paralysis of the limb) and Group IV (complete paralysis of the limb with Horner's syndrome)[9][10].

The right arm is more frequently involved due to the more prevalent left occipitoanterior position at delivery[1][11].

## 2. Treatment

Conventional Mirror Therapy (conventional MT) and Virtual Reality Mirror Therapy (Virtual Reality MT) are two therapeutic strategies whose goal is to improve the affected upper limb functionality and the quality of life in different disorders, including OBP, and both can be performed at home to reduce the parental stress and increase the family-child interaction[12].

Mirror therapy (MT) is a rehabilitation strategy based on the repeated use of the mirror illusion (MI). Patients train by looking into a mirror placed along their midline and hiding their defective limb. The observed reflection of the unimpaired limb superimposes itself on the defective one, thus generating the visual illusion of a functional limb. MT was initially devised as a strategy to alleviate phantom limb pain in amputees before being applied as a neurorehabilitation approach for hemiparetic adults after stroke[13]. There is increasing evidence from randomized controlled trials regarding the effectiveness of MT for improving upper limb motor function, activities of daily living and pain, at least as an adjunct to normal rehabilitation for adults after stroke[14]. In children with hemiplegia, a single pilot clinical trial demonstrated that MT may increase the strength of the paretic arm and improve its dynamic function[15]. The mechanism believed to underlie MT is its effect on “learned paralysis”, in which conflicts between motor efferences and reafferent sensory feedbacks impede motor function[13]. Every time a motor command is sent to the paretic limb, the returning visual and proprioceptive signals inform the brain that the arm is not moving as expected. The aim of mirror visual feedback is to restore the congruity between motor efferences and visual afferences, allowing the subject to unlearn the “learned paralysis”[13]. The effect of the MI could be observed in patients with hemiplegia or another upper limb affectation and in TD subjects[16].The mechanism believed to underlie MT is its effect on “learned paralysis”, in which conflicts between motor efferences and reafferent sensory feedbacks impede motor function[13]. Every time a motor command is sent to the paretic limb, the returning visual and proprioceptive signals inform the brain that the arm is not moving as expected. The aim of mirror visual feedback is to restore the congruity between motor efferences and visual afferences, allowing the subject to unlearn the “learned paralysis” [13]. The effect of the MI could be observed in patients with hemiplegia or another upper limb affectation and in TD subjects[16].

When an individual observes an action, his/her motor system generates an internal representation of the same action, being recruited similarly relative to its execution. This matching mechanism—named mirror mechanism—is thought to be a key substrate of action understanding and imitation[17]. The functional properties of the mirror mechanism indicate that the motor processes and representations that are primarily involved in generating and controlling a given behavior can also be recruited in an individual who is observing someone else displaying that behavior[17]. Thus, mirror neurons fire both when an individual observes an action and when he/she performs a similar action[18]. An observation/execution matching mechanism facilitates the corticospinal pathway, and it is used to improve the motor function; thus, a “mirror box” is a means to facilitate action observation and, therefore, mirror visual feedback is thought to activate the mirror neuron system in a similar way to action observation[19]. Observing an action elicits in the observer’s brain a motor representation of the outcome to which the action is directed, and this motor representation is similar to what would occur if the individual him/herself was planning that action or even just imagining performing it[20][21]. This would allow the individual to identify the goal of the observed action relying mainly on her or his own motor processes and representations[22]. In line with this, in neurological diseases, action observation is thus able to access the motor system, favoring cortical reorganization and ultimately affecting motor abilities[23][24][25]. Such an approach, known as Action Observation Treatment (AOT), has proven effective in improving upper limb motor abilities in several neurological diseases, presenting the advantage of being applicable also at the patient's own home[25].

Conventional MT is a low-cost, non-invasive therapy that allows upper limb rehabilitation, mostly used in adult stroke patients and, to a lesser extent, in pediatric patients with hemiplegia. It generates benefits in joint position, improves the modulation of the proximal muscles and increases muscle activity, as a result of the recruitment of motor units due to the optical illusion created by the mirror[13][14][15]. MT could be combined with virtual reality, since this therapy has shown upper limb changes (grasp strength, bimanual coordination, etc.) in children with cerebral palsy[26]]. Virtual Reality may offer individuals the chance to interact and train with or within interesting and relatively realistic three-dimensional (3D) environments[27]. This allows the intensive repetition of meaningful tasks[28], in a more interesting and autonomous manner than conventional therapy [29]. It is a motivating and entertaining way to engage children in the therapy[30], while enabling the practice and repetition of movements[29][31]]. Virtual Reality MT (using immersive glasses) allows the child to integrate into a virtual environment through external devices[27], which, together with mobile applications, represent a great advance in neurorehabilitation, leading to effective and recreational therapies that are easily accessible to the population[11]. It allows improvements in affected upper limb functionality and a greater adherence to therapy by children and families[32][33][34].

The International Classification of Functioning, Disability, and Health (ICF) provides a standard language and framework for the description of health and health-relate states[35]. The ICF emphasizes the importance of measuring or addressing an individual's function, not only in terms of body structure and function, but also in terms of activities, participation, and environmental factors. Optimal outcome assessment tools should therefore consider the multidimensional nature of function as described by the ICF and measure these multiple facets[36][37]. There is currently a lack of information regarding the measurement tools used for the assessment of different affected upper limb aspects to increase the activity of children with OBP, since most tools assess the range of movement as Mallet scale or goniometric values, based on the reference levels of body structure and function of the ICF[38].

Compared to conventional TM, virtual reality TM would be a therapeutic home supplement to increase independent bimanual tasks using grip on the affected upper limb and improve the quality of life of children diagnosed with upper BPO in the 6-12 year age range.

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