

# The prevalence of musculoskeletal disorders among dentists in KwaZulu-Natal

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## ABSTRACT

Occupational hazards in dentistry can result in injuries and reduced income if work -time is lost. Injuries include percutaneous insults, inhalation of noxious chemicals, hearing loss and musculoskeletal disorders (MSD). The prevalence of MSD among South African dentists is uncertain. This descriptive, cross-sectional study was conducted to determine that prevalence and associated risk factors among dentists in KwaZulu-Natal (KZN), South Africa. A convenience sample (n=350) of dentists registered with the South African Dental Association (SADA) were sent a questionnaire interrogating their medical and work history and their work-related posture. One hundred and nine (31%) responded.

Almost all (99.1%) reported pain in the hands, neck, lower back and/or a shoulder, while 22.5% reported hand symptoms. Nearly three quarters (73.6%) rotated their necks during clinical work and 68.6% tilted a shoulder towards their dominant hand. A strong association ( $p$  value = 0) was found between the number of years in practice and work-related pain in the neck. The prevalence of MSD was very high when compared with international data.

Self-recognition is most important in preventing occupational injuries. This study suggests the need to include ergonomic work practice during training to create awareness of the risk of MSD and to promote wellbeing.

**Keywords:** Prevalence, musculoskeletal disorders, dentists, risk factors, ergonomics

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## INTRODUCTION

Occupational hazards are common among many professions and dentistry is no exception. The occupational hazards reported by dentists include percutaneous injuries, inhalation of noxious chemicals, loss of hearing and musculoskeletal disorders (MSD).<sup>1</sup>

The high prevalence of MSD pain among dentists is well documented, constituting a major health problem, especially as back pain.<sup>2</sup> A summary of published MSD prevalence rates are provided in Table 1 and the paucity of data relating to dentists in South Africa is noted. Possible risk factors of MSD have been classified as biomechanical, ergonomic and work factors (psychosocial risk factors due to job stress).<sup>3</sup> "Self-recognition" of the problem is generally the first step in alerting the clinician of the need to consider changes. Dentists have also been advised to seek and receive education about their musculoskeletal health, injury prevention and ergonomics to improve their working environment.<sup>4,5</sup>

Ninety four per cent of dentists in a study in South East Turkey reported one or more pain symptom while a high prevalence of pain was also reported among Taiwanese (92.4%)<sup>9</sup> and Australian dentists (87.2%).<sup>2</sup> Similar high prevalences were found in Spain (79.8%)<sup>7</sup> and Greece (62%).

Moradia and Patel reported that 63.6% of dentists in Surat City in Gujarat, India, had at least one kind of occupational pain either in the neck, back or shoulder or a combination of these conditions and nearly 96% recorded that the pain had begun when they started practising dentistry.<sup>8</sup> Shrestha, Singh and Niraula researched the work-related complaints among dentists in Biratnager and Daran in Nepal.<sup>13</sup> Seventy nine per cent of respondents in those studies had experienced backache in the previous year.<sup>13</sup> A systematic review by Hayes *et al.* reported an overall MSD prevalence among dentists of between 64-93% with back and neck listed as the most prevalent regions for pain.<sup>16</sup>

Rising *et al.*'s study investigated the body distribution and severity of musculoskeletal pain in dental students and reported an incidence of between 46%-71%.<sup>20</sup> The most frequently affected area was in the neck and shoulder area, followed by mid back, lower back, right arm/hand and left arm/hand. A significantly higher prevalence of pain was reported among dental students who were enrolled in

