Introduction

Facial palsy (FP) affects an estimated 100,000 people in the United Kingdom (Facial Palsy UK, 2012). It is characterised by facial muscle weakness resulting from damage to the facial nerve and is associated with congenital conditions, such as Moebius syndrome, and acquired conditions, such as Bell's palsy, Ramsay Hunt syndrome, trauma affecting the facial nerve, and acoustic neuroma. FP can cause a range of issues including: corneal exposure leading to blindness; visual disturbance; problems with facial function, leading to difficulties with facial expression, eating, drinking, hearing and/or speaking (Shindo, 1999).

Current treatment options include: injections of Botulinum Toxin A (Filipo, Spahiu, Covelli, Nicastri, & Bertoli, 2012); static and dynamic surgical procedures (Ghali, MacQuillan, & Grobbelaar, 2011) and facial therapy focusing on rehabilitating function and appearance (van Landingham, Diels, & Lucarelli, 2018). Options to protect the ocular surface include eyelid repositioning surgery, eyelid loading with weights and tear duct surgery (Schrom, Buchal, Ganswindt, & Knipping, 2009).

Changes in facial function and appearance due to FP, as well as uncertainty about recovery, can result in anxiety, social isolation and concealment of facial appearance, with individuals with FP also reporting low self-esteem, high levels of self-consciousness and concerns about mood (Norris et al., 2019). These psychosocial difficulties may reflect the impact of FP on the use of the face to express emotions, a skill which is crucial for communication (Coulson, O'Dwyer, Adams, & Croxson, 2004). The visible difference associated with FP is often made more apparent by difficulties in facial movement with many affected avoiding facial expression of emotion (Bradbury, Simons, & Sanders, 2006). Others can interpret this absence of expression negatively, leading to greater avoidance of social interactions by

individuals with FP. These parallel issues lead to a combined challenge of being unable to express oneself and stigma for having a visible facial difference (Bogart, Tickle-Degnen, & Joffe, 2012).

Objectives

No paper has systematically reviewed the literature investigating the psychosocial impact of FP. Instead, previous reviews have focused on observer perceptions (Nellis, Ishii, Boahene, & Byrne, 2018) and the quality of patient-reported outcome measures (Ho et al., 2012). This review aims to provide a deeper understanding of FP by 1) systematically reviewing the impact of FP on levels of psychological distress, social function and quality of life (QoL) and 2) determining the demographic factors (e.g. age, duration of FP, aetiology, gender etc.) associated with poorer psychosocial outcomes.

Methods

Protocol and registration

Inclusion criteria and methods for study selection were specified in advance and documented in a BLINDED-registered protocol (DETAILS BLINDED FOR SUBMISSION)..

Eligibility criteria

Types of studies: Included studies were required to have been in the English language, with a quantitative or mixed-methods methodology of any design or format, other than case reports, conference proceedings and reviews. Studies specifically investigating the outcome of any physical or psychological intervention were excluded as the scope of this review was limited to psychosocial outcomes independent of interventions.

Types of participants: Studies were required to include adult patients with a diagnosis of FP of any aetiology and duration, with the exception of studies including patients with FP following stroke, which were excluded due to the known cognitive and emotional changes associated with the condition (Barker-Collo, 2007). Studies examining participants both with and without FP were included, if data for participants with FP were reported separately.

Types of outcome measures: Studies were included if they reported on at least one quantitative measure of psychosocial wellbeing, including measures of mental health, psychiatric symptoms, social function and wellbeing, QoL or body image. Self-report outcome measures did not have to be validated within a FP population, but need to have been validated within the general population or another physical or mental health population.

Information sources

Studies were identified by searching electronic databases and by scanning the reference lists of included studies. Literature search strategies were developed using medical subject headings (MeSH) and text words related to FP and psychosocial outcomes. The following

databases were searched: MEDLINE (1946 onwards), CINAHL (1985 onwards), Embase (1974 to present), PsychInfo (1806 onwards) and AMED (1985 onwards). The search terms in Table 1 were used to search all databases (see Figure S1 for an example of the MEDLINE (OVID) search strategy).

Study selection

Eligibility assessment on titles, abstracts and full text-articles of potential studies identified by the search was carried out independently and in a standardised way by the first and second authors. Any discrepancies were discussed and resolved by consensus, along with a third reviewer (last author).

Data collection

The authors adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in designing and reporting of studies (Moher, Liberati, Tetzalff, & Altman, 2009). A standardised data extraction form was designed and information was extracted from each study on: (1) characteristics of participants (including age, gender and diagnosis); (2) study methodology and design; (3) outcome measures used and (4) psychosocial outcomes.

Risk of Bias

The NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Institutes of Health, 2014) guided assessment of the validity studies. This tool rates each study on 14 criteria; with a score of '1' being assigned to a response of '*yes*' on a criterion and a score of '0' assigned to an answer of '*no', 'cannot determine', 'not applicable'* or *'not reported'*. Studies were therefore rated on a scale of 0 to 14, with a higher score indicating stronger evidence.

Results

Study selection

The database search resulted in 2854 citations. After adjusting for duplicates and the addition of one additional paper identified through alternative sources, 1823 citations remained. Screening of titles and abstracts resulted in 1659 articles being discarded due to failing to meet inclusion criteria. There was very good agreement between the two reviewers, with a kappa coefficient of 0.87.

Further inspection of the full text of the remaining 164 studies by two authors found that 137 papers did not fulfil inclusion criteria, leaving 27 studies for the current review. The phases of selection are shown in Figure 1.

Study Characteristics

Table 2 summarises the basic characteristics of the final 27 studies which originated from 14 different countries. Sample sizes ranged between 20 (Weir, Pentland, Crosswaite, Murry, & Mountain, 1995) and 8,070 (Tseng et al., 2017) participants. Twenty-three studies reported on the gender balance of their samples and all-bar-three (Huang et al., 2012; Leong & Lesser, 2015; Tseng et al., 2017) included more females than males. Mean age of samples ranged from 29.9 years (Briegel, 2007) to 59 years (Fu, Bundy, & Sadiq, 2011). Nearly half of studies (n = 12) included participants with FP of varied aetiology, with others specifically investigating Moebius syndrome (Bogart & Matsumoto, 2010; Briegel, 2007), acoustic neuroma/vestibular schwannoma resection (Cross, Sheard, Garrud, Nikopoulos, & O'Donoghue, 2000; Lee, Fung, Lownie, & Parnes 2007; Leong & Lesser, 2015; Sun et al., 2015), Bell's palsy (Huang et al., 2012; Tseng et al., 2017; Weir et al., 1995) and superficial parotidectomy (Prats-Golczer et al., 2017). Five studies failed to report on the aetiology of participants (Chang et al., 2016; Coulson et al., 2004; Ryu, Lim, Cho, & Kim, 2016; VanSwearingen & Brach, 1996; VanSwearingen, Cohn, & Bajaj-Luthra, 1999), while the majority of studies (n = 15) failed to describe the laterality of participants' FP. Eight studies did not report the duration of participants' FP symptoms. Cross-sectional design was used in 21 studies, making this the most widely used design.

Risk of Bias

Results from the study quality assessment are shown in Table 3. The included studies had a mean score of 6.85/14 (range 5-10). All studies had an identified research question or

objective and the study population was clearly defined in 18 of the studies. Eleven studies failed to report on the participation rate, while a power analysis was only conducted in four studies. Studies generally applied inclusion/exclusion criteria uniformly (n = 25).

Anxiety

Occurrence of anxiety. As shown in Table 4, nine studies measured anxiety in individuals with FP, with the most frequently used measure being the HADS (five studies; Zigmond & Snaith, 1983). Between 30.5% (Pouwels et al., 2016) and 40% (Díaz-Aristizabal et al., 2019) of individuals scored in the clinical range (score ≥ 8) on this measure. Despite this, only one study (VanSwearingen et al., 1999) reported group mean scores falling in the clinical range, compared to three studies in the non-clinical range (Bogart & Matsumoto, 2010; Díaz-Aristizabal et al., 2019; Walker et al., 2012).

Some studies (Walker et al., 2012; Pouwels et al., 2016) found levels of anxiety to be significantly higher than the general population, while others (Bogart & Matsumoto, 2010; Sun et al., 2015) found levels to be similar.

Factors linked to anxiety. Fu et al. (2011) found levels of anxiety to be greater in females, while poorer self-reported physical and social function (Díaz-Aristizabal et al., 2019; VanSwearingen et al., 1998; VanSwearingen et al., 1999) and specific impairment of smiling (VanSwearingen et al., 1999) were found to be associated with higher levels of anxiety.

Objective severity of FP (Díaz-Aristizabal et al., 2019; Fu et al., 2011; Pouwels et al., 2016; VanSwearingen et al., 1998; Walker et al., 2012), laterality (Pouwels et al., 2016), age (Fu et

al., 2011) and duration of FP (Walker et al., 2012) were all shown not to be associated with anxiety.

