



Occupational
Health Clinics
for Ontario
Workers Inc.

Centres de
santé des
travailleurs (ses)
de l'Ontario Inc.

Dupuytren's Contracture

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What is Dupuytren's Contracture (DC)?



- DC is a progressive disabling disease of the fascia of the palm and digits
- Results in the thickening and contracture (shortening) of fibrous bands on the palmar surface of the hands and fingers.
- Is a slowly progressive and irreversible flexion (curling in) of the fingers
- Small painless nodule develops in the crease closest to the ring and little finger in the beginning stages
- As it progresses the nodule develops into a fibrous cord extending under the skin of the palm into the finger, drawing the finger towards the palm.

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What is Dupuytren's Contracture (DC)?

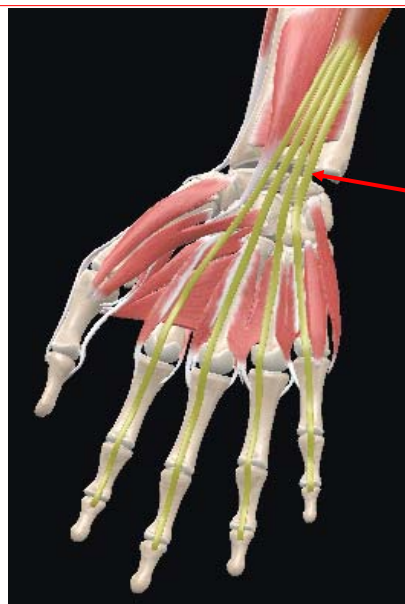


- As fingers are affected it becomes difficult or impossible to do certain daily activities, including getting dressed, washing and any other task involving the use of the hands.
- More common in men than women
- Prevalence increases with age

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Anatomy of the Hand



- Flexor Digitorum Profundus
- Transverse Carpal Ligament
- Flexor Digitorum Profundus Tendons
- Palmar Fascia

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Action of Flexor Digitorum Profundus



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Palmar Fascia



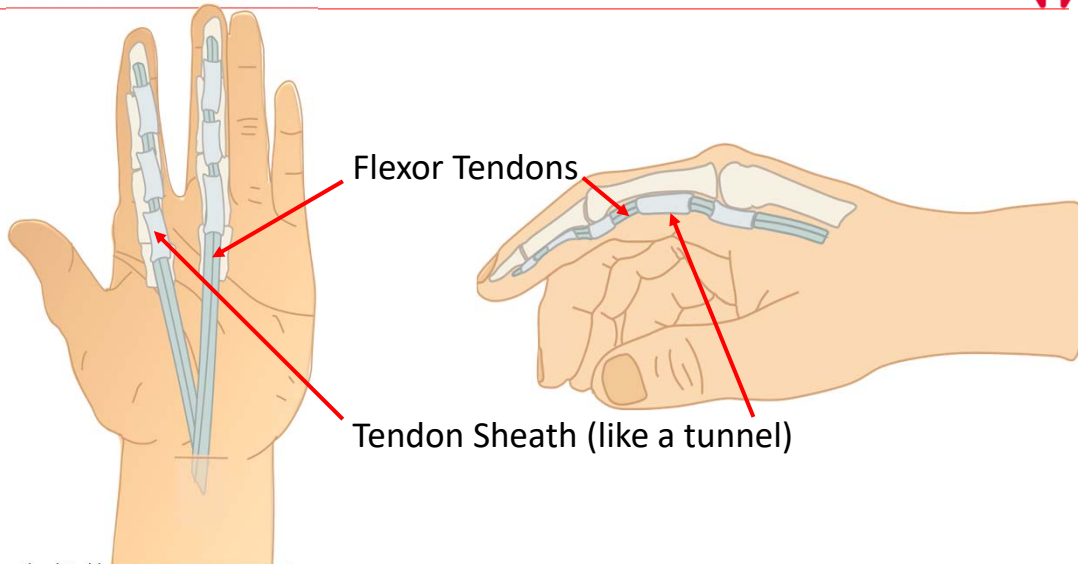
- Triangular in shape
- Has great strength and thickness
- Continuation of the palmaris longus tendon.
- Divides into four slips (one for each finger)
- Provides a tough gripping surface for the hand
- As the nodules from DC form in the palm of the hand they begin to blend, and the skin becomes puckered.
- Skin underlying the fascia contracts, causing an impairment of the hand and finger function