**Table 1:** Summary of Musculoskeletal (MSD) prevalence rates

Author & Year	Country	Participants	Overall MSD(%)	Back (%)	Hand & wrist (%)	Neck (%)	Shoulder(%)	Lower extremities(%)
Ellapen <i>et al.</i> 2007 <sup>6</sup>	South Africa	Dentists n=94	54.26	49.32	18.75 (wrist)		16.7	12.5
Harutunian <i>et al.</i> 2011 <sup>7</sup>	Spain	Dental students & staff n=74	79.8	40.0	27.1 (wrist)	58	24.3	
Moradia & Patel, 2011 <sup>8</sup>	India	Dentists n=77	63.6	75.5	2.04 (wrist)	42.9	22.5	2.04
Lin <i>et al.</i> 2012 <sup>9</sup>	Taiwan	Dentists n=197	92.4	66.5 (lower)		71.6	75.1	
Samat <i>et al.</i> 2011 <sup>10</sup>	Malaysia	Dental team		44.9				
Pargali & Jowkar, 2010 <sup>11</sup>	Iran	Dentists n=82		33		28		
Booyens <i>et al.</i> 2009 <sup>12</sup>	South Africa	Dental Hygienists n=362		59.6	61.3 (hand)	66.5	56.6	
Shresta <i>et al.</i> 2008 <sup>13</sup>	Nepal	Dentists n=68		79.4		58.8	47	
Polat <i>et al.</i> 2007 <sup>14</sup>	Turkey	Dentists n=120	94	30.63		23.75		23.3 (arms and legs)
Leggat & Smith, 2007 <sup>2</sup>	Australia	Dentists n=285	87.2	53.7 (lower back)		57.5	53.3	
Alexopoulos <i>et al.</i> 2004 <sup>15</sup>	Greece	Dentists n=430	62	46 (lower back)	26	26	20	
Hayes <i>et al.</i> 2006 <sup>16</sup>	Review	Dentists	64-93	36.3-60.1		19.8-85		
Rucker & Sunell, 2002 <sup>17</sup>	Canada	Dentists n=421		19	9	24	18	
Szymanska, 2002 <sup>18</sup>	Poland	Dentists n=268		60.1	44	56.3	51.5	47.8
Al Wazzen <i>et al.</i> 2001 <sup>19</sup>	Saudi Arabia	Dentists n=91 Assistants n=72 Technicians n=29 Hygienists n=12		73.5		54.4		

clinical skills training and who were engaged in performing dental procedures.<sup>20</sup>

Ellapen *et al.* reported in a study carried out in South Africa (on dentists from Durban and Verulam) that the frequency of pain and discomfort was 49.3 % in the vertebral area, 18.7% in the wrist, 16.6% in the shoulder and 12.5% in the lower leg.<sup>6</sup>

The data presented in Table 1 confirms that MSD is a problem internationally which stems from poor postures, extended work hour and working without an assistant. Instrument and surgery design and education and training can help to address some of these issues. Given the lack of data on prevalence and distribution of MSD among South African dentists, this study aimed to measure the prevalence of MSD among dentists in KZN and to determine the risk factors associated with the affliction.

## METHODOLOGY

This cross-sectional, descriptive study was conducted to determine the self-reported prevalence of MSD among dentists (n=350) who attended the regional South African

Dental Association (SADA) conference in March 2011. This convenience sample was informed about the study and invited to participate. Completed questionnaires were received from 109 conference attendees.

The explorative nature of the study both in Africa and in this field was taken into consideration when the questionnaire was developed by the researcher. It was self-administered and contained questions aimed at gathering quantitative data. Information was collected on the socio-demographic details of the respondents (age, gender, height, weight and practice), their medical history and the nature of their daily work (intensity, work load, hours spent at work and the average number of days worked per week) and their habitual work posture (patient positioning, chair position). A pilot study was conducted to test the data collection instrument for reliability and validity. Pain was reported by the dental respondents themselves and measurement bias was prevented by requesting them to plot the pain on a body chart which illustrated well-defined anatomical boundaries, a process which was based on an approach by researchers who investigated carpal tunnel syndrome amongst dental hygienists.<sup>21</sup>

Ethical approval to carry out the study was obtained from the Senate Research Ethics Committee of the University of Western Cape (ref no. 11/4/28).

## DATA ANALYSIS

Data were coded and entered into an Excel spreadsheet. Basic descriptive analysis of the demographic factors was completed using Excel and then the data was imported into SPSS® version 20 for more complex statistical analyses. An independent t-test was used to determine any correlation between the scale variables and the Chi-square test was used to determine the association between the nominal and the ordinal variables. The level of significance was set at 0.05.

## LIMITATIONS OF THE STUDY

Self-reported data is sometimes considered a limitation. Dentists could over- or under- report data about pain. However, completing the questionnaire posed no direct benefit to the respondent so there was no incentive to provide any other than accurate responses. The study might have been strengthened by actually observing the dentists at work when more accurate data on the presence and extent of muscle strain could have been secured.