Using Taiwanese health insurance data Tseng et al. (2017) demonstrated that those with Bell's palsy were 1.59 times more likely to develop a diagnosed anxiety disorder than those without, while individuals with a diagnosed anxiety disorder were 1.59 times more likely to develop Bell's palsy, compared to a matched comparison group without an anxiety disorder.

Depression

Occurrence of depression. As shown in table 5 the HADS was the most commonly used measure of depression (n = 5; Bogart & Matsumoto, 2010; Diaz-Aristizabel et al., 2019; Fu et al., 2011; Pouwels et al., 2016; Walker et al., 2012), with the proportion of individuals scoring in the clinical range for depression on the HADS or Beck Depression Inventory (BDI) ranging from 17% (Diaz-Aristizabel, 2019) to 71.8% (VanSwearingen et al., 1999).

Three studies reported mean depression scores falling in the non-clinical range (Bogart & Matsumoto, 2010; Diaz-Aristizabel et al., 2019; Nellis et al., 2017; Walker et al., 2012) and two in the clinical range (VanSwearingen et al., 1998; VanSwearingen et al., 1999). Nellis et al. (2017) and Pouwels et al. (2016) both observed significantly higher mean depression scores in individuals with FP of varied aetiology than in controls. Conversely, Sun et al. (2015) found no difference in mean depression scores between individuals with FP following acoustic neuroma resection and controls.

In an analysis of South Korean cross-sectional national survey data, Chang et al. (2016) reported that 32.0% of individuals with FP had a history of at least two weeks of depressed mood. This was significantly higher than in the general population.

Factors linked to depression. As with anxiety, studies did not demonstrate an association between the objective severity of FP and levels of depression (Diaz-Aristizabel et al., 2019; Fu et al., 2011; Pouwels et al., 2016; Walker et al., 2012), with the exception of Nellis et al. (2017), who only observed an association for those individuals with a House-Brackmann Scale (HBS; House & Brackmann, 1985) grade of 3 or higher.

Age and marital status, as well as duration (Fu et al., 2011), aetiology (Nellis et al., 2017) and laterality (Pouwels et al., 2016) of FP were all shown to be unrelated to levels of depression. There were mixed findings for gender, with Nellis et al. (2017) finding female gender to be associated with higher depression scores and Fu et al. (2011) observing no gender differences.

Bogart & Matsumoto (2010) found that impairment in communicating emotions with the face was not associated with levels of depression in individuals with Moebius syndrome, while VanSwearingen et al. (1999) that specific impairment of smiling increased the severity of depressive symptoms for individuals with FP of varied aetiology. Higher levels of depression were found in individuals with poorer self-reported facial function (Diaz-Aristizabal et al., 2019; VanSwearingen et al., 1999) and social function (Diaz-Aristizabal et al., 2019).

Combined anxiety and/or depression

Walker et al. (2012) found that 60% of individuals with FP had at least mild symptoms of anxiety *or* depression, with 8.7% of individuals reporting moderate or severe anxiety *and* depression, while Weir et al. (1995) found 25% reported clinically significant anxiety *and/or* depression. Neither study observed an effect of duration or objective severity of FP on levels of anxiety and/or depression. However, poorer voluntary facial movement (Walker et al., 2012) and lower facial appearance satisfaction (Weir et al., 1995) were found to be associated with higher combined anxiety and depression. Similarly, VanSwearingen et al. (1998) found combined anxiety and depression to be a significant mediator of the relationship between objective facial impairment and social function.

Social Function and quality of life

Seventeen studies examined social function or QoL (studies summarised in Table 6, excluding those which also measured anxiety or depression). The most widely used measures of facial-palsy specific social function were the Facial Disability Index (FDI; VanSwearingen & Brach, 1996; n = 11) and Facial Clinimetric Evaluation Scale (FaCE; Kahn et al., 2001; n = 7), while the most widely used measure of general health-related QoL was the Short-Form Health Survey (SF-36; Ware Jr & Sherbourne, 1992; n = 8).

Impact of FP on social function and/or QoL. Two studies failed to find differences in health-related QoL between individuals with FP and the general population (Chang et al., 2016; Sun et al., 2015). Bogart and Matsumoto (2010) found individuals with Moebius syndrome reported similar levels of life satisfaction, but lower social competence, than

healthy controls. Similarly, Lee et al. (2007) found individuals with FP following vestibular schwannoma resection to report poorer social function than those without FP at a mean follow-up time of 38.9 months.

Prats-Golczer et al. (2017) found that FP due to parotidectomy also led to reductions in social function. However, this only lasted until three months post-onset of FP, at which point individuals rated their social function as better than before the onset of FP. This appears to have coincided with time point at which patients typically reported that their physical facial function returned to normal.

Factors associated with social functioning and QoL. Coulson et al. (2004) found that individuals with FP who identified themselves as not having effective expression reported lower levels of social function than physical function, while individuals with effective expression reported lower levels of physical function than social function on the SF-36, highlighting the potential impact of impairment of expression of social functioning. However, Bogart and Matsumoto (2010) found no association between life satisfaction and social competence with impairment in communicating facial emotion in individuals with Moebius syndrome.

Two studies (Leong & Lesser, 2015; Volk, Granitzka, Kreysa, Klinger, & Guntinas-Lichius, 2016) found females to have poorer social functioning than males, while Lee et al. (2007) observed no gender difference. Lee et al. (2007) and Leong & Lesser (2015) also observed no association between age and social functioning, while Volk et al. (2016) found older age associated with poorer social functioning and health-related QoL. Poorer social functioning was also observed for individuals who had undergone treatment (e.g. surgical procedures,

facial therapy etc.) for their FP (Leong & Lesser, 2015), but not for those who had FP for a longer period (Lee et al., 2007).

There were mixed findings for the association between objective severity of FP and levels of social function and QoL. Volk et al. (2016) found greater severity of FP to be associated with poorer QoL. Social function was also shown by Marsk, Hammarstedt-Nordenvall, Engström, Jonsson and Hultcrantz (2013) to negatively correlate with objective severity; however significance values were not reported. Kleiss et al. (2015) found social function to be negatively associated with objective severity on one measure (Sunnybrook Facial Grading Scale; SFGS), but not another (House-Brackmann Scale; HBS), while Pavese et al. (2014) found better social functioning to be associated with greater symmetry at rest, but not synkinesis or symmetry of voluntary movement. Lee et al. (2007) and Györi et al. (2018) found no association between objective severity of FP and social functioning. Only one study investigated the impact of FP laterality on social function and QoL, with Ryu et al. (2016) finding those with right-sided FP to report poorer social functioning and health-related QoL.

Other psychological factors

VanSwearingen & Brach (1996) used the Primary Care Evaluation of Mental Disorders (Spitzer et al., 1994) to find psychological distress to be associated with poorer self-reported social functioning, but not facial function. Briegel (2007) found that 35% of participants with Moebius syndrome reported clinically significant levels of distress on the Derogatis Symptom Checklist 90 – Revised (Derogatis, 1992), while Huang et al. (2012) found that individuals within seven days after the onset of Bell's palsy reported higher levels of distress

than controls on the Psychological Distress Scale (Kessler et al., 2002). Huang et al. (2012) also observed a significant positive association between distress and objective severity of FP (Huang et al., 2012), an effect also found by Dey et al. (2017).

Conversely, Cross et al. (2000) found no significant association between degree of appearance-related distress and objective severity of FP. However, appearance-related distress was associated with lower self-esteem, female gender and younger age.

With regards to personality factors, Huang et al. (2012) found that individuals with Bell's palsy reported significantly higher levels of sensitivity, vigilance, apprehension and tension, compared with healthy controls, along with lower levels of warmth, openness to change and self-reliance. Briegel (2007) found that individuals with Moebius syndrome reported significantly greater interpersonal sensitivity, inhibition and introversion than the general population, as well as lower life satisfaction and achievement orientation.

Discussion

Results of this systematic review indicate that FP can have a negative impact on psychological wellbeing, social function and QoL for a substantial proportion of affected adults. Many studies reported significantly greater levels of anxiety and depression in individuals with acquired FP, when directly compared to the general population. For example, rates of anxiety as measured by the HADS in this current review ranged from 30.5% to 40% for anxiety; whilst rates reported in a systematic review on the prevalence of anxiety disorders in the general adult population ranged from 3.8% to 10.4% (Remes, Brayne, van der Linde, & Lafortune, 2016). Furthermore, this study found that researchers

using the HADS reported 17% to 31.2% of those with FP had at least mild depression. Given that approximately 20% of the population with physical health problems experience depression (NICE, 2009), those with FP are likely to experience equivalent, or perhaps greater, levels of depression than groups with other chronic physical health problems. However, it is also important to acknowledge that several studies reported mean levels of anxiety and depression within the 'non-clinical' range, indicating that not every individual is equally affected by FP.