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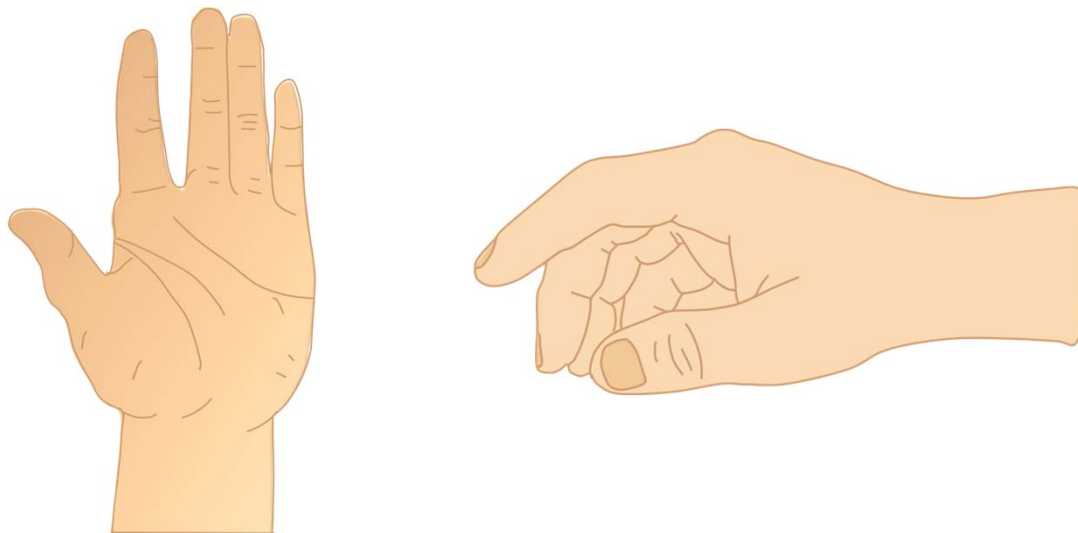
Hand Anatomy



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Progression of DC - Normal Hand



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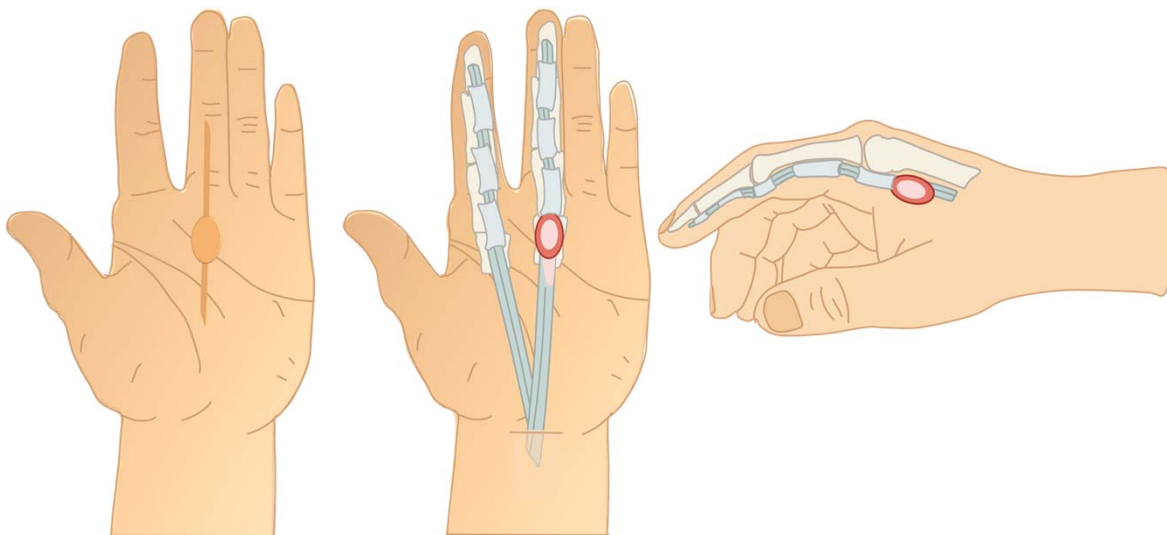
Progression of DC – Nodule Forms Under the Skin