## RESULTS

One hundred and nine dentists (31%) responded to the questionnaire, the majority of whom were male (72.5%). A third of the respondents were aged between 30 – 39 years (30.8%). Nearly two thirds (62.4%) of the dentists considered that they were in good health and reported no medical conditions. However, 18 had hypertension, 15 were diabetic, five reported having arthritis and two reported carpal-tunnel syndrome. The body mass index of the respondents indicated that more than a third (37.3%) were overweight and 16.7% obese. A quarter of the sample (25.5%) did not participate in any form of exercise. Nearly 50% of those who indicated that they exercised performed high impact cardio- routines. Other exercises included stretching and toning (28.4%) as well as yoga and relaxation (9.2%).

A third of the respondents had been in practice for more than 21 years. The majority of the dentists worked five to six days per week (86.2%) and seven to nine hours per day (78.9%). There was no significant relationship between the number of years in practice and the levels of pain experienced ( $p=0.364$ ).

Nearly one hundred dentists (90.8%) were right handed. Slightly more than half of the respondents (52.7%) spent more than 45% of their time on restorative dentistry and about half reported spending approximately 50% of their time in the standing position.

Two-thirds (67%) of the respondents performed four-handed dentistry (working with one dental assistant) and less than 6% performed six -handed dentistry (working with two dental assistants). Almost a third (27.4%) of dentists worked with no dental assistant (Figure 1).

Three quarters (74.8%) reported using a finger rest while doing restorative procedures and during scaling and polishing. Most dentists in this study (58.5%) used the 9 to

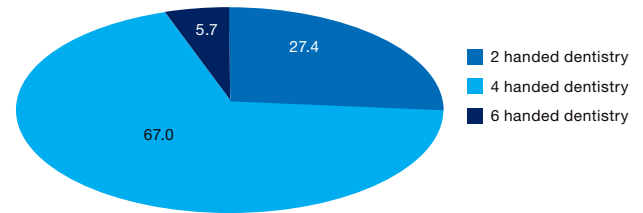


Figure 1: Working with a dental assistant

Table 2: Prevalence of Pain (n=109)

	Prevalence of pain
Lower Back	99.1
Shoulder	98.2
Neck	98.2
Hands	22.5
Total Prevalence (dentist reporting pain in one or multiple sites)	99.1

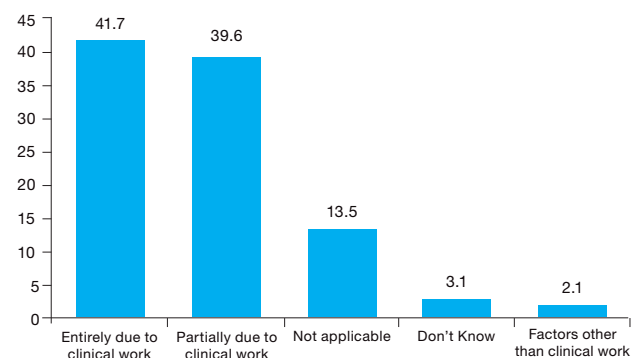


Figure 2: Reasons for pain (n=109)

12 o'clock position when working with a dental assistant. Two thirds (62.7%) reported that they worked with their dominant hand below the work area and sixty four dentists reported working with their dominant elbow below. Nearly three quarters of the responding dentists (73.6%) rotated their necks while performing clinical work while a third tilted their shoulders towards their dominant hand.

The overall reported prevalence of MSD was 99.1% (dentist reporting pain in one or in multiple sites). As illustrated in Table 2, nearly the entire sample reported pain in the neck (98.2%), lower back (99.1%) and the shoulder (98.2%). Less than a quarter (22.5%) reported hand pain, numbness in the hands and 24.4%, a tingling sensation in the hands while performing clinical work. More than half (53.3%) reported severe neck pain and 78.2% reported mild and moderate lower back pain. The ratings for shoulder pain were the lowest. As indicated in Figure 2, clinical work was perceived as the most common reason for pain (81%).

Respondents with hand pain were asked to plot the location of the pain on a chart depicting a hand. These results are illustrated in Figure 3. The thenar eminence is a muscle group located in the thumb and on the palm of the hand which allows for different movements of the thumb and this was the most plotted site for pain.