Research suggests that women with FP may be at increased risk of low mood and poorer social functioning (Fu et al., 2011; Nellis et al., 2017; Volk et al., 2016), which may reflect the influence of cultural factors, such as differing body image ideals and a greater societal emphasis on female appearance (Grogan, 2010). Duration of FP was generally shown to be unrelated to psychosocial wellbeing (Walker et al., 2012; Fu et al., 2011; Lee et al., 2007; Cross et al., 2000), with the exception of participants in the study of (Prats-Golczer et al., 2017) who found improvements in social function over time to closely coincide with improvements in facial function.

Studies were inconsistent with regards to the effect of age on psychosocial outcomes. Cross et al. (2000) found levels of appearance-related distress to decrease with age, which the authors attributed to societal pressure on younger individuals to be attractive. However, Lee et al. (2007) and Leong and Lesser (2015) found no association between age and social function, while Volk et al. (2016) found older age to be associated with poorer social function. This inconsistency highlights the importance of future research including large, representative samples, which include the potential to stratify psychological outcomes by age.

Ryu et al. (2016) found individuals with right-sided FP to report poorer social function and QoL. Research has shown observers to have greater ratings of attractiveness for individuals with left-sided than right sided FP, which may impact on social function (Pouwels, Ingels, van Heerbeek, & Beurskens, 2014). This has been attributed to individuals' preference for the left-side of visual space over the right-side, potentially due to right temporal structures being involved in facial perception and left-to-right reading habits in Western societies (Pouwels, et al., 2014). In contrast to this hypothesis, Pouwels et al. (2016) found no effect of laterality on levels of anxiety, with more individuals with left-sided FP reporting mild depression than individuals with right-sided FP.

In the majority of studies, the objective severity of FP was not found to be directly associated with levels of anxiety or depression, with studies instead indicating that it is social and functional difficulties that predict anxiety and depression (Diaz-Aristizabel et al., 2019; VanSwearingen et al., 1998; VanSwearingen et al., 1999). Conversely, the relationship between objective severity of FP and social function or QoL appears to be more mixed, with several studies (Marsk et al., 2013; Kleiss et al., 2015; Pavese et al., 2014; Volk et al., 2016) finding a negative association and others (Lee et al., 2007; Györi et al., 2018) finding no association. This inconsistency may be explained by the factors influencing the relationship between severity of FP and social function, with Van Swearingen et al. (1998) finding psychological distress to mediate this relationship. It is therefore likely that social and functional difficulties have a greater impact on psychological wellbeing than aesthetic factors do (Walker et al., 2012).

The relationship between social function, facial function and psychological wellbeing may be mediated by the importance of facial expression of emotion in communication (Frith, 2009).

Facial expressions are fundamental for effective social interactions by communicating both emotion and motive information (Horstmann, 2003), enabling individuals to infer intentions and make adaptive decisions (Van Kleef et al., 2010). Indeed, failing to reciprocate smiles negatively impacts interaction quality (Heerey & Kring, 2007). Additionally, facial mimicry is important for understanding the expressions of others (Wood et al., 2016). Impairment in expression, such as difficulties smiling or excessive/reduced eye closure, reduces an individual's ability to provide important social cues or influence the emotion states of others. This can lead others to misinterpret their emotional state and result in fewer positive social interactions (Bogart & Matsumoto, 2010). Anxiety about the negative reactions of others to their facial appearance and function may also lead to a preoccupation with appearance, which can in turn make an individual appear anxious, low in confidence or distracted (Thompson & Kent, 2001). Indeed, individuals with FP report concealment of their face, including deliberately limiting smiles in order to reduce facial asymmetry, as well as social isolation and avoidance of certain scenarios, such as eating and drinking in public settings (Norris et al., 2019). These may in turn lead to an increase in social isolation and avoidance, and consequently a reduction in psychological wellbeing (Thompson & Kent, 2001).

The role of disability self-concept may also be of potential relevance to understanding the impact of FP on psychological wellbeing and the equivocal evidence regarding the effect of the aetiology of FP on psychosocial outcomes. Research in other areas of healthcare has found that individuals with congenital conditions have higher disability self-concept (e.g. lower dissonance between the perceived actual and ideal self) than those individuals with acquired conditions (Bogart, 2014). Specifically, this indicates that individuals with

congenital FP, such as those with Moebius syndrome may have greater disability self-efficacy and confidence to manage their difficulties in facial function, with positive implications for life satisfaction. This may be reflected in the finding that individuals with congenital FP are more likely to use effective adaptations such as alternative facial expressions, tone of voice and gesture, compared to individuals with acquired FP (Bogart, Tickle-Degnen, & Ambady, 2012) and may also explain why Bogart and Matsumoto (2010) found individuals with Moebius syndrome to report similar levels of anxiety and depression to a control group. This highlights the importance of further research directly comparing individuals with acquired and congenital FP, which may help to illuminate those additional factors which predict adjustment.

Although the physiological link between anxiety and Bell's palsy remains unidentified (Tseng et al., 2017) there may be a bi-directional link between the two. For example, Huang et al. (2012) have argued for a link between psychological distress and Bell's palsy due to changes in immune function and consequent raised inflammation associated with myelin swelling and myelin exfoliation of the facial nerve. It is therefore perhaps unsurprising that, on a population level Tseng et al. (2017) found that individuals with pre-existing anxiety disorders were 1.53 times more likely than the general population to develop FP. Given this association, it is also import to consider whether the high levels of anxiety reported in this review reflect anxiety related to having FP, or are instead reflective of higher levels of anxiety which pre-dated the onset of FP.

Limitations

Study level. The majority of studies (n = 18) reported on data collected from patients attending specialist FP clinics, indicating these studies are unlikely to reflect those individuals who have already made a good functional recovery from FP. It is likely that a number of studies included in this review are subject to selection bias, limiting our ability to draw conclusions about those not presenting at specialist clinics.

Other studies recruited individuals from national charities. A limitation of this approach is the typical low response rates. Furthermore, it may be that those patients who are more affected by their condition are more likely to join a charity, again drawing into question the representativeness of samples.

A high number of studies (n = 12) showed heterogeneity with regards to FP aetiology. While this reflects the wide range of individuals presenting in FP clinics, this limits our ability to draw conclusions about the specific psychosocial impact of different aetiologies. Only a small number of studies (e.g. Nellis et al., 2017) commented on whether aetiology affected outcome, highlighting the need for further research in this area. Furthermore, duration and laterality of FP are also factors which future research should consider.

Many studies had small samples, which may have left them under-powered, introduced a high degree of sampling variability and reduced the generalisability of findings. Although the majority of the studies included more females than males, this is reflective of population studies, which find higher rates of FP in women than in men (Chang et al., 2016).

Neither the FaCE nor the FDI provide normative data or clinical cut-offs, making it challenging to determine the clinical significance of findings. As a result, authors have

argued for the use of 'disease-specific' measures such as the FaCE and FDI, in conjunction with generic measures of health-related QoL, such as the SF-36 (Volk et al., 2016; Marsk et al., 2013), as the latter allows comparison to other conditions. Furthermore, some reviewers have criticised the psychometric methods used to establish the content validity of the FaCE and FDI, and have highlighted concerns about a lack of items related to self-perception of facial appearance (Ho et al., 2012).

Review level. One potential limitation of this review was the exclusion of studies which investigated the psychosocial wellbeing of individuals with FP undergoing specific interventions, such as surgery (n = 11). These studies were excluded as participants were likely to represent only those individuals sufficiently concerned with FP to warrant surgical intervention, resulting in a potentially skewed sample. Future research may look to compare the psychological wellbeing of individuals with FP seeking treatment with those who are not.

Clinical Implications

This review highlights the importance of routinely screening patients for psychological distress, as well as difficulties with social function and poor QoL. It must not be assumed that objective severity of FP symptoms predicts psychosocial outcomes. It is recommended that Clinical Psychologists form part of the specialist FP multi-disciplinary team, alongside surgical and facial therapy colleagues. Those reporting high levels of psychological distress should be offered psychological treatment by a skilled clinician with specialist knowledge of FP.

Unfortunately, no research to date has focused on the evaluation of psychological interventions specifically tailored for adults with FP. Therapeutic approaches such as Cognitive Behavioural Therapy (Clarke, Thompson, Jenkinson, Rumsey, & Newell, 2013) and Acceptance and Commitment Therapy (Griffiths, Williamson, Zucchelli, Paraskeva, & Moss, 2018) have been shown to be effective at improving the wellbeing of individuals with other health conditions, including those resulting in visible difference or change in physical function. Future research should focus on evaluating the effectiveness of psychological interventions for the specific difficulties experienced by individuals with FP. Furthermore, given the limited access to specialist FP services within the United Kingdom, the development of self-guided psychological therapy resources might help to provide psychological treatment to the largest number of individuals possible.

Conclusions

FP is a condition that changes facial appearance and function. This systematic review has demonstrated that irrespective of objective symptom severity, it has the potential to significantly impact an individual's psychosocial wellbeing and QoL. The existing research is limited due to an over-reliance on small samples, which may not be reflective of the FP population as a whole, a lack of research into specific aetiologies of FP and heterogeneity between studies with regards to what outcome measures are used. Future research should consider the specific impact of gender, duration, age and laterality. Healthcare professionals should screen all individuals with FP for psychosocial difficulties, with specialist psychological assessment and treatment provided when indicated.