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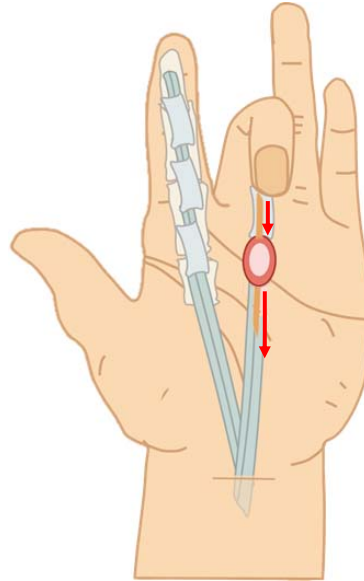
Progression of DC – Fibrous Cord and Nodule are Trapped Behind Sheath



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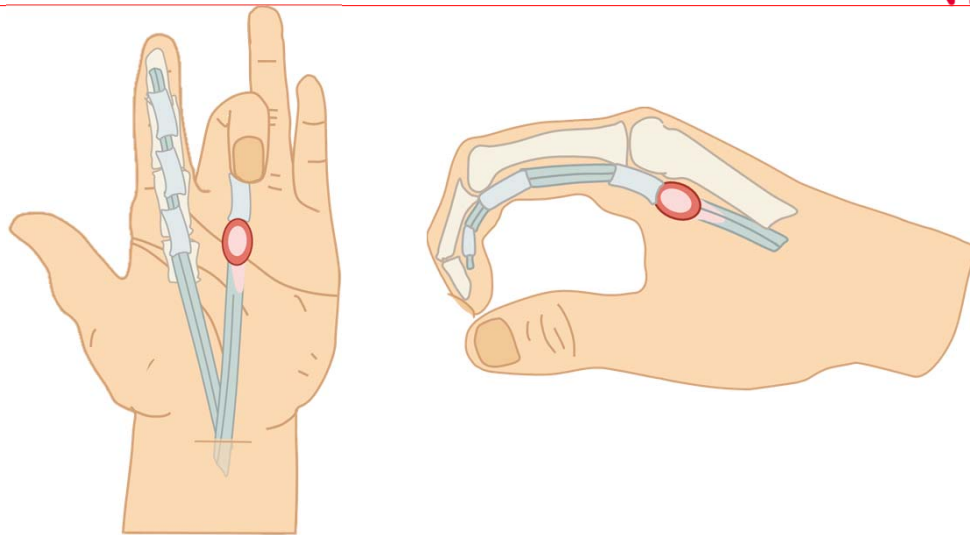
Progression of DC – With Cord Being Rigid and Trapped it Exerts Tension on Tendons



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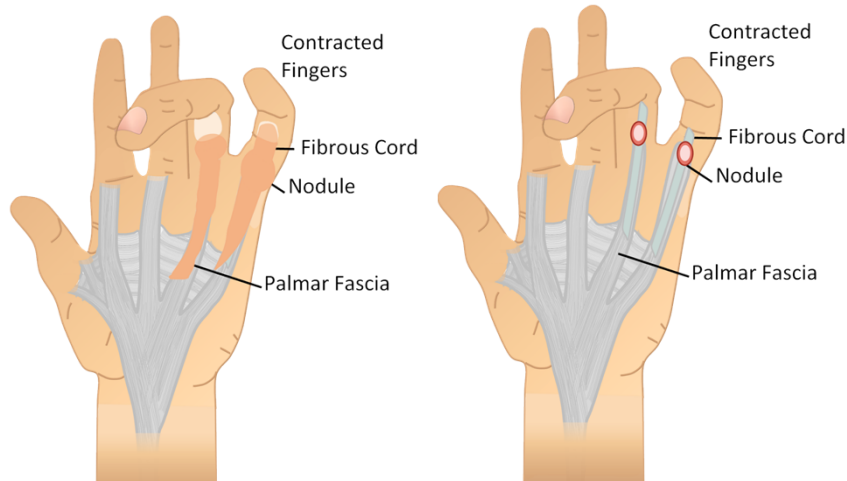
Progression of DC – Finger Begins to Bend Due to Tension



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Progression of DC – Can Occur in Multiple Fingers



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Symptoms of Dupuytren's Contracture



- In the early stages with it begins a lump at the base of the affected finger
- Most commonly affected ring and little finger
- Majority of cases will occur in both hands
- Seldom associated with pain, unless fingers are forced into hyperextension (bent backwards)
- As DC progresses
 - Leads to an inability to extend the affected finger(s) from a flexed position
 - Decrease range of motion of the affected fingers, which can result in a loss of normal grasping.