## PAIN IN THE HANDS

The majority of the respondents (78%) indicated that they had no negative effects when performing restorative work and scaling and polishing. When asked about numbness

as an effect of pain, one dentist indicated extreme levels (Table 3). These respondents noted a slight increase in pain which extended from their working hours and continued into the night.

### DISCUSSION

The present study investigated the prevalence of, and identified risk factors associated with, musculoskeletal disorders among dentists in KwaZulu-Natal.

The prevalence of pain in the neck, lower back and shoulder is extremely high among this group (99.1%). These findings are similar to those of Lin *et al.* (2012) who reported (92.3%) of pain among Taiwanese dentists<sup>9</sup>, as did Leggat and Smith (2006) among Australian dentists<sup>2</sup> and Polat *et al.* (2007) who found that 94% of dentists suffered at least one MSD.<sup>14</sup> Nearly 80% pain prevalence was reported by Harutunian *et al.*<sup>7</sup> while a Greek study reported 62% of dentists with at least one musculoskeletal complaint.<sup>15</sup> The high prevalence of MSD sets the scene for poor health outcomes among dentists.

Symptoms of pain, numbness and tingling in the hands were found to be more intense at night than while performing restorative procedures and scaling and polishing. Similar results were reported by Alexopoulos *et al.*, Elapen *et al.* and Harutunian *et al.*<sup>6,7,15</sup> but were not as high in the Taiwanese study by Lin *et al.*, who recorded a 41% prevalence of hand symptoms.<sup>9</sup>

BMI was not identified as a significant risk factor, despite the fact that just over a third of the respondents were overweight or obese (16.7%). Similar results were found in the Malaysian study conducted by Samat *et al.*<sup>10</sup> Although there was no significant relationship between pain and BMI, weight control is critical in the overall health of a dentist, as an increase in weight increases the load on the back muscles, and may be the cause of any subsequent pain. Although there was no correlation between BMI and MSD in this study, BMI should not be ignored as a risk factor for MSD.

**Table 3: Symptoms of the hand while working**

Pain				
	Frequency	Percent	Valid Percent	p-value
No pain	76	69.7	77.6	0.000
Moderate pain	19	17.4	19.4	
Extreme pain	3	2.8	3.1	
<b>Total</b>	<b>98</b>	<b>89.9</b>	<b>100</b>	
Numbness				
	Frequency	Percent	Valid Percent	p-value
No numbness	79	72.5	80.6	0.000
Moderate numbness	18	16.5	18.4	
Extreme numbness	1	0.9	1	
<b>Total</b>	<b>98</b>	<b>89.9</b>	<b>100</b>	
Tingling				
	Frequency	Percent	Valid Percent	p-value
No tingling	74	67.9	75.5	0.000
Moderate tingling	22	20.2	22.5	
Extreme tingling	2	1.8	2	
<b>Total</b>	<b>98</b>	<b>89.9</b>	<b>100</b>	

More than half of the respondents spent more than 45% of their time on restorative dentistry. Nearly a third of the time was spent on administration, prosthetics and scaling and polishing. The ideal workday should be divided between all categories of dentistry. If one performs clinical work in a seated position for a long time it impacts on the muscles of the lower back especially if these muscles are not supported. This is aggravated when the dentist works with his/her neck in the forward position, resulting in neck and shoulder pain.