References

Barker-Collo, S. L. (2007). Depression and anxiety 3 months post stroke: prevalence and correlates. *Archives of Clinical Neuropsychology*, *22*(4), 519-531. doi: 10.1016/j.acn.2007.03.002

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of general psychiatry*, *4*(6), 561-571. doi: 10.1001/archpsyc.1961.01710120031004

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: psychometric properties. *Journal of consulting and clinical psychology*, *56*(6), 893. doi: 10.1037/0022-006X.56.6.893

Bogart, K. R., & Matsumoto, D. (2010). Living with Moebius syndrome: Adjustment, social competence, and satisfaction with life. *The Cleft Palate-Craniofacial Journal*, *47*(2), 134-142. doi: 10.1597/08-257_1

Bogart, K. R., Tickle-Degnen, L., & Ambady, N. (2012). Compensatory expressive behavior for facial paralysis: adaptation to congenital or acquired disability. *Rehabilitation psychology*, *57*(1), 43-51. doi: 10.1037/a0026904

Bogart, K. R., Tickle-Degnen, L., & Joffe, M. S. (2012). Social interaction experiences of adults with Moebius syndrome: a focus group. *Journal of Health Psychology*, *17*(8), 1212-1222. doi: 10.1177/13591-5311432491

Bogart, K. R. (2014). The role of disability self-concept in adaptation to congenital or acquired disability. *Rehabilitation Psychology*, *59*(1), 107-115. doi: 10.1037/a0035800

Bradbury, E. T., Simons, W., & Sanders, R. (2006). Psychological and social factors in reconstructive surgery for hemi-facial palsy. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *59*(3), 272-278. doi: 10.1016/j.bjps.2005.09.003.

Briegel, W. (2007). Psychopathology and personality aspects of adults with Moebius sequence. *Clinical genetics*, *71*(4), 376-377. doi: 10.1111/j.1399-0004.2007.00787.x

Chang, Y. S., Choi, J. E., Kim, S. W., Baek, S. Y., & Cho, Y. S. (2016). Prevalence and associated factors of facial palsy and lifestyle characteristics: data from the Korean National Health and Nutrition Examination Survey 2010–2012. *BMJ open*, *6*(11), e012628. doi: 10.1136/bmjopen-2016-012628

Clarke, A., Thompson, A. R., Jenkinson, E., Rumsey, N., & Newell, R. (2013). *CBT for appearance anxiety: psychosocial interventions for anxiety due to visible difference*. Oxford, UK: John Wiley & Sons.

Coulson, S. E., O'Dwyer, N. J., Adams, R. D., & Croxson, G. R. (2004). Expression of emotion and quality of life after facial nerve paralysis. *Otology & neurotology*, *25*(6), 1014-1019. doi: 10.1097/00129492-200411000-00026

Cross, T., E. Sheard, C., Garrud, P., Nikolopoulos, T. P., & O'Donoghue, G. M. (2000). Impact of facial paralysis on patients with acoustic neuroma. *The Laryngoscope*, *110*(9), 1539-1542. doi: 10.1097/00005537-200009000-00024

Derogatis, L. R. (1992). SCL-90-R: *Administration, scoring & procedures manual-II for the (revised) version and other instruments of the psychopathology rating scale series.* Baltmore: Clinical Psychometric Research.

Dey, J. K., Ishii, L. E., Nellis, J. C., Boahene, K. D., Byrne, P. J., & Ishii, M. (2017). Comparing patient, casual observer, and expert perception of permanent unilateral facial paralysis. JAMA facial plastic surgery, 19(6), 476-483. doi: 10.1001/jamafacial.2016.1630

Díaz-Aristizabal, U., Valdés-Vilches, M., Fernández-Ferreras, T. R., Calero-Muñoz, E., Bienzobas-Allué, E., & Moracén-Naranjo, T. (2019). Correlations between impairment, psychological distress, disability, and quality of life in peripheral facial palsy. *Neurología, 34* (7), 423-428. doi: 10.1016/j.nrleng.2019.03.001

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of personality assessment*, *49*(1), 71-75. doi: 10.1207/s15327752jpa4901_13

Facial Palsy UK (2012). Care is Uneven for Facial Palsy Sufferers. Retrieved from https://www.facialpalsy.org.uk/inform/media-centre/press-releases/161112-care-is-uneven-for-facial-palsy-sufferers/

Filipo, R., Spahiu, I., Covelli, E., Nicastri, M., & Bertoli, G. A. (2012). Botulinum toxin in the treatment of facial synkinesis and hyperkinesis. *The Laryngoscope*, *122*(2), 266-270. doi: 10.1002/lary.22404

Frith, C. (2009). Role of facial expressions in social interactions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1535), 3453-3458. doi: 10.1098/rstb.2009.0142

Fu, L., Bundy, C., & Sadiq, S. A. (2011). Psychological distress in people with disfigurement from facial palsy. *Eye*, *25*(10), 1322-1326. doi:10.1038/eye.2011.158

Ghali, S., MacQuillan, A., & Grobbelaar, A. O. (2011). Reanimation of the middle and lower face in facial paralysis: review of the literature and personal approach. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *64*(4), 423-431. doi: 10.1016/j.bjps.2010.04.008

Griffiths, C., Williamson, H., Zucchelli, F., Paraskeva, N., & Moss, T. (2018). A systematic review of the effectiveness of Acceptance and Commitment Therapy (ACT) for body image dissatisfaction and weight self-stigma in adults. *Journal of contemporary psychotherapy*, *48*(4), 189-204. doi: 10.1007/s10879-018-9384-0

Grogan, S. (2010). Promoting positive body image in males and females: Contemporary issues and future directions. *Sex Roles*, *63*(9-10), 757-765. doi: 10.1007/s11199-010-9894-z

Györi, E., Przestrzelski, C., Pona, I., Hagmann, M., Rath, T., Radtke, C., & Tzou, C. H. J. (2018). Quality of life and functional assessment of facial palsy patients: A questionnaire study. *International Journal of Surgery*, *55*, 92-97. doi: 10.1016/j.ijsu.2018.04.061

Harris, D. L., & Carr, A. T. (2001). The Derriford Appearance Scale (DAS59): a new psychometric scale for the evaluation of patients with disfigurements and aesthetic problems of appearance. *British journal of plastic surgery*, *54*(3), 216-222. doi: 10.1054/bjps.2001.3559

Heerey, E. A., & Kring, A. M. (2007). Interpersonal consequences of social anxiety. Journal of Abnormal Psychology, 116(1), 125–134. https://doi.org/10.1037/0021-843X.116.1.125

Helmreich, R., & Stapp, J. (1974). Short forms of the Texas Social Behavior Inventory (TSBI), an objective measure of self-esteem. *Bulletin of the Psychonomic Society*, *4*(5), 473-475. doi: 10.3758/BF03334260

Ho, A. L., Scott, A. M., Klassen, A. F., Cano, S. J., Pusic, A. L., & Van Laeken, N. (2012). Measuring quality of life and patient satisfaction in facial paralysis patients: a systematic review of patient-reported outcome measures. *Plastic and reconstructive surgery*, *130*(1), 91-99. doi: 10.1097/PRS.0b013e318254b08d

Horstmann, G. (2003). What Do Facial Expression Convey: Feeling States, Behavioral Intentions, or Action Requests. Emotion, 3, 150-166. doi:10.1037/1528-3542.3.2.150

House, J. W., & Brackmann, D. E. (1985). Facial nerve grading system. *Otolaryngology – Head and Neck Surgery, 93,* 146-147. doi: 10.1177/019459988509300202.