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Diagnosis



- Typically based on physical examination with no special tests required
- Hand is examined to test flexibility and feeling in the thumb and fingers
- Range of motion in the fingers will be measured
- Measuring and recording the locations of the nodules and bands on the palm
- The contraction or curling of the fingers will be measured in order to compare them to the previous measurements

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Epidemiology 101



- Odds Ratio (OR)
 - Is a measure of association between an exposure and an outcome
 - Represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure
 - Higher the number means greater the association (OR = 2.0 means that the outcome is twice as likely to occur)
 - Close to 1 is a weak or slight association (OR = 1.2 means there is a 20% increase in an outcome with given exposure)
 - Less than 1 is a protective effect (OR = 0.2 means there is an 80% decrease in the odds of an outcome with a given exposure occurring).

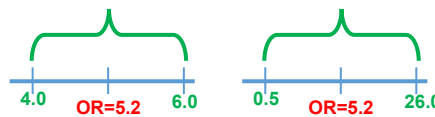
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Epidemiology 101



- Confidence Interval (CI)
 - probability that a population parameter will fall between a set of values for a certain proportion of times.
 - Normally a 95% certainty
 - Narrower CI indicates a more precise estimate, while a wider CI indicates a less precise estimate.



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Causes of Dupuytren's Contracture



- The etiology of DC is extremely complex
- It is one of the least understood and researched Musculoskeletal Disorder (MSD)
- Studies normally consist of small sample sizes making links questionable
- Speculated that non-work-related factors could include:
 - Age > 40
 - Gender (males more likely)
 - Alcohol consumption
 - Diabetes
 - Medicines used to treat seizures
 - Cigarette smoking
 - Nutritional deficiencies
 - Genetic (Scandinavian or Northern European background or family history)

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Age and Gender



- Mostly affects northern Europeans and people of Scandinavian descent (not necessarily true)
- It is more common in men than women
- The condition usually starts in middle age

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Alcohol Consumption



- Research has found increased risk when the number of alcoholic beverages increase based on consumption per day.

Lucas et al. (2008) (n=2,406)	(≥ 5 drinks/day) yielded an odd's ratio of 2.9 (2.1 – 4.0) for development of DC.
Burge et al. (1997) (n=222)	Subjects requiring an operation for DC were strongly associated with alcohol consumption with an odd's ratio of 1.9 (1.02 – 5.57).
Burke et al. (2007) (n= 97,537)	Observed that the risk of developing DC increased based on alcohol consumption level OR 1.09 (1.02 – 1.16) for light consumption <ul style="list-style-type: none">• OR 1.35 (1.259 – 1.45) for moderate consumption• OR 1.59 (1.47 – 1.72) for heavy consumption.

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Diabetes



- Controversy over relationship
- Is there a stronger relationship between the onset of DC with Diabetes Type 1 or 2?

Lucas et al. (2008) (n=2,406)	Examined the role that Diabetes plays on the development of DC with an OR = 4.0 (2.1 – 7.5).
Cagliero et al. (2002) (n=300)	<ul style="list-style-type: none">• DC was present in 16% of diabetic and 3% of the control group.• 35 subjects with DC and Diabetes 20 were type 1, 12 were type 2, and 3 were not Diabetic.• They suggest that type I diabetes is more likely to cause DC than type II.
Arkkila at al. (1997) (n=297)	Found an association between diabetes and the development of DC. But, their study found no difference in the rate of development between type I and type II.
Aydeniz et al, (2008) (n=203)	Found that those with type II diabetes had an odd's ratio of 1.96 for developing DC.
Burke et al. (2007) (n=97,537)	Found that the risk of developing DC increased based on diabetes with OR 1.52 (1.3 – 1.77).
Ramchurn et al. (2009)	Found MSDs to be more common when people have diabetes.

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Epilepsy



- Lucas et al. (2008), found that having a history of epilepsy yielded and developing DC had an OR 6.4 (2.3 – 17.7). (n=2,406)

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Smoking



- Is it smoking that is the problem or the secondary effect of a reduction in circulation?

