

JET LAG



Keith Ross Miller, 1948

Michael Parkinson:

“Tell me Keith, how did you manage to handle the intense pressure of Test Cricket?”

Keith Miller:

“Pressure? How can there be pressure in playing a game? Pressure is having a Messerschmitt up your arse at 20,000 feet. That’s what pressure is.”

“...Keith Miller was my boyhood hero. I saw him with Bradman’s team in 1948 when he pierced the gloom of an English cricket season with his combination of athleticism, skill and glamour. There has never been a more charismatic cricketer than Miller. The critic and writer Neville Cardus, a good friend of Miller’s called him “the Australian in excelsis”. Another distinguished observer of life and cricket, the writer, broadcaster and poet, John Arlott, summed up Miller’s appeal by saying: “If I had to choose one cricketer to take a wicket, hit a 6, or make a catch to save my life, it would be Keith Ross Miller”.

I would argue that almost singlehandedly Keith Miller, in the immediate post war years in Britain, did more than any Australian to promote the image of the carefree, sun kissed, irreverent Australian, so different from the prevailing view at the time, which was Chips Rafferty squinting into the sun and barely opening his mouth to avoid swallowing a squadron of flies. It is hard to explain how grim Britain was in the post war years. It was like living in a catacomb. Nor is it possible to fully demonstrate the way one Aussie sportsman enabled us to forget our sorrow, set aside our tribulations, simply by being there. If Keith Miller was beloved in Australia he was revered in Britain. He came to know Britain well, as did many Australian servicemen during the war.

As a member of the RAAF, Keith Miller flew missions over enemy territory. These airmen have a special place in our hearts. Last year I attended the Battle of Britain Remembrance Day Ceremony and stood next to a 90 year old Englishman who, as a young man, flew Spitfires. He said the British airmen had a particular admiration for the Australian air crews based in Britain. I asked him why, he said: “Because they didn’t have to be there did they? They volunteered.” Miller belonged to an exceptional generation, one which gave us the freedom we now take for granted. The lives of these men and women were forged in that war and they were forever shaped by it.

Keith Miller once told me how he loathed the word “pressure” being applied to the modern day sportsmen. He said “How can there be pressure in playing a game. Pressure is having Messerschmitt up your backside at 20,000 feet. That is what pressure is!”

*Sir Michael Parkinson CBE,
Australia Day Address
24th January, 2011*

In the 1940s and 1950s Keith Ross Miller was the quintessential national Australian sporting idol. Fighter pilot hero of the recent war in Europe, Australia’s greatest ever cricketing all-rounder, key member of perhaps the greatest cricket team ever to take the field in Donald Bradman’s all conquering 1948 “Invincibles”, tall, dashing, straight talking, sharp witted, strikingly good looking, lady’s man, he helped shape the stereotypical image of the great outdoor Bronzed Aussie hero. Quite simply - in an age of subservience and reverence to “mother England” - he made Australians feel good about themselves - proud to be an Australian. Even most Englishmen grudgingly conceded that he was a most remarkable “colonial” - grateful for the assistance he, and many other Australians who enlisted in the RAF - gave mother England in their most desperate days of the Blitz. There was a period in time when Keith Miller was second only to Donald Bradman in the eyes of most Australians, and King George VI in the eyes of many Englishmen!

On the cricket field Miller was noted for his remarkable coolness, and presence of mind even in the glare of the entire nation during the most tense situations imaginable against the old enemy. In the context of the 1950s these so called "sporting" contests were in fact much more than that - a young uncertain nation sought to assert its place in the world and authority over its parent homeland, beneath surface appearances, much more was at stake than simply a cricket match! When Miller was interviewed much later in his life, he was asked by a curious cricket loving, and boyhood hero worshipping Michael Parkinson about how he dealt with the immense unrelenting pressure of five day Ashes Test Match cricket. In an instant Miller's eyes flashed and he responded, indignantly and much to Parkinson's surprise, "Pressure? How can there be pressure in playing a game?" The interview had been going amicably and quite well, but at this sudden outburst, Parkinson was a little taken aback - uncertain how to proceed - had he struck a raw nerve somewhere, had he somehow offended the great man? After a moment Miller continued. "...Pressure is having a Messerschmitt up your arse at 20,000 feet. That's what pressure is!". Parkinson never forgot this response and related the story many years later when he was invited to give the Australia Day Address for 2011.

