Non-invasive ventilation (NIV) for the treatment of acute and chronic respiratory failure has achieved an increasingly important role over the last decade. Until the mid-eighties, mechanical ventilation in intensive care unit (ICU) patients with acute respiratory failure was generally delivered invasively via an endotracheal or tracheostomy tube. With growing knowledge of pathophysiology, it became apparent that there are also risks and complications, not only related to mechanical ventilation itself (volu- and barotrauma), but especially if mechanical ventilation is delivered invasively, such as the increased rate of nosocomial pneumonias [1]. Hoarseness, sore throat or vocal cord dysfunction becoming apparent after extubation may also result in long term complications [2]. Therefore, the application of NIV techniques seems logical.

Since the first clinical application of NIV in ICU patients [3, 4] the spectrum of indications has broadened and the percentage of mechanical ventilation applied non-invasively has continuously increased. Today NIV is used in the treatment of acute and chronic respiratory failure and during weaning from invasive ventilation [5–8]. It has been applied in patients with acute hypoxemic respiratory failure, severe cardiogenic pulmonary edema [9], and acute exacerbation of chronic obstructive pulmonary disease (COPD) in order to decrease the need for, and complications of, endotracheal intubation. A large body of clinical studies has proven the value of NIV although it became evident that careful patient selection and monitoring is crucial, with patients with acute respiratory distress syndrome (ARDS), for example, being less likely to benefit from NIV [10, 11].

Some problems related to higher gas leakage and dead space are observed with NIV. Specific modes of ventilation have been developed in recent intensive care ventilators to overcome these issues, as will be discussed later. However, the role of the interface used to deliver NIV should not be underestimated! In a study by Navalesi and coworkers [12], the choice of interface improved the performance of NIV more than the mode of ventilation. Today a large number of different masks are available. Problems with the widely used face masks result partially from air leakage [12, 13], discomfort for the patient [14], and pressure-related ulceration of the nose [15, 16]. These problems may limit the duration of use and account for a large proportion of NIV failures.
The Helmet Interface

Recently, a helmet interface was developed in order to improve NIV tolerance and patient comfort (Fig. 1). Compared to conventional interfaces, it offers increased patient comfort. The patient is able to communicate with his/her environment, see or even read while being ventilated. There is also a lower risk of skin lesions due to the special fixation system, with no direct pressure on facial structures and it can be used regardless of the anatomical structure of the face [17]. To our knowledge there are currently two manufacturers distributing a helmet for NIV or continuous positive airway pressure (CPAP) (Castar R, StarMed, Mirandola, Italy, and 4Vent Rüsch, Rüsch GmbH, Kernen, Germany), and another distributor (Series 500 Sea-Long Medical Systems, Inc., Louisville, Kentucky), offering a helmet device for hyperbaric medicine and oxygen therapy. The two models allowing administration of NIV or CPAP are transparent, latex free hoods, joined by a soft polyvinyl chloride collar in the Castar R and polyurethane collar in the 4Vent helmet. The collar of the Castar R has inflatable cuffs, whereas the 4Vent has no cuffs. Inspiratory and expiratory tube connectors are connected at the upper part of the Castar R, and at lower part of the 4Vent helmet. Two underarm laces attach to a ring at the lower end of the helmet and prevent the helmet from lifting when it is inflated. A plastic collar fitting around the neck prevents leakage during ventilation. Inspiratory and expiratory tube connectors are connected in the upper part of the helmet. The Castar R Helmet (size M) has an internal volume of 7.5 l with inflated cuffs. The 4Vent Rüsch Helmet has an internal volume of about 8.0 l. Depending on the size of the patient’s head, this volume is reduced by about 50% when put on. Both helmets contain special ports for a nasogastric tube or to enable patients to drink through a straw. Some Starmed models are also equipped with a safety valve with automatic opening which allows immediate access to the patient without taking off the helmet.

Recent Studies using the Helmet Interface

The helmet has been successfully used in different clinical situations (Table 1).