Van Adrichem et al. (1992) (n=32)	By inhaling 2 cigarettes blood flow of the hand is reduced by 29%.
Burge et al. (1997) (n=222)	Subjects requiring an operation for DC were strongly associated with current cigarette smoking with an OR 2.8 (1.5 – 5.2). The mean lifetime cigarette consumption was 16.7 pack-years compared to 12.0 pack-years for the control group.
Godtfredsen et al. (2004) (n=7,254)	Risk of developing DC was increased with smoking dependent upon the level of consumption per week with 15 – 25 g/d and \geq 25 g/d yielding the most significant results.
Burke et al. (2007) (n= 97,537)	Smoking level increased the risk of developing DC with OR of 1.10 (1.04 – 1.17) for light consumption, 1.27 (1.19 – 1.36) for moderate, and 1.31 (1.17 – 1.47) for heavy consumption.

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Genetic Link



- Proposed genetic link is the main reason DC claims are denied by WSIB
- McFarlane (1997) places great weight on the genetic influence for the development of DC. He stated that “Dupuytren’s Disease is a familial disease and thus has a genetic influence.” (Literature review no research)

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Genetic Link



- Links have been made to those of European descent but...

Coulibaly (2020)	<ul style="list-style-type: none">• Examined the rate of DC amongst Africans with a small sample size of 20 men and 6 women with no family history of DC• Twelve patients had diabetes, 11 were smokers and 22 were engaged exclusively in manual labor.• Conclusion “Based on the patients’ recollection of Dupuytren’s disease in their families, heredity is not yet a proven factor.”
Gebereegziabher et al, (2017)	<ul style="list-style-type: none">• “We conclude that there are more cases of Dupuytren’s contracture in Ethiopia than previously thought. This might also apply elsewhere in Africa.”
Liu and Chen (1991)	<ul style="list-style-type: none">• Conducted a study on a Chinese population following 41 cases of DC

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Genetic Link - WSIAT Discussion Paper on DC (2002)



- Current WSIAT Discussion Paper on DC (2002) states
 - “Dupuytren’s disease is a genetic disease and is inherited”
 - Based on a paper by Ling (1963) – 56 years old
- Ling (1963) cites
 - Goyrund (1833) who stated that **10%** of those with DC will have a similarly affected relative
 - Skoog (1948) who stated of his **50** subjects, **44%** had a family member with DC
 - Stackenbrandt (1932) and Schroder(1934) who stated a genetic link was seen in **1/3** of the families investigated. Ling mentioned that these studies contained relatively small sample sizes. Unfortunately both studies are in German.

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Genetic Link - WSIAT Discussion Paper on DC (2002)

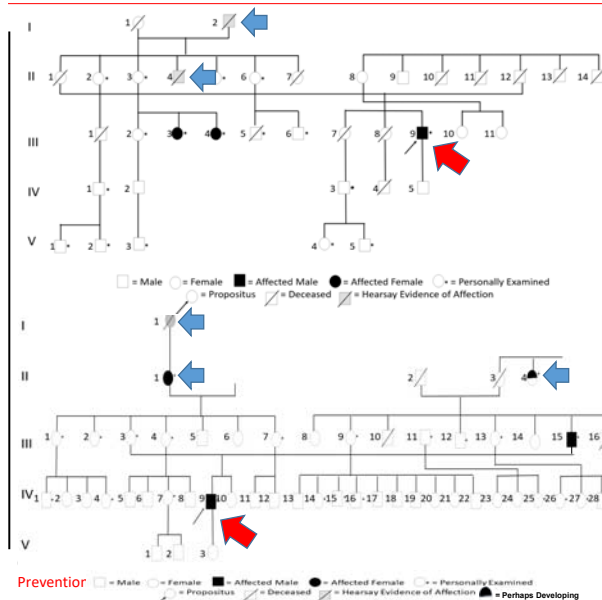


- Ling (1963)
- His study looked only at 50 subjects and found **68%** of subjects had a family member with DC across **four** generations
 - Small sample size
 - Selection of subjects is questionable
 - States there is a high incidence in the general population – **42%** of males from Edinburgh over age of 65 which seems odd
 - DiBenedetti et al (2011) – in 2007 annual number of new cases of DC was 3 cases per 10,000 (or 70,505) or a rate of **0.02%** based on a US population of 301 million in 2007
 - Method of examining familial link was also questionable