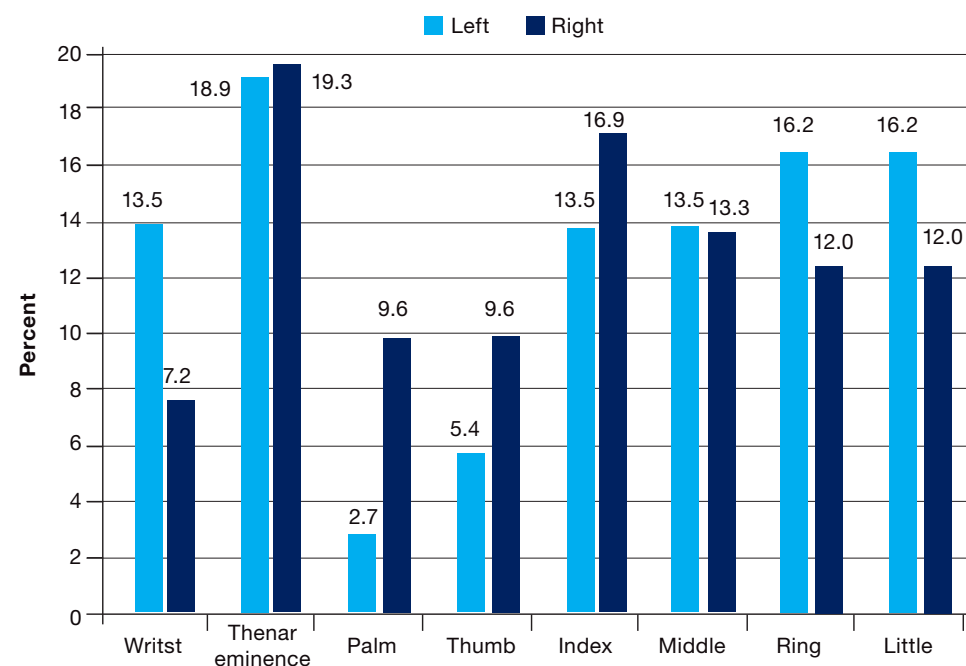


Figure 3: Pain as plotted on the hand chart

The high prevalence of neck and back pain recorded in this study could be due to the numerous dentists who acknowledged they routinely performed neck rotation. These colleagues spent approximately half their working time in the standing position. This proportion was slightly higher than that reported by Symanska (27.6%),<sup>16</sup> and much less than Marklin and Cherney<sup>22</sup> who reported on dentists who spent 78% of their time in a seated position. Standing was the preferred practice position (only 11.7% used the sitting position while working) for dentists in the Polat *et al.* study.<sup>14</sup>



Dentists should adopt various positions while at work. In fact, it is recommended that they alternate between standing and sitting. When one does so, different sets of muscles alternate thereby allowing the other set of muscles to relax.<sup>23</sup> Furthermore, Moradia and Patel also reported that sitting or standing for a long time was the factor that most aggravated the pain.<sup>8</sup> Prolonged standing further puts the dentist at risk of varicose veins and haemorrhoids.<sup>23</sup> Static postures for long periods cause fatigue and a decrease in microcirculation, increase in pressure and insufficient removal of lactic acid, all leading to pain.

In the present study, just over two thirds of the dentists performed four-handed dentistry; lower than the 99% reported by Rucker and Sunell<sup>17</sup> and the 100% reported by Polat *et al.*<sup>14</sup> but similar to results reported by Szymanska in which just over a third worked without a dental assistant.<sup>18</sup> Practising four and six handed dentistry offers an advantage as it allows the dentist to save time and permits resting of the back muscles and lower extremities.<sup>21</sup> From an ergonomic point of view, six handed dentistry is the ideal and yet in this study less than 6% of the sample practised in this way. Dentists in KZN should consider working with two assistants to enhance efficacy and to reduce the possibilities of pain. However Kumar *et al.*<sup>24</sup> reported that dentists working with assistants described a higher prevalence of hip and thigh symptoms and as noted above, it is recommended that while working with an assistant, it is advisable to alternate between standing and sitting.<sup>24</sup>

Nearly three quarters of dentists in this study indicated that they used a finger rest all of the time whilst undertaking restorative procedures and scaling and polishing. The use of hand and finger rests balances the fatigue of the forearms during fine motor activities and therefore can prevent shoulder and hand injuries. This is supported by the findings of the present study as nearly 80% reported no pain during delivery of restorative treatment and of scaling and polishing.

The most common work position reported in this study was the 2 o'clock position, and the range of work positions varied from 9 to 12 o'clock. This was similar to the findings of Chaikumarin<sup>24</sup>, who found that 80% of the dentists in that study preferred the 10 o'clock position. There is an increase in MSD associated with the use of the 7 to 8.30 position and 3.30 to 5.30 positions, due to the difficult adaptive postures the dentists have to then adopt. These poor postures include neck rotation, torso twisting and elbow raising and all increase the probability for MSD.