In an age when war heroes were not meant to publically admit to any sort of fear, Miller's comments were very truthful and quite telling - the pressure in the arena of a sporting event, even though at the highest level, becomes trivial when compared to the pressure of staring death in the face in the arena of war. The greatest stimulus to scientific innovation is often in the setting of warfare where a fight to the death can be won or lost on the basis of who possesses the best technology of the day. Brilliant German innovation and technology produced the world's first jet engines during the course of the long conflict. Initially this resulted in the V2 rockets, but then the world's first jet fighter followed in the form of the Messerschmitt 262 that resulted in a stunning one on one superiority in airpower, however by the time this aircraft was developed it was a case of too little too late for the Luftwaffe. Had these aircraft been available in large numbers earlier in the war, the outcome of the war may have been quite different. Allied pilots were stunned when first encountering the new jet craft. One of the first reports of the new German technology came from an American B24 bomber pilot, William Liscum Borden. He was returning from a bombing raid over Germany. Everything seemed to be routine, when all of a sudden something streaked past his plane at an unimaginable speed, and disappeared into the far horizon, just as quickly as it had appeared. The encounter had a profound effect on him. He would later write, "It resembled a meteor, streaming red sparks and whizzing past us as though our aircraft were standing still".

A multitude of stunning scientific advances emerged from the Second World War, such as radar and nuclear energy. The jet engine ushered in, in aviation terms, the "jet age" - warfare would be more terrifying and the world would become a much smaller place. No longer would cricket teams take weeks to sail to mother England, within 24 hours, they could be across half the globe, a fine thing one would have thought, however every new invention has its price. Whilst the body's physiology readily adjusts to the leisurely pace of the crossing of the time zones in ships, in a jet it simply cannot keep pace. Life in general has become far more pressured in the age of the jet. Indeed a new illness has emerged as a direct result of the pressured pace of modern life - "jet lag".

JET LAG

Introduction

Jet lag is a recognized form of **sleep disorder** that results from crossing time zones too rapidly for the body's **biological circadian clock** to keep pace.

Jet lag is not the same thing as simple travel fatigue, which does not affect the biological circadian rhythm.

Travel fatigue can be reversed within a day or two with adequate diet, rest, and sleep, but symptoms of jet lag persist until the biological circadian system is realigned.

Although jet lag is usually medically benign and self-limited, it may occasionally result in serious cognitive misjudgements.

Among very frequent travellers such as flight personnel or international business executives, the disorder may be recurrent or even become chronic.

There are three principle treatment strategies:

- Promoting a realignment of the circadian clock.
- Planning the optimal duration and timing of sleep.
- Medication to counteract the symptoms of insomnia or daytime sleepiness.

Pathophysiology

The Circadian clock:

Within the suprachiasmatic nucleus of the hypothalamus is a biological or **circadian** clock. The body's physiology is synchronised to night and day by the action of sunlight through brain various neurotransmitters, especially melatonin.

The timing of this clock is normally synchronized to the solar light-dark cycle in order to promote alertness during the day and sleep at night.

In addition to alertness, many other physiological processes of the body are synchronized to the circadian rhythm, including body temperature, hormone secretion, digestion, heart rate and blood pressure changes.

This biological clock is slow to reset in response to sudden changes in time zones that alter the timing of environmental day-light exposure.

After time zones are quickly crossed, endogenous signals for sleep and wakefulness do not correlate with the local light-dark periods. This results in unpleasant symptoms,

independently of any intrinsic tiredness symptoms, from a long period of enforced immobilization and sleep disturbance.

On the first day after time zones are crossed, the circadian clock remains oriented to the departure location (as reflected in the timing of melatonin secretion), and therefore the local times for sleep (and wakefulness) are misaligned with the circadian system. This is thought to be the basis of the pathophysiological mechanism of **jet lag**.

The symptoms of jet lag gradually remit as the circadian system realigns to the new time zone.

Studies using the daily cycle in core body temperature and the timing of melatonin secretion as indicators of circadian time, have shown that the circadian clock resets an average of:

- 90 minutes later each day after a westward flight
- 60 minutes earlier each day after an eastward flight.

