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Review Article

Dentistry Section

Exercise Prescriptions to Prevent Musculoskeletal Disorders in Dentists

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ABSTRACT

Since the number of dental patients is increasing day by day dentists are forced to spend longer times in dental chairs. This is increasing the prevalence of musculoskeletal disorders in dentists. This article reviews the mechanisms causing musculoskeletal disorders among dentists and also covers the exercises that can be done to prevent them. Exercises that increase the fitness of a dentist are divided into aerobic exercises – concentrating on total body fitness, stretching exercises – that concentrate on the muscles that tend to tighten in prolonged dental postures and strengthening exercises – that concentrate on the muscles that are opposite to the tight muscles. These exercises are made simple and of minimal intensity so that a dentist can practice them independently.

Keywords: Dentistry, Ergonomics, Musculoskeletal disorders, Preventive exercises

INTRODUCTION

In the world of increasing dental problems, dentists are exposed to more number of patients. Simultaneously they are also exposed to increased workloads which in turn increased the prevalence of a wide variety of musculoskeletal disorders among them. Hayes et al., (2009) reviewed the prevalence of musculoskeletal disorders among dentists. It is as high as 64–93 per cent with back contributing 36.3–60.1 per cent, neck 19.8–85 per cent and more severe are hand and wrist contributing the highest which is 60–69.5 per cent [1].

The major risk factors associated with musculoskeletal disorders in dentists are repeated unidirectional twisting of trunk (repetitive movements), working in static postures for prolonged period (prolonged static postures), awkward work postures, less flexibility and less core strength (muscle imbalances) [1-3].

Repetitive Movements

Repetitive forces lead to micro trauma which triggers the inflammatory process and results in swelling. In dentistry damage exceeds the rate of repair due to insufficient rest periods [3,4].

Awkward and Prolonged Static Postures

These postures that persist can give rise to muscle necrosis, discomfort, pain or disability which facilitates the development of musculoskeletal disorders [3,5]. This was supported in a study done by Navah Z. et al., in which a significant correlation was said to exist between times spent in sitting and severity of LBA in dentists which was attributed to awkward postures [2].

Muscle Imbalances

Even in optimal postures muscle tension increases causing muscle ischemia and joint hypo mobility because the dentist have to stay in these postures for prolonged period of time. This alters the biomechanics resulting in tightness of one group of muscles and weakness in the opposite group of muscles [3,4,6]. Therefore daily stretches have to be incorporated into their routine. There are also EMG studies supporting this. In these studies they have recorded high muscle activity in splenius and trapezius on the dominant side [7].

There is also a lack of awareness regarding correct posture, prolonged static postures, inadequate operating tools and lack of exercise among dentists [8,9]. Kanteshwari et al., stated that only 90 percent of their study group had ergonomic awareness and also among students who did not suffer any pain 78 percent reported that they were aware of correct posture [10].

Good literature is available on positioning of dentists and patients, light adjustments, use of ergonomically designed equipment and four handed dentistry [11-14] but limited data is available on the exercises that can be done to prevent musculoskeletal disorders among dentists [5,15-16].

Exercises should aim at increasing the overall fitness of a dentist. Fitness is a general term used to describe the ability to perform physical work. Performing physical work efficiently requires a good cardiopulmonary functioning (aerobic fitness), musculoskeletal strength, endurance and flexibility [17].

So, this article gives a detailed prescription of exercises that can be done to prevent musculoskeletal disorders in dentists.

AEROBIC EXERCISES [17]

One major contributing factor for musculoskeletal disorders is decreased flow of nutrients and oxygen to muscles. Aerobic exercises as the name suggest concentrates more on improving oxygen transport by increasing blood flow to the tissues and thereby increasing their efficiency. Since the velocity of blood flows increases they also wash out blood triglycerides. The exercise program should contain warm-up, exercise period and cool down.

Warm-Up

Should be done for 10 minutes and should include total body movements and stretching.

Exercise Period

a. **Intensity:** Should be at 70 per cent heart rate maximum (HRmax– 220-age).
   One should exercise till their heart rate reaches 70 per cent HRmax. This will be somewhat difficult to the person.
b. **Duration:** 20-30 minutes.
c. **Frequency:** 3-4 times a week.
d. **Mode of exercise:** Dentists can choose activities they enjoy which can be walking, biking, running, swimming, stair climbing or weight training.

Cool down period

5-10 minutes whole body movements and stretching.