Huang, B., Xu, S., Xiong, J., Huang, G., Zhang, M., & Wang, W. (2012). Psychological factors are closely associated with the Bell's palsy: a case-control study. *Journal of Huazhong University of Science and Technology [Medical Sciences]*, *32*(2), 272-279. doi: 10.1007/s11596-012-0048-0

Kahn, J. B., Gliklich, R. E., Boyev, K. P., Stewart, M. G., Metson, R. B., & McKenna, M. J. (2001). Validation of a patient-graded instrument for facial nerve paralysis: the FaCE scale. *The Laryngoscope*, *111*(3), 387-398. doi: 10.1097/00005537-200103000-00005

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., ... & Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine*, *32*(6), 959-976. doi: 10.1017/S0033291702006074

Kleiss, I. J., Beurskens, C. H., Stalmeier, P. F., Ingels, K. J., & Marres, H. A. (2015). Quality of life assessment in facial palsy: validation of the Dutch Facial Clinimetric Evaluation Scale. *European Archives of Oto-Rhino-Laryngology*, *272*(8), 2055-2061. doi: 10.1007/s00405-015-3508-x

Lee, J., Fung, K., Lownie, S. P., & Parnes, L. S. (2007). Assessing impairment and disability of facial paralysis in patients with vestibular schwannoma. *Archives of Otolaryngology–Head & Neck Surgery*, *133*(1), 56-60. doi:10.1001/archotol.133.1.56

Leong, S. C., & Lesser, T. H. (2015). A national survey of facial paralysis on the quality of life of patients with acoustic neuroma. *Otology & neurotology*, *36*(3), 503-509. doi: 10.1097/MAO.0000000000000428

Marsk, E., Hammarstedt-Nordenvall, L., Engström, M., Jonsson, L., & Hultcrantz, M. (2013). Validation of a Swedish version of the facial disability index (FDI) and the facial clinimetric evaluation (FaCE) scale. *Acta oto-laryngologica*, *133*(6), 662-669. doi: 10.3109/00016489.2013.766924

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine, 151,* 264-269. doi: 10.7326/0003-4819-151-4-200908180-00135

Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., & Buick, D. (2002). The revised illness perception questionnaire (IPQ-R). *Psychology and health*, *17*(1), 1-16. doi: 10.1080/08870440290001494

National Center for Health Statistics (U.S.), Council on Clinical Classifications., Commission on Professional and Hospital Activities., & World Health Organization. (1978). *The*

International classification of diseases, 9th revision, clinical modification: ICD. 9. CM. Ann Arbor, Mich: Commission on Professional and Hospital Activities.

National Institutes of Health. (2014). Quality assessment tool for observational cohort and cross-sectional studies [National Heart, Blood, and Lung Institute]. Retrieved from https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools.

National Institute for Health and Care Excellence. (2009). *Depression in adults with a chronic physical health problem: recognition and management* (CG 91). Retrieved from https://www.nice.org.uk/guidance/cg91

Nellis, J. C., Ishii, L. E., Boahene, K. D., & Byrne, P. J. (2018). Psychosocial Impact of Facial Paralysis. *Current Otorhinolaryngology Reports*, *6*(2), 151-160. doi: 10.1007/s40136-018-0196-2

Nellis, J. C., Ishii, M., Byrne, P. J., Boahene, K. D., Dey, J. K., & Ishii, L. E. (2017). Association among facial paralysis, depression, and quality of life in facial plastic surgery patients. *JAMA facial plastic surgery*, *19*(3), 190-196. doi: 10.1001/jamafacial.2016.1462

Norris, J. H., Longmire, N. M., Kilcoyne, S., Johnson, D., Fitzpatrick, R., & Klassen, A. F. (2019). Exploring Patient Experience of Facial Nerve Palsy to Inform the Development of a PROM. *Plastic and Reconstructive Surgery Global Open*, *7*(1), e2072. doi: 10.1097/GOX.0000000000002072

Pavese, C., Cecini, M., Camerino, N., De Silvestri, A., Tinelli, C., Bejor, M., & Dalla Toffola, E. (2014). Functional and social limitations after facial palsy: expanded and independent validation of the Italian version of the facial disability index. *Physical therapy*, *94*(9), 1327-1336. doi: 10.2522/ptj.20130254

Pouwels, S., Beurskens, C. H., Kleiss, I. J., & Ingels, K. J. (2016). Assessing psychological distress in patients with facial paralysis using the Hospital Anxiety and Depression Scale. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *69*(8), 1066-1071. doi: 10.1016/j.bjps.2016.01.021

Pouwels, S., Ingels, K., van Heerbeek, N., & Beurskens, C. (2014). Cosmetic appreciation of lateralization of peripheral facial palsy:'preference for left or right, true or mirror image?'. *European Archives of Oto-Rhino-Laryngology*, *271*(9), 2517-2521. doi: 10.1007/s00405-013-2790-8

Prats-Golczer, V. E., Gonzalez-Cardero, E., Exposito-Tirado, J. A., Montes-Latorre, E., Gonzalez-Perez, L. M., & Infante-Cossio, P. (2017). Impact of dysfunction of the facial nerve after superficial parotidectomy: a prospective study. *British Journal of Oral and Maxillofacial Surgery*, *55*(8), 798-802. doi: 10.1016/j.bjoms.2017.07.006

Remes, O., Brayne, C., Van Der Linde, R., & Lafortune, L. (2016). A systematic review of reviews on the prevalence of anxiety disorders in adult populations. *Brain and behavior*, *6*(7), e00497. doi: 10.1002/brb3.497

Ross, B. G., Fradet, G., & Nedzelski, J. M. (1996). Development of a sensitive clinical facial grading system. *Otolaryngology—Head and Neck Surgery*, *114*(3), 380-386. doi: 10.1016/S0194-59989670206-1

Ryu, N. G., Lim, B. W., Cho, J. K., & Kim, J. (2016). Quality of life differences in patients with right-versus left-sided facial paralysis: universal preference of right-sided human face recognition. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *69*(9), e197-e203. doi: 10.10 10.1016/j.bjps.2016.06.02116/j.bjps.2016.06.021

Schrom, T., Buchal, A., Ganswindt, S., & Knippping, S. (2009). Patient satisfaction after lid loading in facial palsy. *European Archives of Oto-Rhino-Laryngology*, *266*(11), 1727-1731. doi: 10.1007/s00405-009-0981-0

Shindo, M. (1999). Management of facial nerve paralysis. *Otolaryngologic Clinics of North America*, *32*(5), 945-964. doi: 10.1016/S0030-6665(05)70183-3

Spitzer, R. L., Williams, J. B., Kroenke, K., Linzer, M., deGruy, F. V., Hahn, S. R., ... & Johnson, J. G. (1994). Utility of a new procedure for diagnosing mental disorders in primary care: the PRIME-MD 1000 study. *JAMA*, *272*(22), 1749-1756. doi: 10.1001/jama.1994.03520220043029

Sun, D., Shi, Z., Li, P., Shi, S., & Cai, Y. (2015). Psychological status and quality of life in acoustic neuroma patients with facial palsy after microsurgery: a 1-year postoperative follow-up study. *Acta Neurologica Belgica*, *115*(3), 311-316. doi: 10.1007/s13760-014-0382-z

The EuroQoL Group (1990). EuroQol-a new facility for the measurement of health-related quality of life. *Health policy*, *16*(3), 199-208. doi: 10.1016/0168-8510(90)90421-9

Thompson, A., & Kent, G. (2001). Adjusting to disfigurement: processes involved in dealing with being visibly different. *Clinical psychology review*, *21*(5), 663-682. doi: 10.1016/S0272-7358(00)00056-8

Tseng, C. C., Hu, L. Y., Liu, M. E., Yang, A. C., Shen, C. C., & Tsai, S. J. (2017). Bidirectional association between Bell's palsy and anxiety disorders: A nationwide population-based retrospective cohort study. *Journal of affective disorders*, *215*, 269-273. doi: 10.1016/j.jad.2017.03.051

Van Kleef, G., De Dreu, C., & Manstead, A. S. R. (2010). An interpersonal approach to emotion in social decision making. Advances in Experimental Social Psychology, 45-96. doi: 10.1016/s0065-2601(10)42002-x

Van Landingham, S. W., Diels, J., & Lucarelli, M. J. (2018). Physical therapy for facial nerve palsy: applications for the physician. *Current opinion in ophthalmology*, *29*(5), 469-475. doi: 10.1097/ICU.0000000000000503

VanSwearingen, J. M., & Brach, J. S. (1996). The Facial Disability Index: reliability and validity of a disability assessment instrument for disorders of the facial neuromuscular system. *Physical therapy*, *76*(12), 1288-1298. doi: 10.1093/ptj/76.12.1288

VanSwearingen, J. M., Cohn, J. F., Turnbull, J., Mrzai, T., & Johnson, P. (1998). Psychological distress: linking impairment with disability in facial neuromotor disorders. *Otolaryngology—Head and Neck Surgery*, *118*(6), 790-796. doi: 10.1016/S0194-5998(98)70270-0

VanSwearingen, J. M., Cohn, J. F., & Bajaj-Luthra, A. (1999). Specific impairment of smiling increases the severity of depressive symptoms in patients with facial neuromuscular disorders. *Aesthetic plastic surgery*, *23*(6), 416-423. doi: 10.1007/s002669900312

Volk, G. F., Granitzka, T., Kreysa, H., Klingner, C. M., & Guntinas-Lichius, O. (2016). Nonmotor disabilities in patients with facial palsy measured by patient-reported outcome measures. *The Laryngoscope*, *126*(7), 1516-1523. doi: 10.1002/lary.25695

Walker, D. T., Hallam, M. J., Ni Mhurchadha, S., McCabe, P., & Nduka, C. (2012). The psychosocial impact of facial palsy: our experience in one hundred and twenty six patients. *Clinical Otolaryngology*, *37*(6), 474-477. doi: 10.1111/coa.12026

Ware Jr, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical care*, *30*(6) 473-483.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, *54*(6), 1063.