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Genetic Link



- Ling Looked at families across 4-5 generations
- Never stated what the incidence was only if someone had a relative with it
- To say DC genetic disease and inherited would one not expect a closer association?
- Larger the family more likely to find something
- Accepted DC cases based on hearsay from 3 generations away
- Did mention some underlying conditions that could increase risk but occupation not accounted for

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Genetic Link



- Percentages in previous studies were very high compared to more recent ones.
 - Small sample size has a large affect on results.
 - Example - 10 subjects. 3 have regular occurring nosebleeds.
 - 30% of population will have recurring nosebleeds...
- WSIAT Paper also cites Matthews (1979) “The expression of the gene is less complete in females, which accounts for the lower incidence and later onset among the female population.”
 - a. One female subject
 - b. 35 relatives of hers were further examined for clinical diagnosis (5 were dead or moved away and their information was still included in the study) ie anecdotal and not confirmed.
 - c. 8/19 with DC were female
 - d. 4/19 with DC were male but only mild symptoms
 - e. Underlying diseases, conditions, occupation and lifestyle habits not examined
- How can WSIAT say genetic when they are referencing papers that are over 50 years old, differencing genetic causes such as male inherited vs female inherited

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Genetic Link



- WSIAT discussion paper by Hurst (2002)
 - “82 percent of the patients with Dupuytren’s disease were from *Northern European families*”
 - This paper is no longer in circulation nor is it readily available.. How then can it be used?
- WSIAT also references an article by Bower (1990) who stated that “the incidence of Dupuytren’s disease among individuals with human immunodeficiency virus (**HIV**) exceeds that of the general population”
 - Since when was HIV genetic?
- WSIAT places so much emphasis on the work of Macfarlane who is well documented over his bias of work-related factors and as a result does not provide an unbiased and well researched document

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Genetic Link



- Many of the more recent studies and textbooks that begin by saying DC is a genetic disorder still reference many of the same articles discussed earlier. They also look at lifestyle but fail to address occupational risks.

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Recent Genetic Studies



- Descatha et al. (2014) conducted a meta-analysis (examination of data from several independent studies of the same subject, in order to determine overall trends) to assess any association between DC and work exposure.
 - Using a range from 1951-2007, only 23 studies were found to meet basic criteria
 - 9 of those met their methodological criteria to be deemed significant (HQMC)
 - After reviewing the studies
 - OR for manual work was 2.02 (1.57-2.60) and HQMC studies only: 2.01 (1.51-2.66)
 - OR for vibration exposure was 2.88 (1.36-6.07) and HQMC studies only: 2.14 (1.59-2.88)

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Recent Genetic Studies



Murínová et al. (2021)	<ul style="list-style-type: none"> Looked at hand arm vibration (HTV) and heavy manual work (HMW). Significant associations were found between DD and HTVs (OR 4.59 (2.05 - 10.32) and HMV OR 3.10 (1.21-7.91). This study confirms a significant association between DD and both HTVs and HMW after long exposures. We suggest that DD should be considered as an occupational disease.
Lurati (2017)	<p>“Dupuytren’s disorder is considered a genetic disorder and therefore not covered under workers’ compensation. Personal risk factors include workers of Northern European descent and workers that are older than 50 years. However, new evidence has shown that certain occupational activities may increase the risk of developing this disorder.”</p>

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Recent Genetic Studies



Lucas et al. (2008)	<p>2,406 male workers, 212 men were diagnosed with DC</p> <ul style="list-style-type: none"> Those with DC provided a health history, leisure manual exposures, and occupational exposures to vibration and manual work. Work was divided into using a tool with a handle, using a vibratory tool, manual handling, and repairing mechanical equipment. Personal risk factors were assessed including family history, diabetes, smoking, and alcohol use. Concluded that after adjusting for personal risk factors, manual work, especially those tasks that involve manual handling and vibratory tools, was associated with the development of DC.
Palmer et al. (2014).	<p>Sample size of 4,969 males</p> <ul style="list-style-type: none"> 2,287 men reported an occupational exposure to vibratory tools. DC only by 72 participants. It was determined that long and elevated levels of vibratory exposures contributed to the development of the disorder.

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Recent Genetic Studies



- Some investigators believe that genetics only predisposes an individual to the condition rather than actually causing it (Al-Qattan, 2006).
- An important factor to note is the **historical trends** that occurred during the “genetic link” papers. The studies references were from 1932-1980 at a time when it was almost dictated for the son to follow in the footsteps of their father and work in the same industry and occupation especially in European countries. So was it genetics or just the fact the father and son held the same occupation???