In the current study two thirds of dentists reported that they worked with their dominant hand below the work area - unlike a report by Rucker and Sunell who found that 66% of their sample raised their dominant elbow while working.<sup>17</sup> Elbow raising increases the risk of MSD. Dentists who do so while working have a 50% chance of experiencing hand, neck, shoulder and upper back pain.<sup>17</sup>

Shoulder tipping is associated with hand pain while neck rotation is associated with neck pain.<sup>17</sup> Nearly three quarters of dentists in this study rotated their necks while performing clinical dentistry, which predisposes them to pain. Only a third of the respondents tilted their shoulders towards their dominant hand, a posture which predisposes

them to hand pain. The frequency of neck rotation is high in this study when compared with other reports in the literature and this is a possible explanation for the high prevalence of neck pain.

More than 80% of the present respondents identified clinical work as the major reason for their pain. This figure is very high when compared with findings from Rucker and Sunell where only one in three dentists attributed their pain entirely to their clinical work.<sup>17</sup> In review studies conducted by Hayes *et al.*<sup>16</sup> and Leggat *et al.*<sup>23</sup> the authors recognised the contribution of MSD to increased sick leave, reduced productivity and early retirement from the profession. Literature in this regard is however, conflicting. Shrestha *et al.*<sup>13</sup> found no relationship between absenteeism and pain. Rucker and Sunell, on the other hand,<sup>18</sup> reported that nearly 60% of dentists experienced work loss due to MSD and 13% had been obliged to reduce the number of working days per week. A study found that only 15% of dentists applied for sick leave due to pain whilst chronic pain was the cause of absenteeism and seeking medical attention.<sup>7</sup> In the present study, despite having neck, shoulder, hand or back pain in the last year, nearly 70% did not miss work. Only 5% of the participants in the present study reported being absent from work due to severe pain. The fact that most were self-employed dentists in the private sector who are directly responsible for their income could be a possible reason for this relatively low percentage.

There was no significant relationship between absenteeism and pain in the neck, nor any relationship between neck rotation and pain in the neck while clinical work was performed. However, a strong association was found between pain in the neck during clinical work and the number of years in practice ( $p < 0.001$ ).

With regard to exercising, two statistically significant relationships were identified, firstly between pain while performing clinical work and frequency of exercise and secondly between the severity of the pain and frequency of exercise. Nearly a quarter of the present sample was not involved in any exercise routine; however, there was no significant relationship between exercise and pain.

Harutunian *et al.* reported that aerobic activity decreases experience of pain, assists in weight loss and strengthens the torso.<sup>7</sup> Stretching of muscles also assists in relieving back pain. Muscle relaxing exercises and rest were found to ease the pain; while lack of exercise was strongly associated with back pain.<sup>16</sup> Szymanska's study, however, found no significant relationship between physical activity and pain.<sup>18</sup>

A study by Marklin and Cherney<sup>22</sup> reported that dentists spent nearly half their working time with their necks flexed. A reduction in neck and trunk rotation would improve the occupational health of dentists. In the present study, there was no significant relationship between neck rotation and pain in the neck while performing clinical work ( $p$ -value=0.16), but a very strong association between the number of years in practice and pain in the neck while doing clinical work ( $p$ -value=0.001).

Dentists should not ignore pain as medical intervention may be required. Ergonomic changes in their practice and practice environment, lifestyle changes, reduction of

stress and involvement in an exercise routine should all be considered. Dentists are responsible for their own muscular skeletal health and that of their staff. Ignoring pain in the early stages and taking no account of risk factors predisposes dentists to more severe pain which would ultimately require more costly intervention and cause further inconvenience.

## CONCLUSION

MSD is a major occupational health problem among dentists in KZN. Ergonomic work practice should be included in the training of dentists, should be reinforced in clinical training and should be included in CPD activities. The working conditions in dentistry should be improved and there is a need for a preventive program to reduce the risks of MSD. The profession should take these steps to prevent MSD and to make dentistry a safer, healthier career.

A limitation of the study was the relatively low response rate on self-reported data. However it can be deduced that there is a need for dentists in this sample to increase their knowledge of ergonomics and to improve their routines in the practice of dentistry.

There is a need for further studies in South Africa to establish the prevalence of MSD at a national level, and indeed to include in the survey dental therapists, oral hygienists, dental assistants and dental technicians. Investigations are indicated into establishing ergonomically correct dental procedures and in designing ergonomic dental units. Studies in clinical training in dental schools in South Africa should be conducted to improve teaching and clinical supervision so that MSD can be prevented.

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