Weir, A. M., Pentland, B., Crosswaite, A., Murray, J., & Mountain, R. (1995). Bell's palsy: the effect on self-image, mood state and social activity. *Clinical rehabilitation*, *9*(2), 121-125. doi: 10.1177/026921559500900206

Wood, A., Rychlowska, M., Korb, S., & Niedenthal, P. (2016). Fashioning the face: sensorimotor simulation contributes to facial expression recognition. *Trends in cognitive sciences*, *20*(3), 227-240. doi: 10.1016/j.tics.2015.12.010

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, *67*(6), 361-370. doi: 10.1111/j.1600-0447.1983.tb09716.x

Zung, W. W. (1971). A rating instrument for anxiety disorders. *Psychosomatics: Journal of Consultation and Liaison Psychiatry*, *12,* 371. doi: 10.1016/S0033-3182(71)71479-0

Zung, W. K. (1965). A self-rating depression scale. *Archives of General Psychiatry, 12,* 63-70. doi:10.1001/archpsyc.1965.01720310065008

Table 1. Search terms used in literature search.

Subheading	Search Terms
Population	*Facial palsy – facial paralys*, facial pals*, facial pares*, hemi-facial paralys*, hemi-facial pals*, hemi-facial pares*, Bell* Pals*, Ramsay Hunt, Mo?bius*
Outcome	*Psychosocial – psychology, psychiatry, psych*, mental disorders, anxiety, anxious, depress*, distress*, mood, emotion*, confidence, self-concept, self-perception, self-esteem, self-image, self-worth, body image, appearance*

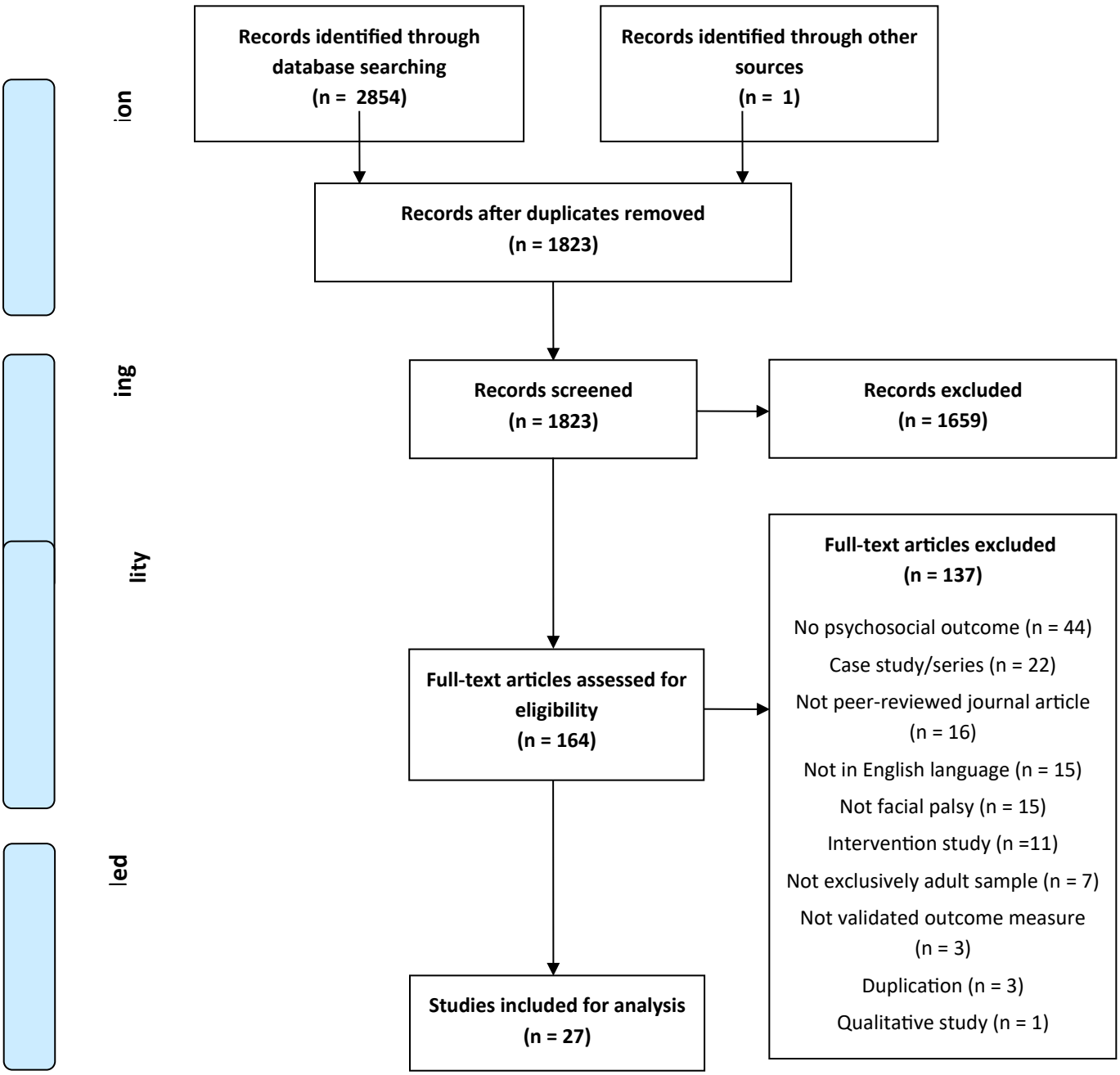

Figure 1 – Flowchart of study selection.

Table 2 – Study Characteristics

Authors	Country	Sample size n (% female)	Age in years *M* (SD)	Diagnosis	Duration of symptoms	Design and setting
1. Bogart & Matsumoto (2010)	USA	Facial palsy: 37 (62%) Controls: 37 (62%)	Facial palsy: 37.7 (13.7) Controls: 35.3 (12.5)	All participants had Moebius syndrome	Since birth	Prospective case-control; participants recruited through the Moebius Syndrome Foundation
2. Briegel (2007)	Germany	22 (59%)	29.9 (range = 17-57)	All participants had Moebius syndrome	Since birth	Cross-sectional; participants recruited through the German Moebius foundation
3. Chang et al. (2016)	South Korea	44 (% not reported)	Not reported	Facial palsy (laterality & aetiology not reported)	Not reported	Cross-sectional; national survey
4. Coulson et al. (2004)	Australia	24 (58.3%)	46.1	Facial palsy (laterality & aetiology not reported	Mean = 7.4 years	Cross-sectional; university setting
5. Cross et al. (2000)	UK	92 (77.17%)	53 (range = 25 – 83)	Facial palsy following acoustic neuroma resection (laterality not reported)	Mean = 4.3 years; range = 1 - 9.8	Cross-sectional; hospital setting and British Acoustic Neuroma Association
6. Dey et al. (2017)	USA	40 (55%)	54 (13)	Unilateral facial palsy (laterality not reported) Vestibular schwannoma resection – 65% Bell's palsy – 12.5% Malignant parotid neoplasm – 7.5% Other (4 further aetiologies) – 15%	30% < 6 months 40% = 6-24 months 30% > 24 months	Cross-sectional; patients attending a facial plastic and reconstructive surgery clinic
7. Díaz-Aristizabal et al. (2019)	Spain	30 (76.7%)	51.1 (16.0)	Unilateral facial palsy (60.0% right-sided) Bell's palsy – 56.7% Iatrogenic – 23.3% Herpes zoster - 13.3% Trauma – 3.3% Otitis – 3.3%	Mean = 8.5 years (SD = 16.4 months)	Cross-sectional; patients attending rehabilitation and physical medicine department
8. Fu et al. (2011)	UK	103 (% not reported)	59 (17)	Laterality not reported Acoustic neuroma resection – 52% Bell's palsy – 19% Parotid tumour – 4% Other – 25%	Range = 6 months – 50 years	Cross-sectional; patients attending a tertiary referral centre in a teaching hospital