The effects of jet lag are usually greater if you are going from west to east than from east to west.

The role of melatonin:

Melatonin is a hormone that is secreted for about 10 to 12 hours at night. The hormone can be considered to be a darkness signal - **i.e. a signal to sleep**, (and in fact has been called a “biomarker” for the nocturnal phase of the circadian cycle).¹

Secretion is synchronized to the light - dark cycle by the biological circadian clock within the hypothalamus and so it is a hormone therefore that appears to *regulate* the biological cycle of sleeping and waking.

Factors contributing to jet lag:

Important factors that contribute to jet lag include:

1. The number of time zones crossed:
 - The degree of circadian disturbance is directly proportional to the number of time zones crossed.
 - Note that non-specific travel fatigue occurs with long-distance travel whether or not times zones are crossed but this can certainly aggravate symptoms of jet lag.
2. The direction of travel:

- For most individuals, it appears to be more difficult to travel east than west. This is because the circadian period of the body clock is typically somewhat longer than 24 hours and it is therefore easier to lengthen the day than to shorten the day, (by flying east - against the rotation of the Earth).
 - However, some individuals, especially “morning types” - whose circadian period may be set shorter than 24 hours - may in fact find eastward travel easier.
3. Sleep lost during travel:
- Sleep disturbance is virtually assured with long overnight travel, especially in the cramped conditions of “economy class”, but even in “business class” as well.
 - Acute sleep loss can be made up with adequate sleep after arrival, but symptoms of true jet lag due to circadian asynchrony with the new environment is likely to persist until full circadian realignment has occurred.
4. The availability of local time cues:
- Exposure to *natural light* at the destination is the most important factor for the resetting of the circadian clock.
 - This can vary however, with the location, the time of year, and the activity of the traveler.
 - Exposure to bright light at the “wrong” phase of the circadian cycle can inhibit the resetting of the circadian clock.
5. The intrinsic ability to tolerate circadian misalignment:
- There is a degree of individual variation in the ability to tolerate circadian rhythm disturbances.
 - In general tolerance also appears to decrease with increasing age.

Clinical features

Although jet lag is usually medically benign and self-limited, it may occasionally cause result in serious cognitive misjudgements.

Among very frequent travellers however such as flight personnel or international business executives, the disorder may be recurrent or even become chronic.

Principle symptoms of jet lag include:

- Insomnia
- Daytime sleepiness
- Fatigue
- Dysphoria (or labile mood)
- Cognitive impairment
- Gastrointestinal disturbances.

Jet lag is often **compounded** by further nonspecific complications of prolonged and cramped immobilization, *irrespective* of the rapid crossing of multiple time zones.

These can include:

- Dehydration
- Muscle and joint stiffness and cramping
- Additional travel fatigue from sleep deprivation and/ or irregular sleep.

Natural recovery periods:

Recovery periods are not easily predicted, and there will be significant individual variation. The body will need anywhere from a **few days to a few weeks** to acclimatise to the new time zone.

One rough average rule of thumb has been quoted as **approximately one day for each hour of time zone changes.**³

Some other expert opinion relates recovery periods more precisely to the direction of travel that is undertaken as follows:¹

- When you fly **east**, the number of days it takes to recover from jet lag will be about **two-thirds the number of time zones** you cross. For example, if you cross six time zones, it will take you about 4 days to get back to normal.
- When you fly **west**, the number of days to recover equals about **half the number of time zones**. So if you cross six time zones, it will take you 3 days to recover.

Investigations

Jet lag is a clinical diagnosis and as such there is no specific confirmatory investigations.

Any investigations therefore are done in order to rule out possible differential diagnoses, and as such must be judged on a case by case basis.

Management

Preventive strategies that may help reduce the degree of jet lag include:

- Push oral fluids, to avoid dehydration, (this doesn't mean alcohol!)
- Maintain some movement during the flight to help avoid prolonged cramped conditions.
- Be well rested before the flight. Sleep deficit or “debt” will make jet lag worse.
- For severe sufferers from jet lag, it may be worthwhile travelling via a **westerly** travel route (as opposed to an easterly one) where possible or practical.