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Recent Genetic Studies – OHCOW Cases



- We at the Occupational Health Clinics for Ontario Workers Inc.(OHCOW)Sudbury, had a client who was diagnosed with DC with significant Hand-Arm Vibration exposure and who had an identical twin brother who did not have DC and worked in an office environment.
- Identical twins are very similar to one another at the genetic level should this be the focus of future studies??
- This could mean that if DC was hereditary, then both should have DC since they have similar DNA. The genetic influence is one that needs to be explored in greater detail and should be an area of future research. Unfortunately, the client and his brother have both passed away and cannot be reached for follow up.

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Work-Related Causes of Dupuytren's Contracture



- Single injury
- Manual work
- Vibration

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Limited Research



- Very limited research and data presented in the literature
- A search in PubMed for research papers with regard to DC:
 - "Dupuytren's contracture causes work vibration" (2 studies in the last 5 years)
 - "Dupuytren's contracture and work for the last 5 years" (3 studies)
 - "Dupuytren's contracture and vibration" (4 studies)
- This disorder is perhaps the most under researched MSD
- Known cause being unclear due to lack of research (genetic or work-related)
- Many studies tend to be anecdotal and cannot be used to demonstrate an association

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Work Related Research



- One of the most comprehensive reviews at the time was by Liss and Stock (1996) who re-examined the data from previous studies in order to determine the work-relatedness of DC.
 - They found one study that they deemed met their acceptance quality that addressed the relationship of DC and manual work
 - Three studies regarding the relationship DC and vibration.
 - All four studies showed a positive association with at least a doubling of risk.

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Single Injury and Dupuytren's Contracture



- Research has shown that DC might result from a complication of a hand injury
- Case reports of DC that followed up in time after a single hand injury
- Single hand injury could include:
 - Penetrating wounds
 - Crush injuries
 - Fractures
- More acceptance by clinician and compensation boards of the association between DC and single hand injury than with chronic manual work

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Single Injury and Dupuytren's Contracture



- Lucas et al. (2008) (n=2,406)
 - Examined the role that hand trauma plays on the development of DC.
 - Found having a history of hand trauma yielded an OR 1.5 (1.1 – 2.2)
- Most single injury studies were cross-sectional in design that have inherent limitations
 - “Survivor bias” (those who have developed the disease leaving the work force, leading to an underestimation of risk among those still employed “healthy workers”).
 - Prevalence data
 - When exposure and disease are obtained at the same time, cannot easily be used to determine cause and effect relationships.
 - Temporal sequence of exposure and the development of disease is not established.
 - Most of the studies, rarely were the examiners blinded to exposure status or to case status; very few quantified exposure with respect to force, frequency, vibration (merely job title).

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Manual Work



- Manual work includes use of the hands in:
 - lifting, turning, pushing, pulling, banging, and hitting, among other things.
- Believed that microtraumas may bring about this condition in predisposed individuals. Some statistics show that workers who suffer repeated microtrauma of the hand are often affected.
- Micro-ruptures observed in the palmar fascia have been attributed to multiple injuries aggravated by manual work.

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Manual Work



- Bennett (1982) (n=216) manual plant workers
 - 7.4% had DC
 - Control group which represents the general population, only one case was found
 - Concluded that the incidence of DC in the cases was greater than in the controls and prevalence of DC was affected by a particular type of work namely handling 25 kg sacks. This repeated action may have led to low grade microtraumas to the palmar fascia leading to an increased incidence of DC.
 - **Note: Very small sample size but was the highest in quality based on Liss and Stock review (1996)**

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Manual Work



- Khan et al. (2004), found incidence rates of DC to be significantly higher in the non-manual occupation group than in the manual group beyond 65 years of age.
- Haines et al. (2017) found that the risk for developing DC becomes substantial after 30 years of steady repetitive hand work
- Evidence for or against the manual work is sparse at best

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Vibration



- Strongest evidence for development of DC is linked to vibration exposure
- Research has shown that the cases of DC with a history of vibration exposure were significantly higher than the cases without
- Bovenzi et al. (1994) a significant association between vibration and Dupuytren's with an adjusted odd's ratio of 2.6 (1.24 – 5.49), adjusted for age, alcohol, and tobacco consumption.
- Liss and Stock (1996) stated of the Bovenzi study n=570
 - “the findings showed consistent increased relative risks, addressed confounding factors in multivariate models, and demonstrated some evidence of increasing prevalence with cumulative lifetime vibration categories”