9. Györi et al. (2018)	Austria	30 (60%)	48.8 (15.6)	Unilateral facial palsy (56.6% right-sided): Iatrogenic – 40.0% Idiopathic – 20.0% Traumatic – 20.0% Infection – 16.6% Developmental – 3.3%	Mean = 10.7 years (SD = 13.5 years)	Cross-sectional; consecutive participants presenting at a facial nerve outpatient clinic
10. Huang et al. (2012)	China	Facial palsy: 306 (42.5%) Healthy Controls: 320 (49.7%)	Facial palsy: 38.5 (12.8) Healthy controls: 36.7 (11.5)	Unilateral Bell's palsy (laterality not reported)	52.6% within 72 hours of onset 47.4% between 72 and 168 hours after onset of symptoms	Case-controlled design; participants recruited at a teaching hospital
11. Kleiss et al. (2015a)	Netherlands	93 (66%)	55.1 (13.8)	Bilateral = 3%, right-sided = 51%, left-sided = 46% Bell's palsy – 52% Ramsay Hunt Syndrome – 17% Iatrogenic – 8% Other – 23%	Mean = 4.6 years (SD = 1.15 years)	Cross-sectional; University medical centre
12. Lee et al. (2007)	Canada	28 (% not reported)	Not reported	Facial palsy following vestibular schwannoma resection (laterality not reported)	Not reported	Cross-sectional; hospital setting
13. Leong & Lesser (2015)	UK	116 (35%)	66% between age of 51 to 70 years; mean not reported	Unilateral facial palsy following acoustic neuroma resection (laterality not reported)	Not reported	Cross-sectional; members of the British Acoustic Neuroma Association
14. Marsk et al. (2013)	Sweden	93 (53%)	56.9 (range 26-89)	Bilateral = 3.2%, right-sided = 49.5%, left-sided = 47.3% Bell's palsy – 78.5% Herpes zoster – 9.7% Borrelia infection – 5.4% Other – 13.4%	Mean duration = 51.9 months; range = 4-696 months	Cross-sectional; consecutive patients presenting with facial palsy at two otorhinolaryngology departments
15. Nellis et al. (2017)	USA	Facial palsy: 88 (65.9%)	Facial palsy: 52.0 (14.9)	Unilateral facial palsy (laterality not reported)	Not reported	Case-control; patients presenting at a plastic surgery clinic

		Controls: 275 (67.4%)	Controls: 47.5 (15.6)	Acoustic neuroma resection – 31.8% Bell's palsy - 29.6% CNS tumour – 6.8% Other (8 further aetiologies) – 31.8%		
16. Pavese et al. (2014)	Italy	100 (72%)	45 (15)	Unilateral facial palsy (54% right sided) Surgical/iatrogenic – 46% Traumatic – 5% Congenital – 2% Other – 47%	Mean = 3.5 years (SD = 5.8 years)	Cross-sectional; rehabilitation unit
17.Pouwels et al. (2016)	Netherlands	With facial palsy = 59 (62.7%) Healthy controls = 59 (66.1%)	Facial palsy: 56 (15) Controls: 40 (16)	Bilateral = 1.7%, right sided = 50.8%, left sided = 47.5% Bell's palsy – 50.8% Herpes Zoster - 16.9% Acoustic Neuroma – 11.9% Other – 20.4%	Mean = 5.4 years (SD = 6.1 years)	Case-control; setting not described
18. Prats-Golczer et al. (2017)	Spain	61 (50.6%)	48 Range: 24-81	Unilateral facial palsy following superficial parotidectomy (laterality not reported)	Follow-up at 12 months post-onset	Prospective cohort; months; patients with facial palsy following superficial parotidectomy
19. Ryu, Lim, Cho, & Kim (2016)	South Korea	100 (62%)	31.3 (12.4)	Unilateral facial palsy (50% right-sided) Aetiology not reported	Not reported	Cross-sectional; facial palsy clinic
20. Sun et al. (2015)	China	21 (52.4%)	45 (17)	Unilateral facial palsy after acoustic neuroma resection (laterality not reported)	Follow-up at median of 24 months post-onset; range 17-35 months	Prospective cohort; patients with facial palsy following acoustic neuroma resection
21. Tseng et al. (2017)	Taiwan	Study 1: 8070 patients with anxiety (60.2%) Study 2: 4980 patients with Bell's palsy (46.7%)	Study 1: Median = 42 Study 2: Median = 47	Study 1: patients with a diagnosed anxiety disorder Study 2: patients diagnosed with Bell's palsy Laterality not reported	Not reported	Both studies: Retrospective case-controlled design; review of nationwide health insurance database
22. VanSwearingen & Brach (1996)	USA	46 (65.2%)	46.8 (15.6)	Facial palsy (laterality and proportion of different aetiologies not reported)	Not reported	Cross-sectional; patients presenting at a Facial Nerve Centre

23. VanSwearingen et al. (1998)	USA	48 (% not reported)	49 (16.3)	Facial palsy (laterality not reported) Bell's palsy – 41.66% Neuroma – 16.66% Tumour – 16.66% Other – 25%	Not reported	Cross-sectional; patients presenting at a Facial Nerve Centre
24. VanSwearingen et al. (1999)	USA	29 (79.3%)	50.2 (17)	Facial palsy (laterality and proportion of different aetiologies not reported)	Mean = 6 years; range = 1 – 40 years	Cross-sectional; patients presenting at a Facial Nerve Centre
25. Volk et al. (2016)	Germany	256 (60%)	52 (18)	Unilateral facial palsy (45% right-sided): Idiopathic – 45% Traumatic/postsurgical – 36% Inflammatory/infection – 13% Neoplastic – 2% Congenital – 2% Other – 1%	Mean = 4.0 years; SD = 8.7 years	Cross-sectional; setting not described
26. Walker et al. (2012)	UK	126 (66.6%)	50.1 (range 17-93)	Laterality not reported Bell's palsy – 33.3% Acoustic neuroma resection – 20.0% Tumour – 15.3% Ramsay Hunt Syndrome – 9.5% Other – 29.9%	Mean = 76 months; range = 1 – 672 months	Cross-sectional; facial palsy clinic
27. Weir et al. (1995)	UK	20 (60%)	Median = 41 (range 15-78)	Unilateral Bell's palsy (55% right-sided)	Median = 65 days; range = 6 days – 7 years	Cross-sectional; facial palsy clinic

Table 3 - Assessment of study quality (NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies).

	Study Number																										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
1. Was the research question or objective in this paper clearly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Was the study population clearly specified and defined?	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No
3. Was the participation rate of eligible persons at least 50%?	NR	Yes	Yes	NR	Yes	NR	NR	Yes	Yes	Yes	NR	Yes	NR	Yes	Yes	Yes	Yes	NR	NR	NA	Yes	NR	Yes	Yes	Yes	Yes	NR
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	Yes	Yes	Yes	NR	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Was a sample size justification, power description, or variance and effect estimates provided?	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	CD	No	Yes	Yes	No	No	No	No	No	No
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	Yes	Yes	NR	Yes	Yes	Yes	Yes	Yes	Yes	CD	NR	Yes	NR	Yes	NR	Yes	Yes	Yes	NR	Yes	Yes	NR	Yes	Yes	Yes	Yes	Yes
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	NA	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	NA	Yes	Yes	Yes	Yes	NA	No	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes
10. Was the exposure(s) assessed more than once over time?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	CD	No	Yes	No	No	No	Yes	No	No	No
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
12. Were the outcome assessors blinded to the exposure status of participants?	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Yes	No	NR	NR	NR	No	No	NR	NR	NR	NR	NR	Yes	NR	NR
13. Was loss to follow-up after baseline 20% or less?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Yes	NA	NA	No	NA	NR	NA	Yes	NA	Yes	NA	NA	NA	NA	No	NA	NA
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure (s) and outcome(s)?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No
Overall score	5	5	5	5	8	5	7	7	8	7	5	9	5	8	7	9	9	6	3	10	7	5	8	9	9	8	6

NR = Not Relevant, NA = Not Applicable, CD = Cannot Determine

Table 4 – Summary of studies investigating the impact of facial palsy (and related factors) on levels of anxiety

Study	Measure of anxiety	Severity of anxiety	Factors related to anxiety	Factors unrelated to anxiety
Bogart et al. (2010)	HADS	Mean anxiety score in the non-clinical range No significant difference in levels of anxiety compared to controls	N/A	Impairment in communicating emotions with the face (FECQ)
Díaz-Aristizabal et al. (2019)	HADS	Mean anxiety score in the non-clinical range Non-clinical – 60%; Mild – 23%; Moderate or severe – 17%	Facial function (FDI – physical) Social function (FDI – social) Total QoL (FaCE – total) Social QoL (FaCE – social)	Severity of facial palsy (Sunnybrook FGS)
Fu et al. (2011)	HADS	Non-clinical – 67.3%; Mild – 17.3%; Moderate – 10.2%; Severe – 5.1%	Female gender Greater consequence of facial palsy (IPQ-R) Higher distress/emotional representation (IPQ-R)	Severity of facial palsy (House-Brackmann Scale) Age Marital status Beliefs about the timeline of recovery (IPQ-R)

				Beliefs about control over facial palsy and treatment (IPQ-R) Understanding of facial palsy (IPQ-R)
Pouwels et al. (2016)	HADS	Significantly higher levels of mild anxiety (but not moderate or severe) compared to control group Non-clinical - 69.5%; Mild – 20.3%; Moderate – 6.8%; Severe – 3.4%	N/A	Laterality of facial palsy Severity of facial palsy (House-Brackmann Scale)
Sun et al. (2015)	SAS	No significant difference in levels of anxiety compared to Chinese norms Clinical range – 9.5%	N/A	N/A
Tseng et al. (2017)	ICD-9-CM diagnosis	Individuals 1.55 times more likely to develop Bell's palsy if they had a diagnosed anxiety disorder prior to onset Individuals 1.59 times more likely to develop a diagnosed anxiety disorder if already had a diagnosis of Bell's palsy	N/A	N/A
VanSwearingen et al. (1998)	BAI	Mean score in moderate range Moderate – 50%; Severe – 50%	Facial function (FDI – physical) Social function (FDI – social)	Severity of facial palsy (Sunnybrook FGS)
VanSwearingen et al. (1999)	BAI	Mean score in the clinical range	Depression (BDI) Specific impairment of smiling	N/A

