CHAPTER 1: INTRODUCTION

1.1. Backgrounds

Temporomandibular disorders (TMD) affect a huge group of people in the general population. Conservative estimate of the number of people in the general population with some form of TMD is about 40% to 60%. However, Solberg et al. (1979) reported in their study that only 10% of the total study group had symptoms that were severe enough to cause the patients to seek treatment, and only 5% of the total study group would be typically described as TMD patients seen in dental clinics with severe problems. This means that less then 10% of the population felt that their problem was severe enough to seek treatment. For many years, functional disturbances of the masticatory system have been identified by a variety of terms. TMD is a general term used to include all disturbances associated with the function of the masticatory system (Bell, 1970). It is mainly divided into masticatory muscle disorders and temporomandibular joint disorders (Okeson, 1996). Masticatory muscle disorders is a collective term used to include all functional disturbances of masticatory muscle. Meanwhile, temporomandibular joint disorders is a collective term used to include all functional disturbances of the temporomandibular joint. For diagnosis of TMD, Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) established by Dworkin and LeResche (1992) is the most popular criteria used in research condition. This diagnostic system allows the diagnosis of the most common forms of TMD, which are the myofascial pain, disc displacements, and degenerative diseases of the TMJ.

Over the years, the confusion and controversy concerning the etiology of TMD continues. According to Okeson (1998), TMD occurs where there are acute changes in

the occlusion or in the presence of orthopaedic instability with loading. Problems that bring the teeth into the intercuspal position are expressed in the muscles. Once the teeth are in occlusion, problems with loading in the masticatory structures are reflected in the joints. On the other hand, other studies (Randow et al., 1976; Magnusson & Endom, 1984) reported that disturbances in the occlusal condition can lead to increased muscle tonus (hyperactivity) and symptoms. Therefore, a good sound occlusal condition is essential for healthy muscle function and mandibular posture (Okeson, 1998).

Many treatment modalities have been advocated for management of TMD. In the first place, TMD may be self-limiting. Okeson (1998) in his review of 30 long-term studies reported that conservative and nonconservative treatments yield the similar success rates of 70-85%. Therefore, it is logical that conservative treatments should be attempted before any other aggressive treatments.

Hard splint is a reversible noninvasive appliance that is traditionally considered as very useful for the conservative treatment of temporomandibular disorders. Clark (1993) in his extensive critical literature review reported that the effectiveness of hard splint in reducing the symptoms of temporomandibular disorders is between 70% and 80%. Another study also reported its effectiveness in about 70-90% of treated patients (Zarb & Speck, 1979). However, its effectiveness was not confirmed through systematic review of randomized controlled trial (Forssell et al, 1999; Al-Ani et al, 2004).

For the last two decades, much attention has been drawn to the use of electromyography (EMG) recording in the diagnosis and treatment of TMD. EMG has been proven to provide excellent information on muscle function under research conditions. However, it has also been demonstrated that relatively small variations in electrode placement can

significantly change EMG recordings (Rugh, 1988). Therefore, recording taken during multiple visits cannot be compared unless extreme care is taken to place the electrode in the exact same location for each recording. However this is not always possible. Sometimes in EMG studies, the differences in the tests are very small and the differences are often less than the variations that occur between patients, such as between male and female, and between thin face and fat face (Oltjen et al., 1990). With such slight differences and such great variations, EMG recordings should not be used without care such as for diagnosis or monitoring treatment of TMD. Some studies (Shi & Wang, 1989; Pinho et al., 2000; Glaros et al., 1997) have reported that TMD is associated with a slight increase in muscle basal tone. However, Glaros et al. (1997) have objected the use of a cut-off score based on EMG values to accurately distinguish TMD patients with myofascial pain from healthy subjects.

It was originally felt that if a painful muscle was in spasm, it will be associated with increased EMG activity. However, studies now demonstrate that muscle pain is often not associated with any significant increase in EMG activity (Majewski & Gale, 1984). Most muscle pain seems to be not a result of myospasms but more of local muscle soreness, trigger point myalgia, or myositis. These conditions are not directly associated with muscle contraction (Okeson, 1998). It is widely accepted in dentistry that the mandibular position and occlusal contact patterns of the teeth can influence the amount of muscle hyperactivity that takes place. Since alteration of occlusal condition can affect muscle function (Riise & Sheikholeslam, 1984), EMG study can be done to assess the effect of splint on muscle function (Kawazoe et al, 1980).

There are different interpretations on how the splint influences the activity of the muscle. The hard splint could reduce muscle activity in TMD patients (Shi & Wang,

1989; Holmgren et al., 1985; Holmgren et al., 1990; Ferrario et al., 2002; Kawazoe et al., 1980). However in healthy subjects, hard splint caused no significant difference in muscle activity (Kawazoe et al., 1980; Christensen, 1990). It appears that the effect of the splint on the TMD patients was different from that of healthy subjects.

Two EMG studies have compared the hard and soft splint (Okeson, 1987; Al-Quran & Lyons, 1999). Okeson (1987) reported that the hard splint significantly reduced nighttime muscle activity while the soft splint significantly increased the muscle activity. Al-Quran and Lyons (1999) reported that the EMG activity of the masseter muscle was non-significantly decreased with hard splint but significantly increased with soft splint. However both of the studies were carried out on healthy subjects and both had small sample size of ten. Therefore it was inconclusive to claim that the hard splint was superior to soft splint.