If you are flying westward, try to go to sleep as late as possible for two to three days before you leave. This will make it easier to adapt to the new location. For example, if you are flying from Melbourne to London, try to go to sleep at 1-2 am for the two to three days before flying out from Melbourne.

Note that there is *no evidence* that popular dietary strategies, such as fasting or eating complicated diets, have any effect.³

There are three principal treatment strategies for the management of jet lag:

- Promoting a realignment of the circadian clock.
- Planning the optimal duration and timing of sleep.
- Medication to counteract the general symptoms of insomnia or daytime sleepiness.

Promoting a realignment of the circadian clock:

Even with adequate night-time sleep, daytime sleepiness may persist until the **circadian system is realigned**.

This can be done by:

- Light exposure manipulation
- Melatonin administration.

Light exposure:

Exposure to bright light in the evening and the first part of the night is thought to reset the clock later (a phase delay), whereas exposure to bright light in the last part of the night and the morning resets the clock earlier (a phase advance).

The effects of melatonin administration are approximately the *inverse* of the effects of light exposure, that is, administration of melatonin in the afternoon and evening shifts the clock earlier, and administration of melatonin in the morning shifts the clock later.

In the case of exposure to light, the magnitude of a response is largest in the middle of the night, when exposure is usually minimal. In the case of melatonin administration, the magnitude is largest during the day, when endogenous secretion is minimal.

Melatonin:

Melatonin can be taken to try and reduce the symptoms of jet lag, although exact recommendations about how to take this agent are not standardized and so vary among different experts.

Recommendations include:

- Taking melatonin after dark the day you travel and after dark for a few days after arriving at your destination.
- Taking melatonin in the evening a few days before you fly if flying eastward.

The *long-term* side effects of melatonin have not been established.

Planning the optimal duration and timing of sleep:

The timing of exposure to light is the most important time cue for synchronizing circadian rhythms in humans.

Exposure to light in the evening shifts the clock to a later time, and exposure to light in the morning shifts the clock to an earlier time, thereby compensating for any drift away from a 24-hour cycle.

Unplanned exposure to natural daylight in the new location generally facilitates the adaptation of the circadian clock to the local time.

The intensity and availability of light however can vary markedly according to multiple factors including:

- The time and season of travel
- The local weather
- The brightness of interior illumination

- The activity and sleep schedule of the traveller.

These factors can result in marked variability in the realignment of the circadian rhythm in any particular individual

A simple recommendation for travel across up to eight time zones is to seek exposure to bright light in the morning after eastward travel and in the evening after westward travel.

After a **few days**, the circadian system will have shifted sufficiently that avoidance of light can be discontinued. If avoiding bright light is impractical, wearing low-transmittance sunglasses may be a useful alternative, as suggested by studies that have simulated shift work.

Medication to counteract the symptoms of insomnia or daytime sleepiness:

Promoting wakefulness:

- Not surprisingly, **caffeine** has been suggested as the best agent for this purpose!

It may counteract the daytime sleepiness associated with jet lag.

Promoting sleep:

- A short course of hypnotic medication has been shown in randomized trials to reduce insomnia. They can help re-establish the sleep cycle in the new time zone.
- **Non-benzodiazepine** hypnotics are thought to have less detrimental effects on normal circadian rhythm than the traditional benzodiazepine hypnotics.
- Options include:
 - ♥ Zolpidem (10 mg at bedtime) for 3 to 4 nights.
- Note that there may be additive sedation if hypnotic agents are used together with melatonin.

In flight hypnotic agents:

Hypnotic agents taken during a long flight can promote sleep, however they have a number of drawbacks including amnesia and disorientation, (which may adversely affect decision making should some in flight emergency occur), as well as aggravating risk from DVT due to prolonged immobilization.

If a hypnotic agent is to be taken during a flight, one that has only a 2 to 3 hour duration of action (e.g. **zaleplon**) is preferred.

References

1. Sack R.L Jet Lag, NEJM vol 365 no. 5, February 2010, p. 440 - 447.
2. eTG, March 2012.
3. Better Health Channel Fact Sheet, in consultation with the Newcastle Sleep Disorders Centre, 2012.

Dr J. Hayes
August 2012