STRETCHING EXERCISES [17]

After the development of 400 dentistry even the optimal sitting posture [Table/Fig-1] result in muscle tightness because they are maintained for a prolonged period of time. It is said that prolonged

static postures need contraction of 50 per cent of the total body muscles. This calls for the need of stretching the tensed muscles. A stretch that is maintained for 15–30 seconds slowly decreases the tension in the muscles. The stretch force should be slow, gentle and pain free. Each stretch can be done 2–3 times a day which can be even on the dental chair during micro brakes (i.e. 30 seconds brakes between treatments [5,18].

Optimal Dental Posture: Neck slightly flexed, shoulders slightly abducted and flexed, elbows parallel to the floor, hips and knees are flexed with thighs parallel to the floor and feet resting on the floor. Because these positions are to be maintained for longer times the muscles responsible for these positions become tight. So stretching exercises are aimed at these tightened muscles [Table/Fig-1].

Tucked Chin: Sit in the chair and try to tuck the chin (take the chin towards larynx) until a stretch is felt near the posterior hair line. Now gently apply pressure on the occipital region while tipping the head forward (Don not bend the neck too far) [Table/Fig-2].

Scalene stretch: Sit and hold the under surface of the chair with one hand, tuck the chin and side bend the neck to opposite side and rotate to the same side. Now with the other hand a gentle pressure is applied on the head in the direction of the stretch. (stretch is felt on the side of the neck) [Table/Fig-3].

Upper Trapezius: Same as scalene stretch but rotation is done to the opposite side [Table/Fig-4].

Pectoralis Major Stretch: Stand facing the corner of a wall two feet away from it with arms against the wall. Lean the entire body forward from the ankles with knees slightly bent till you feel a stretch on the front of your shoulder [Table/Fig-5].

Hand Stretch: Raise the arm with elbow and wrist extended spread the fingers wide. With other hand bend the wrist and fingers into more extended position (a stretch is felt under the wrist) [Table/Fig-6].

Upper Thoracic Extension Exercises (stretches anterior chest wall): Sit in the chair and place both hands behind the head. Inhale and take both elbows backwards [Table/Fig-7].

Lateral Trunk Stretching: Sit in the chair and bend to one side with opposite hand raised above the head (stretch is felt on the side of the trunk).

Hip Flexor Stretching: Stand with one leg forward and the other backward (legs three feet apart). Bend the front leg forward at the knee while maintaining the back leg straight with knee extended and the heel slightly raised. Shift the body weight on to the front leg (a stretch is felt over the anterior thigh) [Table/Fig-8].

Hamstring Stretching: Sit with the leg to be stretched extended across another chair and lean forwards towards the knees. Stretch is felt under the thigh and knee.

Tensor Fascia Lata Stretch: Stand with the side to be stretched towards a wall and the hand on that side placed on the wall. Cross the leg that is to be stretched behind the other leg. With both feet on the floor, shift your pelvis towards the wall and allow normal knee to bend slightly (stretch is felt on the side of the hip and thigh) [Table/Fig-9].

Calf stretch: Stand on a slope and bend forward with straight spine (stretch is felt on the back of the leg).

STRENGTHENING EXERCISES [17]

Tightness in one group of muscles on a long run results in weakness of opposite group of muscles that further aggravate the bad posture. It is said that strengthening exercises increase the power and endurance of a muscle. Initially start with minimal load. They should be done smoothly and should be pain free. Eight-ten repetitions per set and two to three sets can be done per day.

Tucked Chin: Lying on back. Move the chin towards the chest without lifting the head.

Shoulder Retractor Strengthening: Lie on belly, rest the upper arm on table with shoulder at 90º and flex the elbow with forearm over the edge of the table. Lift the arms off the couch maintaining the elbows in the same position till the shoulder blades come close to each other. Progression-Add a small weight in the hand [Table/Fig-10].

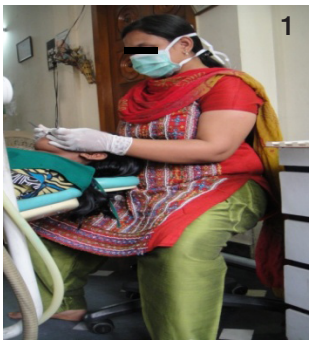
Shoulder Rotator Strengthening: Position as in Exercise 2. Instead of lifting the arms rotate the forearms first in one direction and then in other [Table/Fig-11,12].

Shoulder Depressor Strengthening: Sit on a hard surface and push the body upwards with the help of the hands [Table/Fig-13].