			Facial function (FDI – physical)	
Walker et al. (2012)	HADS	Mean score in non-clinical range but significantly higher than norms Moderate or severe – 30.2%	N/A	Severity of facial palsy (Sunnybrook FGS & House-Brackmann scale) Duration of facial palsy

BAI – Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988); BDI – Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961)FaCE – Facial Clinimetric Evaluation Scale (Kahn et al., 2001); FDI – Facial Disability Index (Van Swearingen & Brach, 1996); FECQ – Facial Expression Communication Questionnaire (Bogart & Matsumoto, 2010); HADS – Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983); ICD-9-CM - International Classification of Diseases, Ninth Revision, Clinical Modification (National Center for Health Statistics (U.S.), Council on Clinical Classifications, Commission on Professional and Hospital Activities, & World Health Organization, 1978); IPQ-R – Illness Perception Questionnaire – Revised (Moss-Morris et al., 2002); SAS – Zung Self-Rating Anxiety Scale (Zung, 1971); Sunnybrook FGS – Sunnybrook Facial Grading Scale (Ross, Fradet, & Nedzelski, 1996).

Table 5 – Summary of studies investigating the impact of facial palsy (and related factors) on levels of depression

Study	Measure of depression	Severity of depression	Factors related to depression	Factors unrelated to depression
Bogart et al. (2010)	HADS	Mean depression score in the non-clinical range No significant difference in levels of depression compared to controls	N/A	Impairment in communicating emotions with the face (FECQ)
Díaz-Aristizabal et al. (2019)	HADS	Mean depression score in the non-clinical range Non-clinical – 83%; Mild – 10%; Moderate or severe – 7%	Facial function (FDI – physical) Social function (FDI – social) Total QoL (FaCE – total) Social QoL (FaCE – social)	Severity of facial palsy (Sunnybrook FGS)
Fu et al. (2011)	HADS	Non-clinical – 68.8%; Mild – 16.7%; Moderate – 11.5%; Severe – 3.1%	Duration of facial palsy Beliefs about the timeline of recovery (IPQ-R) Greater consequence of facial palsy (IPQ-R) Higher distress/emotional	Severity of facial palsy (House-Brackmann Scale) Gender Age Marital Status

			representation (IPQ-R)	Beliefs about control over facial palsy and treatment (IPQ-R) Understanding of facial palsy (IPQ-R)
Nellis et al. (2017)	BDI	Mean depression score in the non-clinical range Significantly higher levels of depression compared to controls Non-clinical – 58%; Mild – 31%; Moderate – 8%; Severe – 3%	House-Brackmann Scale grade of 3 or higher Female gender	Aetiology House-Brackmann grade of 2 or lower
Pouwels et al. (2016)	HADS	Significantly higher levels of mild and moderate depression (but not severe) compared to control group Non-clinical – 72.8%; Mild – 13.6%; Moderate – 11.9%; Severe – 1.7%	N/A	Laterality of facial palsy Severity of facial palsy (House-Brackmann Scale)
Sun et al. (2015)	SDS	No significant difference in levels of depression compared to Chinese norms Clinical range – 9.5%	N/A	N/A
VanSwearingen et al. (1998)	BDI	Mean score in mild range Non-clinical – 35.4%; Mild – 39.6%; Moderate – 12.5%; Severe – 12.5%	Anxiety (BAI)	N/A
VanSwearingen	BDI	Mean score in clinical range	Specific impairment of smiling	N/A

et al. (1999)		Non-clinical – 28.2%; Mild-to-moderate – 71.8%	Facial function (FDI – physical) Positive affect (PANAS)	
Walker et al. (2012)	HADS	Mean score in non-clinical range Moderate-severe – 23.8%	N/A	Severity of facial palsy (Sunnybrook FGS & House-Brackmann Scale)

BAI – Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988). BDI – Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961); FaCE – Facial Clinimetric Evaluation Scale (Kahn et al., 2001); FDI – Facial Disability Index (Van Swearingen & Brach, 1996); FECQ – Facial Expression Communication Questionnaire (Bogart & Matsumoto, 2010); HADS – Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983); IPQ-R – Illness Perception Questionnaire – Revised (Moss-Morris et al., 2002); PANAS – Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988); SDS – Zung Self-Rating Depression Scale (Zung, 1965); SFGS – Sunnybrook Facial Grading Scale (Ross, Fradet, & Nedzelski, 1996).

Table 6 – Summary of studies investigating the impact of facial palsy (and related factors) on social function and Quality of Life

Study	Measure of social function/QoL	Factors related to social function/QoL	Factors unrelated to social function/QoL
Bogart & Matsumoto (2010)	TSBI (social competence) SWLS (satisfaction with life)	Individuals with Moebius syndrome reported significantly lower levels of social competence than controls	Individuals with Moebius syndrome reported similar levels of life satisfaction as controls Life satisfaction and social competence not associated with impairment in communicating emotions with the face
Chang et al. (2016)	EQ-5D (health-related QoL)	N/A	No significant difference in QoL between individuals with facial palsy and the general population
Coulson et al. (2004)	FDI (facial palsy-related social function) SF-36 (health-related QoL)	Individuals with effective emotional expression reported higher social function than physical function (SF-36) Individuals without effective emotional expression reported higher levels of physical than social function (SF-36)	N/A
Györi et al. (2018)	FaCE (facial palsy-related social function) FDI (facial palsy-related social function)	FaCE social function associated with SF-36 social functioning, mental health and emotional health FDI social function associated with SF-36 social functioning and mental health	No association between Sunnybrook FGS score and FDI social function or any SF-36 domain

	SF-36 (health-related QoL)		
Kleiss et al. (2015)	FaCE (facial palsy-related social function) FDI (facial palsy-related social function) SF-36 (health-related QoL)	FaCE social function positively associated with all domains of the SF-36 FaCE social function negatively associated with objective severity of facial palsy (Sunnybrook FGS)	No association between FaCE social function and objective severity of facial palsy (House-Brackmann Scale)
Lee et al. (2007)	FaCE (facial palsy-related social function)	Individuals with facial palsy following vestibular schwannoma resection reported significantly poorer social function than individuals with normal facial function after resection	No association between FaCE social function and: objective severity of facial palsy (House-Brackmann Scale); age; sex; time since operation and tumour size
Leong & Lesser (2015)	FaCE (facial palsy-related social function)	Female gender predictor of poor social function Better social function in patients who had not received treatment for facial palsy	Age
Marsk et al. (2013)	FaCE (facial palsy-related social function) FDI (facial palsy-related social function) SF-36 (health-related QoL)	Fair (FDI) and moderate-to-good (FaCE) correlation between social function and objective severity of symptoms (Sunnybrook FGS & House-Brackmann Scale)	N/A
Pavese et al. (2014)	FDI (facial palsy-related social function)	Social functioning associated with symmetry at rest (Sunnybrook FGS)	Synkinesis and symmetry of voluntary movement (Sunnybrook FGS)

Prats-Golczer et al. (2017)	FDI (facial palsy-related social function) SF-36 (health-related QoL)	Social functioning significantly worse than baseline after one week, but better than baseline at 3 and 12 months, following onset of facial palsy due to parotidectomy,	SF-36 scores did not significantly differ before and after the onset of facial palsy
Ryu, Lim, Cho & Kim (2016)	FDI (facial palsy-related social function) SF-36 (health-related QoL)	People with right-sided facial palsy reported significantly lower social function (FDI) and QoL (SF-36) than people with left-sided facial palsy	N/A
Sun et al. 2015	SF-36 (health-related QoL)	Patients with facial palsy reported better General Health and Vitality than the general Chinese population norms	No difference between patients with facial palsy and population norms on all other domains of the SF-36
Volk et al. (2016)	FaCE (facial palsy-related social function) FDI (facial palsy-related social function) SF-36 (health-related QoL)	Older age associated with poorer social functioning (FDI, FaCE & SF-36) and poorer mental health (SF-36) Females had significantly lower social functioning (FDI & FaCE) Poorer SF-36 social function associated with higher House-Brackmann Scale grade.	N/A

EQ-5D – EuroQoL 5 Dimensions Questionnaire (The EuroQoL group, 1990); FaCE – Facial Clinimetric Evaluation Scale (Kahn et al., 2001); FDI – Facial Disability Index (Van Swearingen & Brach, 1996); SF-36 – Short Form 36 Health Survey Questionnaire (Ware Jr & Sherbourne, 1992); SWLS – Satisfaction with life scale (Diener, Emmons, Larsen, & Griffin, 1985); TSBI – Texas Social Behaviour Inventory – Short Form B (Helmreich & Stapp, 1974)