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Vibration



- Liss and Stock (1996) stated of the Thomas (1992) study that results should be interpreted with caution for two reasons.
 1. Study group that was examined was not one with vibration exposure per se, but rather a subgroup of the vibration exposed population that developed vibration white finger (VWF). Those developing VWF may differ from other vibration-exposed subjects (and controls) in some way that may also be associated with the development of DC.
 2. Since the control group was drawn from patients being admitted to a hospital, their location was no doubt different from that of the VWF claimants.
- Cocco et al. (1987), found that the cases of DC with vibration exposure were significantly higher than the cases without. On the other hand, the inclusion of “manual workers” among the non-exposed group may have diluted or masked the association in some studies.

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Vibration



- Gloves also cause an increase in vibration absorption
 - Lose tactile (touch) sense
 - Squeeze harder in order to 'feel' what they are doing
 - More tense muscles lead to increase rate of absorption to the hand
- Lucas et al. (2008) examined the role of vibratory tools with DC
 - OR = 1.7 (1.3 - 2.3)
- Pelmeur and Wasserman (1998) stated that "...proper glove fit and the ability of the glove to provide tactile feedback to the worker is the most critical."
- Pelmeur et al. (2014), concluded " risk of DC is more than doubled in men with high levels of weekly exposure to hand transmitted vibration"

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Vibration



- Lucas et al. (2008) (n=2,406), having a history of using vibratory tools yielded an OR 1.7 (1.3 – 2.3).
- There is good support for an association between vibration exposure and DC, and the studies examined in the literature met a number of the criteria for causality (Liss and Stock, 1996). However, further studies need to be conducted to confirm the association of causality between vibration exposure and DC.

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Internal Review- Industrial Sectors



- Review of OHCOW database for past 30 years found:
 - 75% of all DC cases came from the following industrial sectors:
 - Manufacturing (27%)
 - Construction (24%)
 - Mining (24%)

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Internal Review- Occupations



Underground Production and Development Miners (16%)
Boilermakers (11%)
Automotive Mechanical Installers and Servicers (9%)
Construction Millwrights and Industrial Mechanics (Except Textile) (8%)
Other Labourers in Processing, Manufacturing and Utilities (6%)
Construction Trades Helpers and Labourers (5%)
Industrial Electricians (5%)
Petroleum, Gas and Chemical Process Operators (5%)
Heavy Equipment Operators (Except Crane) (4%)
Glass Forming and Finishing Machine Operators and Glass Cutters (3%)

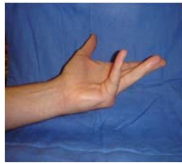
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Treatment – Non-Surgical

- Treatment option depends on the severity and the underlying condition of the affected individual
- Temporary relief of the pain and inflammation can be accomplished through Cortisone shots.
- Heat and stretching treatments.
- Wearing a splint at night to keep the fingers straight.
- Collagenase Injection: An enzymatic drug that breaks down collagen can be injected into the corded tissue to soften and weaken the contracture. 85% of people treated had a 50 % reduction in contractures



A 65 year old patient with DC, a. before collagenase injections b. 30 days after one collagenase injection showing full correction of contracture

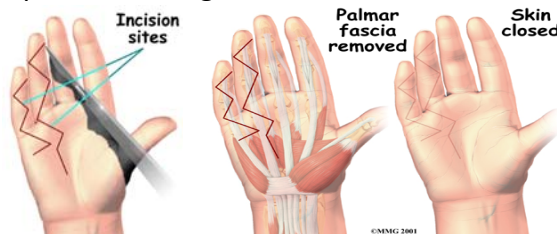
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Treatment - Surgical

- When the joints at the knuckles have reached 30 degrees flexion they have reached the accepted criteria for surgery
- Goal of surgery is to allow the finger to straighten by removing the diseased fascia.
- Tension in the finger is released by removing the tight cords and fascia
- If DC recurs the contractures are often more severe, resulting in the surgeons fusing the individual finger joints together. In a worst-case situation, it may be necessary to amputate the finger if the contracture affects the nerve or blood supply to the finger.



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