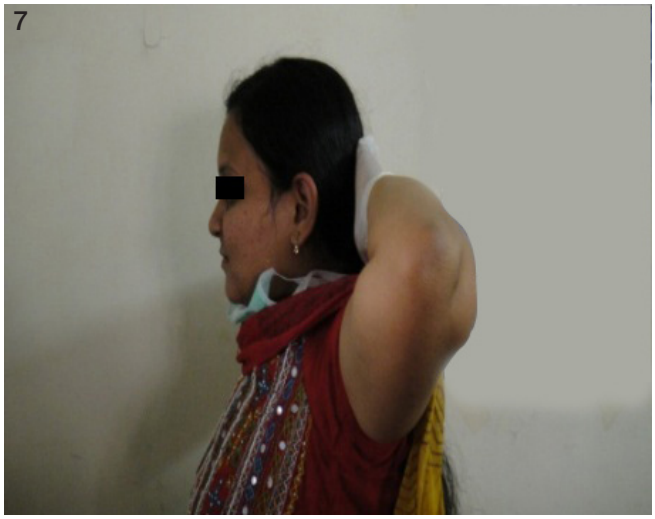
Serratus Anterior Strengthening: Lie on your back and lift the arm to 90º with elbow straight. Raise the shoulder off the table. Progression-add a 1/2 Kg weight in hand [Table/Fig-14].

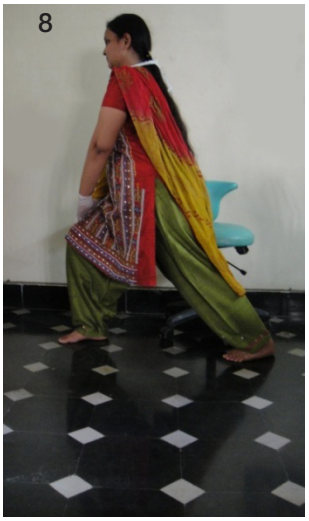
Spinal Extensor Strengthening

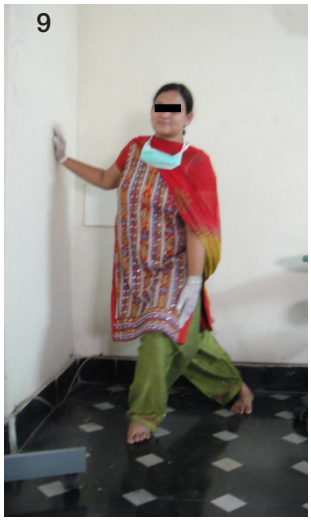
Bridging: Lie on your back and place arms at sides. Lift he buttocks off the couch [Table/Fig-15].

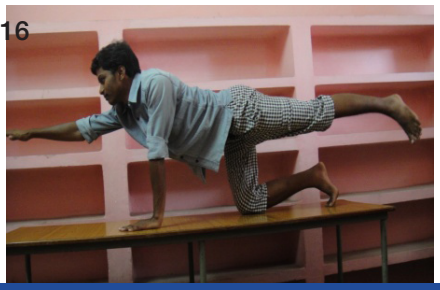


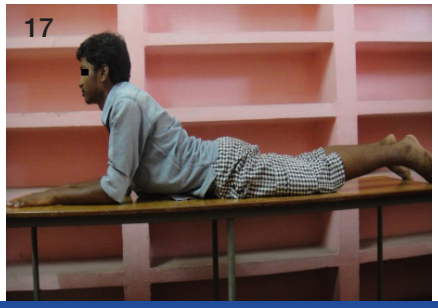
[Table/Fig-1]: Optimal dental posture **[Table/Fig-2]:** Tucked chins **[Table/Fig-3]**: Scalene stretch **[Table/Fig-4]:** Upper trapezius **[Table/Fig-5]:** Pectoralis major **[Table/Fig-6]:** Hand stretch











[Table/Fig-7]: Upper thoracic extension **[Table/Fig-8]:** Hip flexor stretching; **[Table/Fig-9]:** Tensor Fascia Lata Stretching
[Table/Fig-10]: Shoulder retractor Strengthening **[Table/Fig-11]:** Shoulder external rotator strengthening **[Table/Fig-12]:** Shoulder internal rotator strengthening
[Table/Fig-13]: Shoulder depressor strengthening **[Table/Fig-14]:** Serratus anterior strengthening
[Table/Fig-15]: Bridging **[Table/Fig-16]:** Multifedus strengthening **[Table/Fig-17]:** Back extensor strengthening **[Table/Fig-18]:** Quadriceps strengthening

Multifidus Strengthening: First lift one hand and opposite leg, look at the hand. Repeat with the other side [Table/Fig-16].