Pettengill (1998) reported in his study that the soft and hard stabilization appliances may be equally useful in reducing masticatory muscle pain in short-term appliance therapy. Soft splint was easier to fabricate and the cost was lower. Wright et al. (1995) suggested that the soft splint is an effective short-term treatment for reducing the signs and symptoms of masticatory muscle pain in TMD patients, in comparison with palliative treatment and no treatment. Patients also seemed to have better compliance with soft splint compared to hard splint (Wright et al., 1995).

Although soft splint does not offer an optimum occlusal condition, it may still reorganizes the neuromuscular reflex activity, which in turn reduces parafunctional activity that often accompanies periods of stress (Holmgren & Sheikholeslam, 1978; Sheikholeslam et al., 1986). However, the direct measurement of the parafunctional

activity such as nocturnal muscle activity would normally involve great variability especially because of random changing patterns of nocturnal muscle activity. Therefore, the effect of the splint on the parafunctional activity might need to be conjectured from other design of the study. For an example, the static maximum clenching activity might resemble the dynamic grinding activity at each point of time. For individual with parafunctional habit who clenched his teeth, the maximum clenching activity might probably refer to the greatest damaging effect of his parafunctional clenching.

To date, no EMG study has investigated the effect of soft splint on masticatory muscle activities of the TMD patients. The only two published papers (al-Quran & Lyons, 1999; Okeson, 1987) that reported on the effect of soft splint on the EMG muscle activity was actually based on healthy subjects but not on TMD patients. There was also no EMG study that has compared the effect of soft splint on TMD patients with healthy subjects. Moreover, there was also no EMG study that has investigated the effect of soft splint on the postural activity of the masticatory muscle.

1.2. Objectives

The objectives of this study were:

1. To assess the effectiveness of soft splint in reducing the postural and clenching EMG activity of the anterior temporal and masseter muscles in TMD patients. This was done by comparing the EMG activities before and after insertion of soft splint. Healthy control subjects were also assessed to see whether the soft splint would cause different effect on them compared to TMD patients.

2. To assess again the effectiveness of soft splint in reducing the postural and clenching EMG activity in TMD patients after six weeks of conservative treatments, to see whether the muscles activities of the TMD patients after conservative treatments would be similar to that of the healthy subjects in terms of their response towards the soft splint.

3. To explore the effectiveness of conservative treatments in relieving the symptoms of TMD especially in resolving the pain of patients to resume routine oral function. The conservative treatments comprised patient education and self-care, analgesics and soft splint.

4. To look for characteristics that were more common among the TMD patients group and then to identify from them those characteristics that might be indicative of soft splint treatment.

1.3. Rationales of study

1. Soft splint was assessed in this study because at the research centre of this study, the splint of choice was normally soft splint. On the other hand, although hard splint was widely used in the treatment of TMD, its effectiveness was still not confirmed through systematic reviews of randomized controlled trial (Forssell et al, 1999; Al-Ani et al, 2004). The studies by Al-Quran and Lyons (1999), and Okeson (1987) were also not conclusive to prove that the soft splint would increase the muscle activity in TMD patients simply because only healthy subjects were tested by them. Thus, in this study, the effect of soft splint was assessed among TMD patients. Meanwhile, as a control, the effect of soft splint in healthy subjects was also assessed to see whether the soft splint would actually cause different effect between TMD patients and healthy subjects.
2. The effect of soft occlusal splint was assessed again after six weeks of conservative treatments to see whether there would be any changes in the muscle activity. Hard splint caused a significant decrease in the muscle activity of TMD patients (Shi and Wang, 1989; Holmgren et al., 1990; Ferrario et al., 2002; Kawazoe et al., 1980); however it caused no significant difference in the muscle activity of healthy subjects (Kawazoe et al., 1980; Christensen, 1980). It was probably because the TMD patients have weaker muscle and therefore was more sensitive to the elongation of the muscle caused by the increased vertical dimension by the splint, as compared to that of healthy subjects. It was suggested that as the TMD patients was recovering from TMD, the muscles also become stronger. This in turns resulted in that the splint caused no significant difference in the muscle activity. Thus, in this study, the TMD patients was followed up after 6 weeks of conservative treatments to see whether the response

of the muscles of TMD patients towards the splint would be more resembling that of the healthy subjects.

3. The conservative treatments that were assessed in this study comprised patient education and self-care, analgesics and soft splint, which was more practical in real clinical situation. Generally, patient education and self-care was the fundamental treatment to other TMD treatment. TMD treatment with the soft splint alone would doom to have less effectiveness, which was also not practical. Since soft splint is generally not recommended to be prescribed as the sole treatment for any TMD patients, this conservative treatment package might suggest one of the ways for the application of soft splint. Analgesics were normally prescribed during acute pain period, which was very helpful for TMD patient practically. Therefore patient education and self-care, and analgesics were incorporated into the conservative treatments as a package in this study. On the other hand, TMD patients normally seek for treatment mainly because of pain and they were more concern in resuming their routine oral function. Thus, in this study the conservative treatments were assessed for their effectiveness in resolving the symptoms of TMD especially in resolving the pain to resume routine oral function.
4. The systematic reviews of randomized controlled trial (Forssell et al, 1999; Al-Ani et al, 2004) reported that there was lack of evidence to support or to oppose the use of hard splint in TMD treatment. This implied that splint might be beneficial for certain group of TMD patient but not others. Thus, this study also tried to look for characteristics that were more common among the TMD patients group and subsequently to identify from them those characteristics that might be indicative of soft splint treatment.