Erector muscle strengthening: Lie on your belly and lift the trunk on your elbows [Table/Fig-17].

Quadriceps Strengthening: Sit on a chair and lift the leg keeping the knee straight [Table/Fig-18].

Hands Strengthening: Press soft balls or putty clay of different sizes.

DISCUSSION

Many studies proved the lack of awareness among dentists regarding their own problem which might shorten their professional carrier [8–10]. There are also studies supporting the importance of exercises in preventing musculoskeletal disorders but a clear prescription of them was limited [5,15,16]. So, with the aim of increasing awareness about preventive exercises in dentists we tried to place musculoskeletal disorder prevention right in the hands of dentists themselves.

The majority of dental practitioners are at a major risk for developing work related musculo skeletal disorders and their prevalence was reviewed to be as high as 93 per cent [1]. The risk factors responsible for these disorders are multifactorial. Bethany Valachi and Keith Valachi in their article on musculoskeletal health of dental professionals stated that the major risk factors are prolonged working postures, repetitive movements, awkward postures, lack of muscle flexibility and strength [3]. There are also studies supporting the increased muscle activity among dentists during their work. E. Milerad et al., studied the muscle activity in neck, shoulder and arm muscles during ordinary dental work and found high muscular loads

in both sides' trapezius and dominant side extensor carpi radialis [18]. Lotte Finsen et al., also found increased muscle activity levels in upper trapezius and splenius during different dental works [7]. Warren N. in his article on causes of musculoskeletal disorders stated that psychosocial problems are also to be considered as risk factors in the development of musculoskeletal disorders in dentists [19]. Another contributing factor responsible for the development of musculoskeletal disorders in dentists is a lack of awareness regarding these disorders. Vishwas Madaan and Amit Chaudhari in their cross sectional study among dental students of 3rd year, 4th year students and interns at MGM dental college in Navi Mumbai, India concluded that the students are prone to development of musculoskeletal pain due to lack of awareness regarding the risk factors and preventive exercises [8]. Pooja Sharma and Vineet Golchha in their study on 102 Indian dentists also found a significant correlation between number of sessions taken for physical activity and self perceived improvement in the symptoms using Pearson Correlation test. They also stated that self-awareness and benefits of regular exercises is the need of the hour [9].

Bethany Valachi and Keith Valachi in their article on preventing musculoskeletal disorders in clinical dentistry addressed the issues of postural awareness techniques, use of magnification, positioning strategies, importance of periodic breaks, stretching and strengthening exercises. In this study they named the muscles that are to be exercised and general guidelines for doing these exercises. But the exact position and method of exercising each muscle is not clearly mentioned [3]. Allan C. Jones and Shad Forsythe in their article on functional training for dentistry covered exercises under three categories that included torso training addressing the spinal core strength, strength training that include both upper and lower body strengthening and interval training that addresses the aerobic endurance of the whole body [15]. Though these exercises form an excellent training for dentists they are at a higher intensity level and in the interval training part of the exercise the authors mentioned that the exercises should be done at maximum exertion level. But what do they mean by maximum exertion level was not clearly stated. So to address the problem in this article we mentioned a clearer version of aerobic exercise programme. In addition to this, small chair side exercises that target the specific muscles if done on a regular basis will help in preventing the musculoskeletal pain in dental profession. So in this article we tried to emphasise more on strengthening the weak muscles, stretching the tight muscles and improving the aerobic and muscular endurance. These exercises are mainly aimed at preparing the muscles to withstand the increasing forces involved in activities that the dentist needs to perform in his daily practice. The aerobic part of the exercises in addition to decreases the professional stress also helps to increase the overall health of a dentist. Also with the aim of increasing awareness about preventive exercises and placing prevention right in the hands of dentists we made these exercises as simple as possible so that the dentists can practice them chair side.

These exercises are proved to be effective to address the specific muscles [19]. But further studies are recommended to prove the efficacy of these exercises in dental population. Once their efficacy is proved they should be included in the curriculum of dental education so that prevention of musculoskeletal disorders is learnt from the beginning of the profession.

CONCLUSION

With respect to the increased prevalence of musculoskeletal disorders in dental profession there seems to be an urgent need of implementing preventive strategies. This can much effectively be done if the mechanisms leading to musculoskeletal disorders are brought into their notice and if the strategies to be followed are taught to them. This enables the dentists to concentrate on patient care.

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